



THE IMPACT OF COMPUTERIZED EXAM FEATURES, EFFECTIVE EXAM IMPLEMENTATION, TOWARD STUDENT SATISFACTION

***Indra Hendro¹, Victor Wiley², and Thomas Lucas³**

STMIK Swadharma^{1,2,3}

indrahendroiswaraswadharma@gmail.com¹, codingvictor@gmail.com²,
and thomasreliable10@gmail.com³

*correspondence: indrahendroiswaraswadharma@gmail.com

<https://doi.org/10.24071/ijiet.v6i2.2440>

received 18 February 2020; accepted 13 July 2022

Abstract

This paper intends to examine in detail the relationship between computerized exam features and effective exam implementation toward student satisfaction. The main goal is to examine the synergistic relationships which impacting student satisfaction after they using a computerized standardization exam in the college setting. Design/methodology/approach –an initial exploratory analysis was conducted methodically to confirm the proposed model through a structural equation modeling approach. The computerized exam features (especially, clear wording instruction and exam rulebook) had high effects on student satisfaction. Secondly, Effective Exam implementation (especially, efficient effort, time and cost) also impacted student satisfaction. Thirdly, the statistical testing result confirmed a joint impact of computerized exam features and effective exam implementation toward student satisfaction. The conceptual model has been validated to understand the role of both variables toward student satisfaction. However, there is lack of empirical validation and generalization of the model into wider scope due to limited time of research and a small number of the participant which suggest future research.

Keywords: computerized exam features, effective exam implementation, student satisfaction

Introduction

There are two types of exams. Firstly, a paper based exam which delivered through paper sessions and classroom face-to-face meetings. Secondly, the computerized exam used by technological supports with computer facilities. Many colleges have implemented computerized standardization exams to improve their education results (Moser, et al., 2015). However, the exam quality is rarely to be assessed from student perspectives. The issues bring us to observe further methodically and in detail about the constitution or structure of the exam process and its benefit to the students, especially the computerized exam typically for purposes of education and exam goal (Meier & Knoester, 2017; Flynn & Featherstone, 2017). Therefore, we need to analyze the benefit of the exam and how the exam implementation more clearly from the student position.

As education competition is increased, a trend of implementation of the standardization exam is been raised. However, implementing such an exam method in a multicultural school is still debatable. On the first hand, as schools accepting many students they have to facilitate the students with adequate services. Technology has been offered to provide such services with challenging tasks (Tidd & Bessant, 2018; Strayhorn, 2018). On the other hand, there is increased complaints about the integration of technology into educational services. There are opportunities from the growth of educational technology systems such as the adoption of eLearning, computerized exam, and administration management system in many colleges (AlAzawei et al., 2016; Trelease, 2016). However, their benefits to the students are still rarely inspected.

Some reports have indicated that such technology has visible weaknesses such as lack of clear wording instruction, misunderstandable questions, and unfair exam rulebook (Skinner, 2016). Even though many colleges have provided assurance and guarantee of the technology adoption for their education service (Johnson, et al., 2016), however, many critics and complaints have still occurred especially from their users (eg, students). Therefore, providing computerized exams and measuring its exam quality from student's perspectives are challenging efforts (Debus & Lawley, 2016).

The system quality of the computerized exam also contains issues of low student satisfaction (Napitupulu, et al., 2018; Horvat, et al., 2015). Such issues can be divided into two types, eg, clear working instruction and timing schedule. For clear working instruction, there is a debatable result about how computerized exam can help the exam participants to understand the exam instruction (Smith, et al., 2019). Thus, there is an issue that the question instruction of the computerized exam is sometimes given problem and difficult to be understood by the student since it contains a technical term. Such an issue can prevent the development of a social cognitive aspect of the students (Bjorklund and Causey, 2017).

For the timing schedule, there is a difficulty faced by the exam participants since they have very tight time to finish the exam. Such lack of time in exam timing impact on the student perception that the exam is unfair (Bottiani, et al., 2017). Such an issue leads to a gap to find the scale of fair timing toward student satisfaction. However, developing a new scale to measure student satisfaction toward the exam is challenging because it needs modeling and testing.

Research De Marco and Broshek, (2016) showed that computerized exams have more benefits than weaknesses. However, understanding the process of how the user getting the benefit is often challenging because it has a complex process. From the user side, we have to understand how the user will perceive the exam's usefulness, ease of use and acceptance of information technology (Moridis, et al., 2018).

There is a debatable definition and construct of exam effectiveness from its dimension (e.g., effort, time and cost) (Yu, 2016). In many studies, these three types of constructs are often examined separately (Hwang, et al., 2016; Apugliese & Lewis, 2017). This separation has an impact on the difficulty to know the integrative relationship between the three constructs. Such confusion leads many scholars to put the exam effectiveness as dependent variables so than an independent variable. Therefore, it is important to evaluate how the satisfaction will fit with the context of the computerized exam system.

By evaluating the effectiveness of the system, it can be seen that the exam potentially affects student satisfaction (Hanus & Fox, 2015; James & Casidy, 2018). However, such satisfaction is often ignored by satisfaction scholars, especially its impact on student anxiety in exam implementation. Thus, student distress in a web-based distance education course is often ignored, which impacted on their concentration and cognitive load during exams (Grangeia, et al., 2016). Thus, exploring the relationships between clear working instruction and student satisfaction is challenging tasks for some reason.

Firstly, an exam with good quality is indicated by adequate instructional and student acceptance (Nilson, 2016). Also, a good computerized exam system will shape self efficacy and self-regulated effort among the student to improve their development (Bol, et al., 2016). Through self-regulated effort, students can maintain their response and error prevention promptly.

Secondly, from the programmer's perspective, they have to design and facilitate the exam system with adequate and powerful exam features (Romiszowski, 2016). They also have to provide a good system with the assurance of objectivity to support the student's interaction with the system. Such assurance improves the user's willingness to use the exam system since it increases user acceptance (Yang, et al., 2016). This means that a good system must provide accurate and fast results to be a predictor of student satisfaction. When students can answer exam questions and obtain a good response promptly and accuracy, the exam will be perceived as fair and consequently have an impact on student satisfaction.

Overall, some problems need to be addressed through this research. Although the computerized exam promises advantages of the accuracy of the test results and the efficiency of cost and manpower, it also has weaknesses because the system is complex to be understood by an unexperienced user (Malik & Khan, 2016). Such complexity can shape the perception and satisfaction of students toward the exam system. This problem will increase if there are technical problems such as power outages, programs, and computer equipment during the exam (Card, 2018). These problems will cause prospective graduates to feel disadvantaged due to the limited time so that it might affect their satisfaction. Therefore, this study will examine the relationship between computerized exam features and effective exam implementation toward student satisfaction with the population of STMIK SWADHARMA students.

Previous studies Holinka (2015) revealed a significant number of causes of student satisfaction. Through the adequate review, two main factors are impacting the student satisfaction toward the computerized exam system (eg, exam features and effective exam implementation) (Permzadian & Credé, 2016). To understand the relationship and how they can impact on student satisfaction, it needs to clarify whether computerized exam features will effect on satisfaction. Furthermore, the synergistic relationship can be found among the effective exam implementation toward student satisfaction. Therefore, their relationships need to be investigated. Following the above explanation, the purpose of this paper is to investigate the effect of computerized exam features and effective exam implementation on student satisfaction. consequently, this paper will describe the synergistic relationship between the variables.

The proposed model will be tested using Exploratory Factor Analysis (EFA) (to uncover the underlying structure of variables) and Confirmatory Factor Analysis (CFA) (to refine the resulting scales in EFA). Each variable is divided into dimensions and constructs to determine the loadings of the measured variables and confirm pre-established theories. Therefore, a Structural Equation Modelling (SEM) approach is implemented.

This paper consisted of five main parts. The first part contains an introduction and problem background. The role of each variable is described and explained. The third part contains the research methodology, population, and the statistical testing approach. The result analysis and discussion are given in part fourth. Finally, the discussion, conclusion and managerial implications are also given.

Literature Review

Theories of Social Cognitive and Blended Learning

Scholars have studied the role of the social foundation of humans in their thought and action (McDougall, 2015). The human can improve their interaction with the environment through multifacets variables and constructs. However, measuring such constructs are complex and time consuming. By following Bandura's social cognitive theory, many scholars have focused on the methodological choices in studying student experience toward computerized exams as part of blended learning especially in higher education (Devi, et al., 2017; Connolly, 2017).

To get the best results student must understand how they will adapt and interact with the system. Practically, this means that the students should be fully involved in achieving the optimal result through their interaction with the system (Myers, et al., 2016). A student satisfaction may be one variable which also important to change or shaped the students to gain better performance.

For example, in a system with adequate interaction, the users can easily develop interaction and establish their responsibility to achieve student satisfaction (Yilmaz, 2017). Thus, a good system must have the ability to establish an organizational atmosphere to facilitate others. They can be driven to be actively engaged with the system collectively in the achievement of the exam score.

Researchers have used various perspectives to understand the cause of high student satisfaction. These include the theory of social cognitive and theory of blended learning in higher education. A theory of social cognitive theory is a conceptual paradigm that influencing studies of human behavior in the education environment (Whiteside, 2015; Harasim, 2017). The theory becomes the social foundation of interaction between students and the environment to shape their thought and action. For example, a good exam system can provide interaction that supports the student (user) to finish the exam since it has clear wording instruction. The theory is based on the determinant of interaction that will result in agreement or rejection about the exam system (Wampoid, 2015). If a student can interact better with the system, the interaction will be repeated or continued. Based on the relationship between the social exchange theory, a system designer can add a computerized exam with higher interaction features to increase student satisfaction. From both theories of social cognitive and blended learning, there is a research focus and methodological choice in studying the student's experience about the

blende learning in both theories have been implemented and expected to provide a positive relationship between the exam system quality toward student satisfaction for at least two reasons (Jones & Alba, 2019; Oliver, 2017). First, students' perception of exam theory can lead to a higher benefit for the students. Secondly, such benefit is given as education institution supports which then increases the interaction of the student with the system. These attributes could translate into important behavior adapted by the students to achieve a higher score and frequent action.

After reviewing the related literature, this study proposed three variables which expected to be inter-correlated, e.g., computerized exam features, effective exam implementation, and student satisfaction. To do so, it is important to understand the direct and indirect impact of the exam features and exam implementation and finally the student satisfaction. The individual parts of the model are discussed below, and then the hypotheses of this study are presented.

Standardization exam

Exam standardization has been trending among favorite colleges as an approach to adopt technology and educational process to provide high level education goals in the sense of the future community and help students to understand and respond positively to the personal future (Rangel and Coulson, 2017; Calderón, et al., 2019).

The standardization exam aims to identify the skills possessed by students as a requirement of passing the education level (DarlingHammond, 2015). The exam can be computerized as a collaborative tool for testing student competence through the transparent process (Shoemaker, et al., 2017). A good exam can help the students to do an effort to finish the exam. Such a process will create student received usefulness, perceived ease of use and user acceptance of the exam system quality.

Computerized standardization exam system

Recent research shows that the standardization exam has been integrated with technology to support students' interest in using computers in the college environment (Rashid & Asghar, 2016; Sung, et al., 2016). However, the success of the computerized technology based standardization exam still raises questions for the dependent variable, especially regarding the form of the test it can provide the results desired by its users (i.e., students).

Current research on examinations with systems tends to produce the desired results. However, it is difficult to explain how to design and evaluate the quality of the exam system to support student needs (Dennis, et al., 2018; Rowntree, 2015). Although some views show that a good system must be flexible and conducive to provide effective solutions to problems students face during the exam.

Some studies propose a model of measuring system user satisfaction exam system with satisfying results (Halpern, et al., 2016). It is considered that the exam system is very effective in increasing student scores. There are several important features of a quality system, that is, the system has powerful and powerful test procedures (Johansen, et al., 2015). Then, the system supports the system and provides optional computerized options.

Student satisfaction

Student satisfaction is a complex, multidimensional factor for which a global and unidimensional definition is still arguable and debatable. Regarding the definition of student satisfaction, it means that the variable must be measured from the student perspective, it also presents biased expectations, while also incorporating multifaceted dimensions such as system quality to measure the satisfaction level (Annamdevula & Bellamkonda, 2016).

Scholars have defined the debatable meaning of student satisfaction. In this paper, we synthesized many theories and defined the student satisfaction as a situation where students are pleased with their experiences in a virtual exam environment, including interactions with the system, features, and instruction (Lee, et al., 2017). If the system quality matches their expectations and provides support services, there is a tendency a higher student satisfaction.

Even though student satisfaction has been previously used by many authors (Turner and Briggs, 2017; Napitupulu, et al., 2018; Yilmaz, 2017). The variable is derived from a scholar's perspective. Student satisfaction is still the area of psychology that lack matches criteria and definition to confirm its constructs. Therefore, the content validity of these items must be ensured. This means that establishing a validated scale important by comparing the terms of validity and reliability is important. Therefore, the student satisfaction must use the same scale was adopted by (Harrati, et al., 2016) and tested for its content validity, construct validity and reliability.

For example, in the exam system, satisfaction is the level of student's feelings after comparing the performance or the exam system results they experience toward their expectations. Following Ladhari, et al., (2017) satisfaction is a function of the difference between perceived performance and expectations. If the system performance is below expectations, disappointment arises. Student satisfaction will increase if the system performance is as expected. If the system performance exceeds the expectation, then, the student will be very satisfied. Thus, the student's expectations will be shaped by past experiences, comments from acquaintances or relatives, and the promises and information of the school. Satisfied students will make good comments about the exam system. To test both hypotheses, we propose a conceptual model (see Fig.1).

Computerized exam features

Considering the importance of the features that must be owned by a system, then we deepen through a review of this literature. Research Tarhini, et al., (2017) showed that user satisfaction was increased after using the exam system in developing countries. In the previous study, a good exam system quality is indicated by the ability of the exam system to prevent errors in answering the wrong questions. Besides, the exam system can improve self efficacy for self-administered exam forms. The exam implementation has increased the student score through the web based exam (Balta, et al., 2018). On average, students as the users have high satisfaction after participating in the exam because the system works well.

Several studies provided additional support to facilitate learning in web-based environments (Wang, et al., 2017; Rahimi, et al., 2015). The results showed that computers can shape human behavior during exams. On average the participants felt that the exam was in line with their expectations (Hanus & Fox, 2015). Some

recent evidence shows that a quality exam system can improve education management and ultimately deliver test results more quickly and accurately. Thus, a complete system feature can be a predictor of student satisfaction.

The students can internalize the need for the system features, devote their efforts to adapt toward the system deficiencies, and thereby achieve the goals of finishing the exam. Besides, they can provide feedback to evaluate performance, enabling the outcome of the quality of the system to be incorporated into the knowledge base after they finishing the exam (Dennis, et al., 2018). Beyond any doubt, the student must follow the procedures that are laid out in the exam instruction. Such instruction can be a driver of their perception and opinion after they experience the exam.

So, when the student is given the exam, they will try hard to finish the questions to provide the right answers. As students learn about the exam instruction and process, they also will get familiar with the features and their learning development is facilitated through the system features (Wlodkowski & Ginsberg, 2017).

The explanation above leads us to explore further the interaction that can play to drive student satisfaction. Student adaptation and familiarity toward the computerized system features will contribute to improved student satisfaction; generating new ability to finish the exam faster and working in a timely and effective way. Thus, the following hypothesis is proposed:

H1. Computerized exam features are positively related to student satisfaction. Effectiveness of Use

Effectiveness of use has synonym with efficiency. It is a pattern of the desired result that is built to be systematic and as simple as possible, but complete and accurate. It also means a tight and strict procedure that can reduce errors. In a blended learning context, the effectiveness of use as attributes of student learning is recognized as an important factor of effective implementation of method efforts (Kintu, et al., 2017). For example, in exam implementation, the term represents efficient effort with scheduled time which adequate and right destination (McKnight, et al., 2016). It also concentrates on students being aware of and empowered to act on achieving the goal of the exam to resolve the tested questions through frequent interaction (Brock & Hundley, 2016). A student who has intensive engagement with the system will know better about their roles and goals. They will be aware of how to achieve the exam goals through such engagement. Through an active role in the system, they can develop and motivate themselves to improve the exam output.

The system has a role as equipment to achieve the goals set. If the chosen exam system is following the objectives set, then there will be a gradual achievement of these goals which will, in turn, be related to the effectiveness of the system's performance (De Boer et al., 2015). Thus, Cameron, (2015) distinguishes the effectiveness of performance in four approaches, e.g., achieving goals, system, constituency, and values.

Such effectiveness of use can be created through interaction with the system. Successful use of the system is an interaction that creating a bounded relationship between the system with the user and leads them to be motivated students (Bano &

Zowghi, 2015). After understanding the effectiveness of use, the effectiveness definition leads us to expose the role of student satisfaction.

Through the effectiveness of using the system, students will be satisfied, motivated and committed to response the system (Navimipour & Zareie, 2015). This means that the system with high effectiveness will predict positively related to student satisfaction. The engagement of students and the system can create a positive and conducive exam environment (Czerkawski & Lyman, 2016). If students are not involved in a good and effective environment and interaction, their satisfaction will be low. To determine the relationship between both variables, the second hypothesis is given:

H2. The effectiveness of use is positively related to student satisfaction.

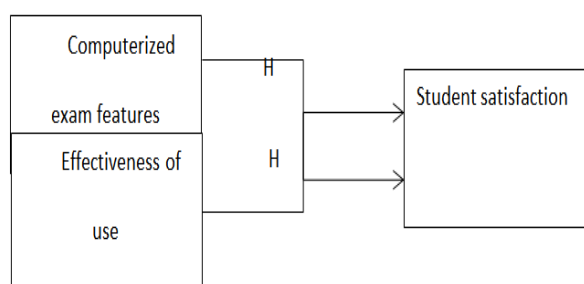


Figure 1. Proposed conceptual model

Method

Quantitative design is implemented as a research approach in this paper. The quantitative data is collected through a cross sectional survey from observed students (Simonetti, et al., 2015). The students are the analysis unit as a participant in this study.

Like quantitative research, this study tests the relationship between the variables through a correlational approach (Nardi, 2018). The proposed hypotheses are tested after data collection. The questionnaire survey was developed through the multistep process. Through a comprehensive literature review, the measured items of the questionnaire were validated for reliability using Structural Equation Modelling (SEM) Lisrel.

The data collection instrument was pretested by distributing to 30 participants. The pretests included structured interviews with the students. All of them were asked: first, whether the questions were easy to understand and clear enough to be accurately answered; second, whether any other questions needed to be added to the questionnaire; and third, who would be the most appropriate person(s) to contact for the study. Feedback from the pilot study was used to clarify some questions. Based on the feedback, some items in a few scales were either dropped or added. Finally, because of their familiarity with both organizational support and student performance, the general managers were determined to be the most appropriate participants. The survey instrument was pilot tested on the students proving its appropriateness and achieving the content validity of the constructs. All questions (40 items) of the four factors/dimensions were measured on a five point modified Likert scale (1 very low to 5 very high). The measurement items used in the survey are listed in the appendix. The questionnaire was sent by

email to participants that constitute the population size. We received two waves of responses including 89 and 107 questionnaires, respectively. A total of 196 valid questionnaires were collected, yielding a response rate of 38.75 percent, satisfying the criterion for SEM analysis (Wu and Liu, 2010). A profile of the responding firms is provided in Table I.

Table 1. The participants' demographic characteristics

Profile of the participants	No	%
Gender		
Male	134	68,4
Female	62	31,6
Age		
Less than 18 years old		
21 – 24 years old	53	27
24– 27 years old	89	45,4
28 – 31 years old	52	26,5
Greater than 31 years old	2	1
years of education		
Less than 1 years	78	39,7
23 years	103	52,5
Greater than 4 years	15	7,6

Source: Questionnaire data (2019)

Demographic characteristics

Site location is STMIK Swadharma which located in Jalan Malaka, Kota Administrasi Jakarta Pusat. The college has operated two faculties, e.g., Informatics Engineering (IE), and Information System (IS). The participant is collected from the site location. Most of them have enrolled in various years of study. The participant's demographic background is given in Table I which representing their gender, age, and years of study.

Method of Data Analysis

The tested variables in this study are the student's perception of the exam features, their effectiveness in using the exam, and their satisfaction toward the exam. We also want to test whether latent variables or constructs exist. To increase accuracy, the variables are expanded with some indicators that so called dimension of manifest variables to understand the relationship of the variables.

Structural Equation Model (SEM) Lisrel

Structural equation modeling (SEM) is used in this study comprehensively through the multivariate analysis process. There are two main characteristics of SEM testing. Firstly, an estimation of the interdependence of the multivariable, secondly, an ability to represent the unobserved concept in the model to measure the error of estimation. In the proposed model, it is assumed that variables have a normal distribution. A good model should have fitness values in the theoretical range to represent the TLI and CFI score with a normal distribution. The model testing is conducted through software SPSS and Lisrel. For testing the validity and reliability, a strict requirement is implemented on the sampling number, outliers and normality test.

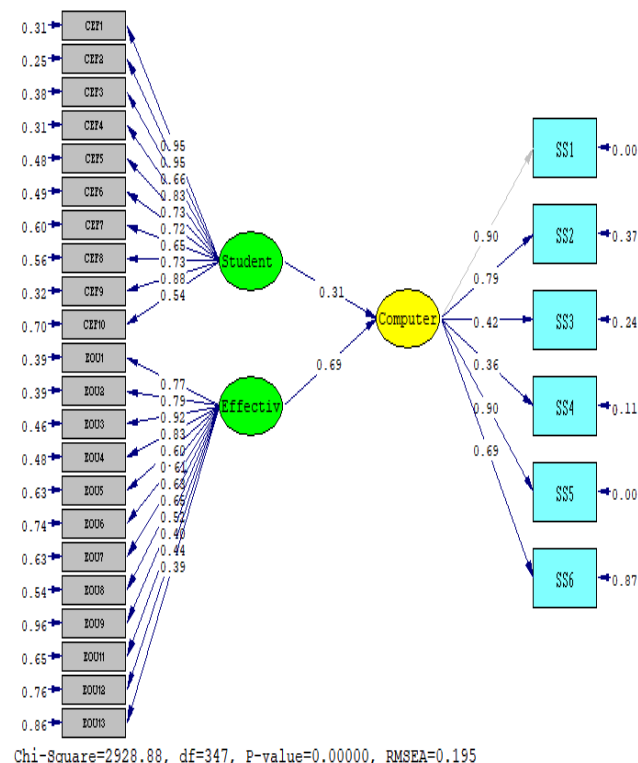
The result of validity and reliability testing can be evidence that the proposed model is adequate. The result of the testing is given in the next part.

Data Analysis and Discussion

Validity and reliability testing

Validity testing is conducted by observing the value of the loading factor from the constructs. In the testing, the result is valid if the score of the loading factor >0.5 . The result of validity testing from a total of 40 questions, there are 11 invalid statements with a loading factor <0.5 . The invalid questions are dropped from the questionnaires with left 29 valid statements. The valid statement is tested to the reliability score to get AVE and CR. The valid statements are reliable if the $AVE > 0.5$ AND $CR > 0.5$.

It is evident that the entire model has adequate validity and reliability as shown in Table 2 ($AVE > 0.5$; $CR > 0.7$). the results showed that the model can be used for testing in a real situation. Therefore, we will implement the model to exam the research hypotheses. The steps in the model testing are" creation of the model, feasibility testing, and significance testing of exogen toward endogen variables. The complete scheme of the proposed SEM model and its specification is given in Fig.2. Figure 2. Result of Goodness of fit testing for the proposed SEM model and its specification



Source: analysis result of SEM Lisrel (2019)

From Table 2, it showed that the criteria of goodness of fit for the proposed model have been achieved especially on the Chi-square and probability with a value of over 0,05. The result showed that the proposed model has a covariant matrix equal

to the population covariant matrix. Therefore, the proposed model is adequate to be used in a real setting.

Table 2. Goodness criteria

Goodness of Fit	Cut off value	Result	Description
Probabilities Chi Square	$\geq 0,05$	0,077	Good Fit
CMIN/DF	$\leq 2,00$	1,422	Good Fit
GFI	$\geq 0,90$	0,838	Marginal Fit
AGFI	$\geq 0,90$	0,793	Marginal Fit
CFI	$\geq 0,90$	0,952	Good Fit
TLI	$\geq 0,90$	0,969	Good Fit
NFI	$\geq 0,90$	0,908	Good Fit
IFI	$\geq 0,90$	0,943	Good Fit
RMSEA	$\leq 0,08$	0,045	Good Fit
RMR	$\leq 0,05$	0,038	Good Fit

Source: analysis result of SEM Lisrel (2019)

Result of hypotheses testing

The hypotheses testing is conducted to understand the effect of each variable to create causal paths, their level of significance and the results of the squared multiple correlations for the endogenous factors. Therefore, we tested and compare their relationship.

For inspection of H1, the result indicates that, as expected, computerized exam features are positively related to student satisfaction.

Computerized exam features have a strong and significant positive effect on student satisfaction (H1: COM à SAT; p value = ***; CR=7,680; p value < 0,05; CR> 1,96). It is concluded that work computerized exam features have positively and significantly influenced student satisfaction. Higher computerized exam features will lead to increased student satisfaction, and vice versa. Therefore, H1 is accepted. The testing result of H2 is also provided satisfied result. As expected, the effectiveness of use has a strong and significant positive effect on student satisfaction (H2: EF à SAT; p value = ***; CR=6,878; p value < 0,05; CR> 1,96). It is concluded that the effectiveness of use has positively and significantly influenced student satisfaction. Higher effectiveness of use will lead to increased student satisfaction, and vice versa. Therefore, H2 is accepted.

Discussion

Several useful points are made in the present paper about the hypothesized model and its empirical validation. Several studies have attempted to address the effect of independent toward dependent variables and its related constructs. In this study, it presents and addresses four main constructs, namely, computerized exam features, the effectiveness of use, and student satisfaction. The constructs are tested using the data from STMIK Swadharma in the City of Jakarta.

After integrating the constructs into a defined model, we conduct and measure the respective items and the results showed that they have adequate and significant psychometric properties.

For computerized exam features in hypothesis H1, it affects student satisfaction positively. The result is similar to the previous study by Rohatgi, et al., (2016) that computerized exam features are also correlated since the computerized

exam features can provide a positive effect on student satisfaction. This means that a higher of computerized exam features will lead to better satisfaction.

This result is logical as supported by the theory of social cognitive and blended learning that satisfaction is related to their experience toward an environment that shaped their thought and action (Littlejohn, et al., 2016). Besides, by following Bandura's social cognitive theory, the computerized exam features can drive more intense engagement and finally higher satisfaction.

For general discussion, it is apparent from the results of the present study that computerized exam features and effectiveness of use are major contributors to student satisfaction (Rohatgi, et al., 2016). This result is supported by previous studies that representing the real situation, for example, STMIK Swadharma with a certain number of students always implement the exam effectively through routine knowhow and training, accept the changes required and present greater commitment to maintaining the exam system by adding and updating the exam system to improve the student satisfaction.

Conclusion

The purpose of this study is to analyze the effect of computerized exam features and effectiveness of use on student satisfaction. The result provides empirical support for the major structural relationships proposed in the conceptual model. Some student's attributes have a higher effect on student satisfaction as tested in this study. The hypothesized relationships between the factors have an acceptable fit with data. Thus, the results of this study clarify the controversial subject of the contribution of this study which has been related to student satisfaction literature.

Our study results have a contribution to the development of knowledge in the area. More specifically, the study provides a theoretical basis regarding the effect of computerized exam features and effectiveness of use on student satisfaction, as well as their final effect to maintain satisfaction.

Finally, this work has successfully bridged the gap between theory and practice by providing STMIK Swadharma with a framework to help them improve, and thus become more competitive and sustainable in implementing the computerized exam system. The study suggests that students must be well educated, empowered, involved and accept the changes required to achieve and maximize their participation to pass the exam system. A well-educated and continuously trained student base is vital to pass the system by following the rule and policies of the exam instruction.

Managerial implications

The results of this study offer significant implications for both the student and lecturers of STMIK Swadharma. The findings of this study should motivate the college to concentrate on the system quality and its features to improve student satisfaction. The enhanced computerized exam features of students will lead them to the creation of continuous improvement through online interaction. Besides, proper training and education of students at all levels of an organization also improve the effectiveness of use and finally the satisfaction. As managing satisfaction can be problematic, the research result in this paper can address these problems through better strategies and policies of updating the system features to

ensure that its features are relevance and adequate to support the student engagement with the computerized exam system.

The study also helps exam administrators to realize that the performance of the system must be based on the features needed by the students. Thus, the effectiveness of use directly, while they may influence student satisfaction is a key contributor to the successful exam system.

References

- AlAzawei, A., Parslow, P., & Lundqvist, K. (2016). Barriers and opportunities of elearning implementation in Iraq: A case of public universities. *The International Review of Research in Open and Distributed Learning*, 17(5).
- Annamdevula, S., & Bellamkonda, R. S. (2016). Effect of student perceived service quality on student satisfaction, loyalty, and motivation in Indian universities: Development of HiEduQual. *Journal of Modelling in Management*, 11(2), 488517.
- Apugliese, A., & Lewis, S. E. (2017). Impact of instructional decisions on the effectiveness of cooperative learning in chemistry through metaanalysis. *Chemistry Education Research and Practice*, 18(1), 271278.
- Balta, N., PereraRodríguez, V. H., & HervásGómez, C. (2018). Using socrative as an online homework platform to increase students' exam scores. *Education and Information Technologies*, 23(2), 837850.
- Bano, M., & Zowghi, D. (2015). A systematic review of the relationship between user involvement and system success. *Information and Software Technology*, 58, 148169.
- Bjorklund, D. F., & Causey, K. B. (2017). *Children's thinking: Cognitive development and individual differences*. Thousand Oaks: Sage Publications.
- Bol, L., Campbell, K. D., Perez, T., & Yen, C. J. (2016). The effects of selfregulated learning training on community college students' metacognition and achievement in developmental math courses. *Community College Journal of Research and Practice*, 40(6), 480495.
- Bottiani, J. H., Bradshaw, C. P., & Mendelson, T. (2017). A multilevel examination of racial disparities in high school discipline: Black and white adolescents' perceived equity, school belonging, and adjustment problems. *Journal of Educational Psychology*, 109(4), 532.
- Brock, A., & Hundley, H. (2016). *The growth mindset coach: A teacher's month by month handbook for empowering students to achieve*. Berkeley, CA: Ulysses Press.
- Calderón, A., Meroño, L., & MacPhail, A. (2019). A student centered digital technology approach: The relationship between intrinsic motivation, learning climate, and academic achievement of physical education preservice teachers. *European Physical Education Review*, 1356336X19850852.
- Cameron, K. (2015). Organizational effectiveness. *Wiley Encyclopedia of Management*, 14.
- Card, S. K. (2018). *The psychology of human computer interaction*. Boca Raton: CRC Press.
- Connolly, G. J. (2017). Applying social cognitive theory in coaching athletes: The power of positive role models. *Strategies*, 30(3), 2329.

- Czerkawski, B. C., & Lyman, E. W. (2016). An instructional design framework for fostering student engagement in online learning environments. *TechTrends*, 60(6), 532539.
- Darling Hammond, L. (2015). *The flat world and education: How America's commitment to equity will determine our future*. New York: Teachers College Press.
- De Boer, H., Jongbloed, B., Benneworth, P., Cremonini, L., Kolster, R., Kottmann, A., ... & Vossensteyn, H. (2015). *Performance-based funding and performance agreements in fourteen higher education systems*. Enschede: Center for Higher Education Policy Studies.
- De Marco, A. P., & Broshek, D. K. (2016). Computerized cognitive testing in the management of youth sportsrelated concussion. *Journal of child neurology*, 31(1), 6875.
- Debus, J. C., & Lawley, M. (2016). Benefits and drawbacks of computer-based assessment and feedback systems: Student and educator perspectives. *British Journal of Educational Technology*, 47(2), 294301.
- Dennis, A., Wixom, B. H., & Roth, R. M. (2018). *Systems analysis and design*. Hoboken: John Wiley & sons.
- Devi, B., Khandelwal, B., & Das, M. (2017). Application of Bandura's social cognitive theory in the technology enhanced, blended learning environment. *International Journal of Applied Research*, 3(1), 721724.
- Flynn, A. B., & Featherstone, R. B. (2017). Language of mechanisms: Exam analysis reveals students' strengths, strategies, and errors when using the electronpushing formalism (curved arrows) in new reactions. *Chemistry Education Research and Practice*, 18(1), 6477.
- Grange, T. D. A. G., de Jorge, B., Franci, D., Santos, T. M., Setubal, M. S. V., Schweller, M., & de CarvalhoFilho, M. A. (2016). Cognitive load and self-determination theories applied to e learning: Impact on students' participation and academic performance. *Plus One*, 11(3), e0152462.
- Halpern, M., Zhu, Y., & Reddi, V. J. (2016, March). *Mobile CPU'S rise to power: Quantifying the impact of generational mobile CPU design trends on performance, energy, and user satisfaction*. In 2016 IEEE International Symposium on High Performance Computer Architecture (HPCA) (pp. 6476). IEEE.
- Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education*, 80, 152161.
- Harasim, L. (2017). *Learning theory and online technologies*. New York: Routledge.
- Harrati, N., Bouchrika, I., Tari, A., & Ladjailia, A. (2016). Exploring user satisfaction for elearning systems via usage-based metrics and system usability scale analysis. *Computers in Human Behavior*, 61, 463471.
- Holinka, C. (2015). Stress, emotional intelligence, and life satisfaction in college students. *College Student Journal*, 49(2), 300311.
- Horvat, A., Dobrota, M., Krsmanovic, M., & Cudanov, M. (2015). Student perception of the Moodle learning management system: A satisfaction and significance analysis. *Interactive Learning Environments*, 23(4), 515527.

- Hwang, G. H., Chen, B., & Huang, C. W. (2016). Development and effectiveness analysis of a personalized ubiquitous multi device certification tutoring system based on bloom's taxonomy of educational objectives. *Journal of Educational Technology & Society*, 19(1), 223236.
- James, L. T., & Casidy, R. (2018). Authentic assessment in business education: Its effects on student satisfaction and promoting behavior. *Studies in higher education*, 43(3), 401415.
- Johansen, J. D., Aalto-Korte, K., Agner, T., Andersen, K. E., Bircher, A., Bruze, M., ... & John, S. M. (2015). European society of contact dermatitis guideline for diagnostic patch testing–recommendations on best practice. *Contact dermatitis*, 73(4), 195221.
- Johnson, L., Becker, S. A., Cummins, M., Estrada, V., Freeman, A., & Hall, C. (2016). *NMC horizon report: 2016 higher education edition* (pp. 150). Austin, Texas: The New Media Consortium.
- Jones, G., & Alba, A. D. (2019). Reviewing the effectiveness and learning outcomes of a 3D virtual museum: A pilot study. In *Virtual Reality in Education: Breakthroughs in Research and Practice* (pp. 5275). Hershey, Pennsylvania: IGI Global.
- Kintu, M. J., Zhu, C., & Kagambe, E. (2017). Blended learning effectiveness: The relationship between student characteristics, design features, and outcomes. *International Journal of Educational Technology in Higher Education*, 14(1), 7.
- Ladhari, R., Souiden, N., & Dufour, B. (2017). The role of emotions in utilitarian service settings: The effects of emotional satisfaction on product perception and behavioral intentions. *Journal of Retailing and Consumer Services*, 34, 1018.
- Lee, J., Lim, C., & Kim, H. (2017). Development of an instructional design model for flipped learning in higher education. *Educational Technology Research and Development*, 65(2), 427453.
- Littlejohn, A., Hood, N., Milligan, C., & Mustain, P. (2016). Learning in MOOCs: Motivations and self-regulated learning in MOOCs. *The Internet and Higher Education*, 29, 4048.
- Malik, M. F., & Khan, M. N. A. (2016). An analysis of performance testing in distributed software applications. *International Journal of Modern Education and Computer Science*, 8(7), 53.
- McDougall, W. (2015). *An introduction to social psychology*. Kitchener, Ontario: Psychology Press.
- McKnight, K., O'Malley, K., Ruzic, R., Horsley, M. K., Franey, J. J., & Bassett, K. (2016). Teaching in a digital age: How educators use technology to improve student learning. *Journal of research on technology in education*, 48(3), 194211.
- Meier, D., & Knoester, M. (2017). *Beyond testing: Seven assessments of students and schools more effective than standardized tests*. New York City: Teachers College Press.
- Moridis, C. N., Terzis, V., Economides, A. A., Karlovasitou, A., & Karabatakis, V. E. (2018). Using EEG frontal asymmetry to predict IT user's perceptions regarding the usefulness, ease of use, and playfulness. *Applied psychophysiology and biofeedback*, 43(1), 111.

- Moser, R. S., Schatz, P., & Lichtenstein, J. D. (2015). The importance of proper administration and interpretation of neuropsychological baseline and post-concussion computerized testing. *Applied Neuropsychology: Child*, 4(1), 4148.
- Myers, R. H., Montgomery, D. C., & AndersonCook, C. M. (2016). *Response surface methodology: Process and product optimization using designed experiments*. Hoboken, NJ: John Wiley & Sons.
- Napitupulu, D., Rahim, R., Abdullah, D., Setiawan, M. I., Abdillah, L. A., Ahmar, A. S., ... & Pranolo, A. (2018, January). Analysis of student satisfaction toward the quality of the service facility. *Journal of Physics: Conference Series*, 954(1), 012019. IOP Publishing.
- Nardi, P. M. (2018). *Doing survey research: A guide to quantitative methods*. New York: Routledge.
- Navimipour, N. J., & Zareie, B. (2015). A model for assessing the impact of elearning systems on employees' satisfaction. *Computers in Human Behavior*, 53, 475485.
- Nilson, L. B. (2016). *Teaching at its best: A research based resource for college instructors*. Hoboken: John Wiley & Sons.
- Oliver, G. P. (2017). Taking it to heart: A case study of supporting English language learners through culturally responsive teaching, collaboration, and ESOL focused leadership. The State University of New York at Albany.
- Permzadian, V., & Credé, M. (2016). Do first year seminars improve college grades and retention? A quantitative review of their overall effectiveness and an examination of moderators of effectiveness. *Review of Educational Research*, 86(1), 277316.
- Rahimi, E., van den Berg, J., & Veen, W. (2015). Facilitating student driven constructing of learning environments using Web 2.0 personal learning environments. *Computers & Education*, 81, 235246.
- Rangel, V. S., & Coulson, H. L. (2017). Educational resilience: How students navigate the challenges of attending an early college high school. *Annual meeting of the University Council for Educational Administration November*.
- Rashid, T., & Asghar, H. M. (2016). Technology use, self -directed learning, student engagement, and academic performance: Examining the interrelations. *Computers in Human Behavior*, 63, 604612.
- Rohatgi, A., Scherer, R., & Hatlevik, O. E. (2016). The role of ICT self efficacy for students' ICT use and their achievement in a computer and information literacy test. *Computers & Education*, 102, 103116.
- Romiszowski, A. J. (2016). *Designing instructional systems: Decision making in course planning and curriculum design*. London: Routledge.
- Rowntree, D. (2015). *Assessing students: How shall we know them?*. London: Routledge.
- Shoemaker, J. R., Chavez, R. A., Keane, P., Butz, S., & Yowler, S. K. (2017). Effective utilization of computerized curricular assistive tools in improving NCLEXRN pass rates for a baccalaureate nursing program. *CIN: Computers, Informatics, Nursing*, 35(4), 194200.

- Simonetti, V., Comparcini, D., Flacco, M. E., Di Giovanni, P., & Cicolini, G. (2015). Nursing students' knowledge and attitude on pressure ulcer prevention evidence based guidelines: A multicenter crosssectional study. *Nurse education today*, 35(4), 573579.
- Skinner, B. F. (2016). The technology of teaching. BF Skinner Foundation.
- Smith, G. G., Besalti, M., Nation, M., Feldman, A., & Laux, K. (2019). Teaching climate change science to high school students using computer games in an intermedia narrative. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(6).
- Strayhorn, T. L. (2018). *College students' sense of belonging: A key to educational success for all students*. New York: Routledge.
- Sung, Y. T., Chang, K. E., & Liu, T. C. (2016). The effects of integrating mobile devices with teaching and learning on students' learning performance: A meta-analysis and research synthesis. *Computers & Education*, 94, 252275.
- Tarhini, A., Hone, K., Liu, X., & Tarhini, T. (2017). Examining the moderating effect of individual level cultural values on users' acceptance of E-learning in developing countries: a structural equation modeling of an extended technology acceptance model. *Interactive Learning Environments*, 25(3), 306328.
- Tidd, J., & Bessant, J. R. (2018). *Managing innovation: Integrating technological, market, and organizational change*. Hoboken, NJ: John Wiley & Sons.
- Trelease, R. B. (2016). From chalkboard, slides, and paper to e-learning: How computing technologies have transformed anatomical sciences education. *Anatomical sciences education*, 9(6), 583602.
- Turner, J., & Briggs, G. (2017). Using third party audiovisual materials in module production: learning design, cost effectiveness, and student satisfaction on DD210 and DE200.
- Wampoid, B. E. (2015). The intensive examination of social interaction. In *Single Case Research Design and Analysis (Psychology Revivals)* (pp. 105144). Routledge.
- Wang, M., Cheng, B., Chen, J., Mercer, N., & Kirschner, P. A. (2017). The use of web based collaborative concept mapping to support group learning and interaction in an online environment. *The Internet and Higher Education*, 34, 2840.
- Whiteside, A. L. (2015). Introducing the social presence model to explore online and blended learning experiences. *Online Learning*, 19(2), n2.
- Wlodkowski, R. J., & Ginsberg, M. B. (2017). *Enhancing adult motivation to learn: A comprehensive guide for teaching all adults*. Hoboken, NJ: John Wiley & Sons.
- Yang, H., Yu, J., Zo, H., & Choi, M. (2016). User acceptance of wearable devices: An extended perspective of perceived value. *Telematics and Informatics*, 33(2), 256269.
- Yilmaz, R. (2017). Exploring the role of e-learning readiness on student satisfaction and motivation in flipped classrooms. *Computers in Human Behavior*, 70, 251260.
- Yu, G. O. (2016). Intellectual and personality factors in the achievement of high exam effectiveness in first year Russian university students. *Psychology in Russia: State of the art*, 9(3).