The online examinations at Universitas Terbuka: an innovation diffusion viewpoint

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Abstract

Purpose – The purpose of this paper is to provide insight into the students' adoption rate of the online examinations at Universitas Terbuka (UT), which is a hotbed of technological innovation in higher education, by analyzing the students' adoption rate of the online examinations related to their academic factors (program of study, GPA, credit earned), socioeconomic status (age, sex, marital status, employment status), and residential factor.

Design/methodology/approach – This is an in-depth case study of 1,540 first-year students for the period ranging from the start of the second semester of 2013 to the first semester of 2016 at Bengkulu Regional Office of UT. During the term, quantitative data were set up with ordinal regression to measure the extent to which the adoption rate categories were influenced by such demographic characteristics as academic attainment, personal background, and current residence.

Findings – The results showed that while the program of study, grade point average, credits earned, sex, and residence had systematic effects on adopter categories, employment and marital status did not. The highlights of the results were that students with GPA less than or equal to 2.9 were 2.02 times likely to fall into a higher adopter category as compared to those with GPA above 2.9, and students residing in city were 2.50 times more likely to hit the higher levels of adopter category, compared to those residing outside city.

Research limitations/implications – As this is a case study of the students enrolled in the second semester of 2013 and because there has been a rapid change in the way people access information technology, further work should be done, in particular on the sample of students who have enrolled lately.

Practical implications – The institution of open and distance learning (ODL) should accelerate the introduction of new learning resources based on diffusion of innovation modeling.

Social implications – It is also recommended to especially encourage the new students of ODL to have a feeling of easiness and self-confidence regarding online examinations, and understand their importance. To achieve this objective, regional office staffs can guide the students to try out the online examination in the orientation study activities for new students.

Originality/value – Despite the extensive research on diffusion model for the past decades, this field of study has much more to offer in terms of describing and incorporating such current innovation as an online examination in ODL platforms with which to associate students' academic and demographic profiles.

Keywords Diffusion of innovation, Adopter categories, Adoption rate, Online examination,
Open and distance learning university

Paper type Research paper

Introduction

Online examination is a relatively more open and flexible learning platform, and is more convenient than a pencil-and-paper examination. As such, open and distance learning (ODL) institutions are urged to lead the endeavor to provide quality and excellence in the online examination services. Khare and Lam (2008) argued that "the implementation of online examination for distant learners can no longer be ignored or indefinitely postponed" (para. 1).

Conforming to such stipulation, Universitas Terbuka (UT) conducted the online examination in 2010. The number of participants saw a considerable rise from 332 in the first semester of 2010 to a staggering 2,293 in the second semester of 2012 (Sapriati and Pardede, 2015). This paper reflects on the profileration of online examination as a newly introduced education platform and analyzes how and why it broadened the extent to which the aforesaid students' demographics were interrelated, to bring those demographics into a unified diffusion framework (Iftakhar, 2016).

Lane and van Dorp (2011) defined the diffusion of innovation as a process of adoption involving four elements, i.e. an object of innovation, a group of people, communication channels, and a period of time. Accordingly, the diffusion of innovation is an adoption process of an innovation object in a group of people through communication channels over a period of time. This paper weighs in the concept of innovation-decision process that the students of UT depend upon to make decisions about rejecting, suspending, or using and adopting the online examination as an innovation in UT. Rogers (2003) has broken the innovation-decision process into five stages:

> (1) knowledge – the individual (or other decision-making unit) is exposed to the innovation existence and gains some understanding of how it functions; (2) persuasion – the individual (or other decision-making unit) forms a favorable or unfavorable attitude toward the innovation; (3) decision – the individual (or other decision-making unit) engages in activities that lead to a choice to adopt or reject the innovation; (4) implementation – the individual (or other decision-making unit) puts an innovation into use; and (5) confirmation – the individual (or other decision-making unit) seeks reinforcement for an innovation-decision already made, but he or she may reverse this decision if exposed to conflicting messages about the innovation (p. 206).

The innovation-decision period is referred to as adoption rate, which in this paper attributes to the students' time elapsing from awareness-knowledge of the online examination to the point at which it is put into use.

ODL has gained tremendous growth with an ample amount of innovations, most notably, in the strict sense, for students' learning support. UT as an ODL institution should accordingly keep providing sustainable innovations of learning support to its 300,000 students currently studying in nearly 13,000 islands in Indonesia. There has therefore been an urgent need for ODL institutions to observe and integrate the online examination as a modeling effort of diverse types of interpersonal characteristics, which are the students' demographics in this case, into a valid single framework of diffusion. Research in the diffusion modeling will have to expand the horizon. This paper proposes potential guidances for that expansion.

The purpose of the study was to elucidate how the adoption rate of online examination as an innovation at Bengkulu Regional Office of UT was linked to a number of students' demographics. The length of time between the beginning of the second semester of 2013 and their first participation in the online examination was taken into account to extend the measure of the students' adoption. The diffusion of innovation theory was then used to analyze the students' classification based on the adoption rates, i.e. innovators, early adopters, early majority, late majority, and laggards.

On the basis of the aforementioned purpose of study, the researcher therefore outlines research question as follows:

> RQ1. How is the students' adoption rate of online examination related to their academic factors (program of study, GPA, credit earned), socioeconomic status (age, sex, marital status, employment status), and residential factor?

Research context
UT has provided two forms of students' learning outcome evaluation, known as the final evaluation, i.e. paper-and-pencil test and online examination. The paper-and-pencil test was organized simultaneously in a fixed schedule and place determined by UT as written in the

academic calendar. The online examination was intended for the students who wanted to take the final evaluation beyond the schedule of the academic calendar of UT. In UT's regulation, the online examination is an option for the students to partake the final evaluation. Bengkulu Regional Office of UT began administering the online examination since the second semester of 2013. In the first semester of 2015, the number of students participating in the online examination was 1,239 or about 30 percent of the total number of students in the educational program for non-teachers. Since the first semester of 2016, re-examination has been introduced as the online examination in the event of students failing paper-and-pencil examination. In such capacity, the number of the participants is most likely to continue to have a growing number in the future.

The data showed that while the online examination was still carried out at Bengkulu Regional Office of UT in Bengkulu City, the capital city of Bengkulu Province, 66 percent of the participants came from outside Bengkulu City. They consequently had to make a travel arrangements, as they stayed hours away from the exam venues, so as to manage to snag a spot. Students from Mukomuko Regency, as an example, had to go on a seven-hour trip to get to Bengkulu City. A research result found that the cost factor of commuting to the exam venues was a determinant factor, though it might depend on the commuting distance and proximity to the exam venues (Sugilar, 2016). Despite the travel and financial burden, most of the students had high academic aspiration and a strong commitment to the university.

Prior to sitting for an online examination, students have to meet a number of procedures. Using their logins, students have to register for the desired examinations. It is their responsibility to ensure that they are aware of the examination details, including the date, the starting time, and the venue, set out by Bengkulu Regional Office of UT. Hence, it is highly recommended that they contact the regional office to get notified at all times about the online examination arrangements.

Related studies
Socioeconomic status has effects on the adoption rate. A study by Ganiyu *et al.* (2013) described that socioeconomic characteristics of adopters were closely associated with the adoption of innovation, which in turn heavily modulated it. Zhang *et al.* (2015) studied the adoption process of the e-appointment service focused on some factors influencing patient acceptance and the usage of this process, and found that "the patients' social and demographic characteristics, including age, education level, and work status, appeared to have influenced their choice of use or non-use of the e-appointment service" (p. 13). The research also found that the variable of sex play-acted as a moderating variable on the correlation between employment status and usage of the e-appointment service. Accordingly, a recent study by Penjor (2016) used age and gender to predict the adoption rate for the virtual learning environment among academic staffs. To conclude, in some cases of adoption process of an innovation, the socioeconomic status variable was related to the level of innovativeness of the adoption. This paper assumed that the socioeconomic status had an effect on the adoption of the online examination and conceptualized socioeconomic status which included the variables of age, sex, marital status, and working status.

Several personal characteristics have explained the individual adoption rate of an innovation. Rogers (2003) generalized that "earlier adopters had greater intelligence, […] more favorable attitude toward education and science, […] had higher levels of achievement motivation than later adopters, [and] […] had higher aspirations (for education, occupations, and so on)" (p. 258). A study by Campbell (2015) about the diffusion of innovation of video-conference technology in distance education pointed out that the interaction of the students with instructors and material were key elements affecting adoption decisions of students regarding video-conference. In an academic setting, as discussed in this paper, students' pursuance of a program of study, GPA, and credits earned may attribute to such characters.

The students' program of study, among other variables in this paper, was included due to an assumption that the characteristics of students of teacher-training programs were different from those of the regular programs. The students of teacher-training programs are typically professional teachers who are required by the law to earn a bachelor degree, while those of regular programs are non-teachers, be it employees or fresh graduates from high school, who attend UT with considerably diverse motivations and goals which they might want to achieve.

Another characteristic equally relevant to this study is the degree of cosmopoliteness, i.e. "the degree to which an individual is oriented outside the social system" (Rogers, 2003, p. 259). Rogers specified that early adopters are more cosmopolitan than later adopters, since the innovators' networks are more likely to be outside, rather than within, their social system and "they travel widely and are involved in matters beyond the boundaries of their local system" (Rogers, 2003, p. 258). On the basis of this theory, this study broadened in scope from focusing on socioeconomic status to encompass the so-called cosmopoliteness with respect to the variable of residence, which denoted whether the respondents currently resided in or outside Bengkulu City.

Despite the growing trend of the innovation, online examinations at UT have yet to garner much research attention to date. One of the researches was regarding a number of determinants of students' participation in the online examination by Sugilar (2016), who documented group comparison analysis between the groups of participating and non-participating students. The results showed that the following factors influenced the students to participate in the online examination: self-efficacy in using computers, perceived easiness in operating an online examination, perceived importance of online examination, intrinsic value of online examination, and cost of online examination. In addition, the following personal factors of students were of equally crucial importance in relation to their participation in the online examination: age, grade point average, gender, and marital status. Based on the rank of the amount of effect size for each factor, the order of the five most important of those nine factors was as follows: first, perceived easiness, second, intrinsic value, third, self-confidence, fourth, marital status, and fifth, grade point average.

Another research was conducted by Iriani (2010) who evaluated the online examination practices at Surabaya Regional Offices of UT. The results concluded that 64.22 percent of the students had not known the online examination, and only 2 percent of the students thus 2 percent participated in the online examination. However, the students who participated in the online examination showed exceptionally favorable attitudes toward the arrangement of the online examination.

Sapriati and Zuhairi (2010) observed that in a regional office of UT about 75 percent of students who took a computer-based testing were also participating in a paper-and-pencil test. For the students taking both examination modes, Sapriati and Zuhairi found that the mean score of computer-based testing (equal to 54.00) was higher than the mean score of paper-and-pencil testing (equal to 46.00). Since, as the students know certainly, the examination results do not rely on the mode of examination, rather they depend on the learning process before the examination, these findings expressed that the students had a good preparation before they took the computer-based testing; this was probably because the paper-and-pencil testing was held prior to the computer-based testing.

Research method
This case analysis of 1,540 first-year students at the beginning of the second semester of 2013 at Bengkulu Regional Office of UT employed ordinal regression (Norusis, n.d.) to examine the adoption rate among students of the online examination based on explanatory factors and variables, i.e. academic factors (program of study, GPA, credits earned), personal factors (age, sex, marital status, working status), and residential factor (within or outside the city). The adoption rate of the online examination as an innovation was measured for each student.

The adoption rate was measured by the number of semesters between the beginning of the second semester of 2013 and the first time they participated in the online examination until the first semester of 2016. Because the number of semesters from the first semester of 2013 to the first semester of 2016 was seven, the adoption rate was represented by $7 - d$, where d was the number of semesters between the beginning of the second semester and their first participation in the online examination. On the basis of this formula, it can be identified that students who were first participating in the online examination in the second semester of 2014 had the adoption rate equal to $7 - 2 = 5$, since the students needed two semesters before they took the online examination. The students who participated at the time of their first enrollment (the second semester of 2013) would have the adoption rate equal to $7 - 0 = 7$. In this case, the students who never participated in the online examination, until the first semester of 2016, were considered to have the adoption rate equal to $7 - 6 = 1$. Therefore, there were seven adoption rate categories, from 1 to 7. Whenever the students showed higher adoption rate, they were more likely to adopt the online examination faster.

The adoption rate categories in this research were presented in the ordinal quantities from 1 to 7 and are related to adopter categories based on Rogers (2003), who classified the categories as laggards, late majority, early majority, early adopters, and innovators. The relationship between the adoption rate and the adopter categories was not a one-to-one mapping, for two reasons. First, the number of adoption rate categories in this research was seven, while the number of adopter categories in the diffusion of innovation theory was five. Second, the adopter categories in the diffusion of innovation theory described adopter categorization with a certain standard. For example, the laggards category lies at $\overline{X} + 2sd$ interval and the innovators category lies at $\overline{X} - 2sd$ interval in a normal distribution, while the adoption rate in this research is merely indicated by the number of semesters. Therefore, the adopter categories were simply a direction to define the adoption rate categories in a process of innovation diffusion. In fact, there was no clear-cut boundary for adoption rate categories in relation to adopter categories. Table I describes the relationship between adoption rates and adopter categories.

This study used an ordinal regression model to analyze a relationship between adopter categories and academic factors (program of study, GPA, credits earned), personal factors (age, sex, marital status, working status), and residential factor (within or outside the city). The ordinal regression required only the dependent variable as an ordinal variable. The independent variables could be an interval, ordinal, or categorical. However, to avoid too many empty cells and for convenient interpretations, the independent variables are all converted to categorical numbers, as shown in Table II.

The parameters of ordinal regression need different interpretation compared to parameters in simple linear regression. The basic concepts for interpreting parameters of ordinal regression are the concepts of odds, odds ratio, and logit (National Centre for

First time enrolled in Bengkulu Regional Office of Universitas Terbuka	First time participated in the online examination	Number of semester before joining the online examination (d)	Adoption rate ($7-d$)	Adopters categories (as a direction for interpretations)
2nd semester of 2013	2nd semester of 2013	0	7	Innovators
	1st semester of 2014	1	6	Early adopters
	2nd semester of 2014	2	5	Early majority
	1st semester of 2015	3	4	Late majority
	2nd semester of 2015	4	3	Laggards
	1st semester of 2016	5	2	
	Not participated yet until 1st semester of 2016	6	1	

Table I.
Relationship adoption rate and adopter categories

Factors	Variables	Variable values
Academic	Program of study	= 1, non-teacher program (regular program) = 0, teacher-training program
	GPA	= 1, more than 2.9 = 0, less than or equal to 2.9
	Credits	= 1, more than 62 = 0, less than or equal to 62
Personal	Age	= 1, more than 25 = 0, less than or equal to 25
	Sex	= 1, male students = 0, female students
	Marital status	= 1, married = 0, unmarried
	Working status	= 1, working = 0, not working
Cosmopoliteness	Residential	= 1, residing in city = 0, residing outside city

Research Methods, n.d). The odds express the likelihood of an event occurring relative to the likelihood of an event not occurring. For a dichotomous explanatory variable, the odds ratio is simply the difference between the odds for the base category $(x = 0)$ and the other category $(x = 1)$. Logit is the log of the odds ratio. The parameter estimate in ordinal regression as shown in Table IV is in the form of logit numbers. For instance, the parameter estimation for teachers' category is −0.853. Therefore, the odds ratio for teachers and non-teachers is $\exp(-0.853) = 0.426$. This means that the odds of teachers achieving the higher adopter category are 0.426 times compared to non-teachers. Similarly, the odds ratio for non-teachers compared to teachers is $1/\exp(-0.853) = 2.345$, which means the odds of non-teachers reaching the higher adopter category is 2.345 times that of teachers. In some contexts, the odds ratio could be also expressed in percentage terms, e.g. the odds ratio of adoption rate for teachers was 42 percent for non-teachers.

Findings and discussion

Description of adopter category by explanatory variables

This study dealt with 1,540 students who first enrolled in the second semester of 2013 at Bengkulu Regional Office of UT. In Table III, teachers make up 53.4 percent of the students, most notably elementary school teachers. None of the students in the teacher program was included in the innovators category. More than 50 percent of the students had a GPA of 2.9 or less in the first semester of 2016, and made up the bulk of the innovators category. Meanwhile, the students who earned 62 credits or less stood out in the laggards category with 64.0 percent.

In terms of the age group, the number of the students aged 25 or less surpassed the number of students aged over 25 in the lower adoption categories 1, 2, and 3. This led to a domination of student groups aged over 25 in the higher adoption categories 4-7, where in fact none of the students aged 25 or less were found in category 7 or classified as innovators. Classifying on gender basis, the number of female students surpassed the number of male students in almost all adoption rate categories, except for category 7. However, no such systematic difference was found for variables of marital status and working status, since the percentage between the levels in each variable converged to a percentage of the total.

As for the students' residences, the low adoption categories 1-5 were dominated by the students residing outside Bengkulu City. In contrast, those residing in Bengkulu City

Adopters' Categ. Exp. variables	Laggards 1	Late majority 2	Early majority 3	4	Early adopters 5	Innovators 6	7	Total
Academic								
1. Program								
Teachers	762/58.7%	10/14.5%	13/34.2%	25/27.5%	12/100.0%	1/4.5%	0/0.0%	823/53.4%
Non-teachers	537/41.3%	59/85.5%	25/65.8%	66/72.5%	0/0.0%	21/95.5%	9/100.0%	717/46.6%
2. GPA								
⩽ 2.9	628/48.3%	30/43.5%	22/57.9%	62/68.1%	9/75.0%	15/68.2%	6/66.7%	772/50.1%
> 2.9	671/51.7%	39/56.5%	16/42.1%	29/31.9%	3/25.0%	7/31.8%	3/33.3%	768/49.9%
3. Credits								
⩽ 62	831/64.0%	11/15.9%	16/42.1%	21/23.1%	3/25.0%	11/50.0%	7/77.8%	900/58.4%
> 62	468/36.0%	58/84.1%	22/57.9%	70/76.9%	9/75.0%	11/50.0%	2/22.2%	640/41.6%
Personal								
4. Age								
⩽ 25	659/50.7%	47/68.1%	21/55.3%	36/39.6%	3/25.0%	6/27.3%	0/0.0%	772/50.1%
> 25	640/49.3%	22/31.1%	17/44.7%	55/60.4%	9/75,0%	16/72.7%	9/100.0%	768/49.9%
5. Gender								
Female	804/61.9%	37/53.6%	27/71.1%	56/61.5%	11/91.7%	16/72.7%	4/44.4%	955/62.0%
Male	495/38.1%	32/46.4%	11/28.9%	35/38.5%	1/8.3%	6/27.3%	5/55.6%	585/38.0%
6. Marital status								
Not married	816/62.8%	57/82.6%	25/65.8%	56/61.5%	4/33.3%	14/63.6%	7/77.8%	979/63.6%
Married	483/37.2%	12/17.4%	13/34.2%	35/38.5%	8/66.7%	8/36.4%	2/22.2%	561/36.4%
7. Working status								
Not working	193/14.9%	27/39.1%	8/21.1%	14/15.4%	0/0.0%	3/13.6%	0/0.0%	245/15.9%
Working	1,106/85.1%	42/60.9%	30/78.9%	77/84.6%	12/100.0%	19/86.4%	9/100.0%	1,295/84.1%
Geography								
8. Residential								
Outside city	1,141/87.8%	36/52.2%	29/76.3%	69/75.8%	7/58.3%	11/50.0%	0/0.0%	129/84.0%
City	158/12.2%	33/47.8%	9/23.7%	22/24.2%	5/41.7%	11/50.0%	9/100.0%	247/16.0%

Table III.
Adopter category by explanatory variables

outnumbered those residing outside Bengkulu City in categories 6 and 7. This signifies that the students residing in Bengkulu City were more inclined to adopt the online examination faster than those residing outside Bengkulu City.

Model of adopter category on online examination
The parameters of the ordinal regression model for the effects of academic (program, GPA, credits earned), personal (age, gender, marital status, working status), and residential variables (within city or outside city) on the adopter categories are presented in Table IV. The model of ordinal regression proposed a significant χ^2 statistic ($p < 0.0005$) to suggest that the final model led to a significant improvement upon the baseline or intercept-only model. The Nagelkerke of the pseudo R^2 statistics value was 16.6 percent, stipulating that the explanatory variables defined 16.6 percent of the variation among adopter categories. The model also corroborated the assumption of goodness of fit, indicated, respectively, by the χ^2 test for the null hypothesis of deviance statistics that was not rejected by χ^2 test at $p < 0.997$ and the χ^2 test for the assumption of parallel lines that was not rejected at $p < 0.278$.

The threshold in the Table IV represents the intercept in the model of ordinal regression. All intercept coefficients were significant at $p < 0.05$ by the Wald test, which in turn would

	Estimate	SE	Wald	df	Sig.	Exp(B)	1/Exp(B)
Threshold (intercept coefficients)							
(Adopter category = 1.00)	0.696	0.230	9.160	1	0.002		
(Adopter category = 2.00)	1.139	0.232	24.055	1	0.000		
(Adopter category = 3.00)	1.442	0.235	37.613	1	0.000		
(Adopter category = 4.00)	2.707	0.265	104.322	1	0.000		
(Adopter category = 5.00)	3.052	0.281	117.757	1	0.000		
(Adopter category = 6.00)	4.325	0.397	118.858	1	0.000		
Location (Bs' coefficients)							
(Teachers = 0)	−0.853	0.207	16.928	1	0.000	0.43	2.35
(Non-teachers = 1)	0[a]			0			
(GPA = 0)	0.703	0.162	18.740	1	0.000	2.02	0.50
(GPA = 1)	0[a]			0			
(Credits earned = 0)	−1.148	0.182	39.843	1	0.000	0.32	3.15
(Credits earned = 1)	0[a]			0			
(Age = 0)	−0.531	0.190	7.789	1	0.005	0.59	1.70
(Age = 1)	0[a]			0			
(Sex = 0)	0.533	0.167	10.161	1	0.001	1.70	0.59
(Sex = 1)	0[a]			0			
(Marital status = 0)	0.242	0.197	1.520	1	0.218		0.79
(Marital status = 1)	0[a]			0			
(Working status = 0)	−0.112	0.218	0.264	1	0.607		
(Working status = 1)	0[a]			0			
(Outside city = 0)	−0.915	0.168	29.695	1	0.000	0.40	2.50
(City = 1)	0[a]			0			

Note: [a]This parameter is set to zero as it is redundant

Table IV.
Parameter estimation
of the model

be included in the model. The location in the table represented coefficients of the explanatory variables in the model. If the coefficient was significant at $p < 0.05$, the associated variable would be included in the model. Table IV demonstrated that all variables were significant at $p < 0.01$, denoting that there was a strong association between each of these variables and adopter categories. However, no such significant association was found for marital and working status.

As described earlier, the parameter estimate in ordinal regression as shown in Table IV is in the form of logit numbers. The logit is log of odds ratio between two categories. For a dichotomous explanatory variable, the odds ratio is simply the difference between the odds for the base category ($x = 0$) and the other category ($x = 1$). For easy interpretation of the parameters in Table IV, the last two columns of Table IV provide the exponential values of the parameters and their inverses.

Academic factors
In Table IV, the educational program consists of teachers and non-teachers (or regular program). Adopter category of the students of teacher program was indicated by the parameter estimation equal to −0.853. Therefore, the odds of a student of teacher program breaking into a higher adopter category (from laggards to innovators category) was exp (−853) = 0.46, or 46 percent of the odds of a student of the regular program. Conversely, the odds of breaking into a higher adopter category increased by 1/0.46 = 2.35 times for a regular student compared to those for a teacher student. The regular program students, simply put, were more likely to adopt the online examination much faster than the teacher program students. Referring to the previous argument, the students majoring in teacher education and training program are typically teachers required by the law to earn at least a bachelor degree

at UT to qualify for teaching, and evidently they are of relatively homogenous characteristics. The students of regular program, on the other hand, are of tremendously diverse kinds, from high school fresh graduates to retiring people. The differences in characteristics of such two groups brought about differences in the odds of falling into a higher adopter category to 46 percent for those in the teacher-training program.

The parameter estimate for the variable of GPA was 0.703, which was GPA > 2.9 as a baseline, suggesting that the odds of a student with a GPA of 2.9 or less to fall into a higher adopter category were 2.02 times (or 202 percent) as much as those with GPA above 2.9. The GPA data were taken in the first semester of 2016, before the inception of the online examination, which let the students decide whether to participate or not in the elapsed time – from the second semester of 2013 to the first semester of 2016. This research yet stumbled upon unexpected finding that a student with a higher GPA turned out a slower adopter. On the other hand, this finding was consistent with that of earlier research that a student with a lower GPA had a high score in expectancy and value toward the online examination (Sugilar, 2016). The study also discovered that a student with a lower GPA, in fact, needed the online examination much more, as a re-examination, to improve his/her GPA. Students with lower GPA, simply put, were more likely to adopt the online examination faster. Some students, who could be categorized as laggards or late adopters, explained that they did not yet need the online examination because they were obtaining good grades for their courses. This should have supported the fact that the students who were fast adopters of the online examination were largely the students who acquired lower GPA.

It is important to note, however, that the online examination is just been another tool for measuring students' competence in one course and assessing their failure in improving their learning so that they can learn from their mistakes. The finding that the students with lower GPA belonged to the category that adopted the online examinations faster indicates that the online examinations provided the students with the benefits of re-examination but did not lead to significantly higher scores. Therefore, there is a need for further research regarding the examination results and the students' preparations before taking the online examinations.

The students that earned credits above 62 in the first semester of 2016 had a 3.12 times the chance to be in higher levels of adopter category as compared to those that earned 62 credits or less. In accordance with the earlier findings, this finding suggests that while the online examination did not add to the GPA significantly, the students acquired sufficient grade for credit accumulation. To conclude, although the online examination did not pull off the GPA above 2.9, it helped the students in the second semester of 2013 to gain a credit greater than 62.

Personal factors
Students aged 25 or less were 0.59 times slower adopters than students aged over 25. In other words, those aged above 25 were 1.7 times faster adopters than those aged 25 or less. This was contrary to the assumption that younger people, as digital natives, tended to be better adopters of communication technology. On the other hand, this finding was in line with a research result that older students demonstrate higher scores in expectancy and values toward the online examination (Sugilar, 2016). This indicated that the students considered the online examination less related to technological issues, but more associated with tools that enabled them to frequently take the re-examination. The participation in online examination was, thus, closely linked to a sense of learning seriousness. This was underlined by a research conducted by Darmayanti (1993), among others, in UT's context, who posited that older students had seriousness and self-directed learning compared to younger students.

The odds for the female students to be part of higher adopter categories were 1.7 times that of male students; the male students had only 0.59 times the females' possibility.

This finding extended the result of a research in online examination by Sugilar (2016) that the male students tend to participate more frequently in online examinations. The male students are consequently slower adopters than the female students, but once the male students participate in online examinations, they will participate several times more than the female students.

Residential factor
Residential factor refers to the place where the students resided during research period. Bengkulu Province has nine regencies and one city, which is its capital, Bengkulu City. Bengkulu Province has an estimated population of 1.828 million, of which about 310,000 are concentrated in Bengkulu City. As the capital city, Bengkulu City has better infrastructure and facilities for communication and a more heterogeneous mix of people coming from other places in Indonesia, with several foreign-born people. The people of Bengkulu City are assumed to be more cosmopolitan than those belonging to other places in Bengkulu Province.

Cosmopoliteness is a characteristic strictly associated with innovation, and people who are more cosmopolitan are earlier adopters of innovations (Rogers, 2003). Table IV reveals that students' residential factor gives different odds for higher levels of adopter category. Those residing in Bengkulu City were 2.50 times more likely to hit the higher levels of adopter category, compared to those residing outside Bengkulu City. The city-dwelling students were thus faster adopters of the online examination.

Conclusions and recommendations
Conclusions
The results of this study showed that while program of study, grade point average, credits earned, sex, and residence had systematic effects on adoption rate categories, no such effects were found in employee status and marital status. The conclusions of this study are as follows:

- The students majoring in teacher education and training program were faster adopters of the online examination than those majoring in a non-teacher program of study. The adoption rate of the online examination among the students in the teacher program was 46 percent of the adoption rate of the students in the regular program.

- There was greater likelihood of the online examination adoption among students with lower GPA (2.9 or less) than among students with higher GPA (above 2.9), implying that students with lower GPA benefited from the online examination as a re-examination effort to improve their GPAs.

- The students with credits greater than 62 were 3.12 times more likely to achieve higher levels of adopter category compared to those with 62 credits or less.

- Students aged 25 or less had 59 percent likelihood of those aged above 25 to gain higher levels of adopter categories.

- Female students were 1.7 times more likely to pull off the higher adopter categories. The male students were thus slower adopters of the online examination as compared to the female students.

- The students that resided in Bengkulu City were 2.50 times more likely to reach higher levels of adopter categories than those residing outside Bengkulu City. These city-dwelling students, in other words, pushed on the adoption of the online examination 2.50 times faster than the non-city-dwelling students.

Recommendations

This study implies that the institution of ODL should accelerate the introduction of new learning resources based on diffusion of innovation modeling. Upcoming technological changes in the nature of ODL innovations are expected to extend this scope further and are expected to be integrated with students' demographic profiles. Diffusion modeling has attempted to reflect the increasing complexity of newly introduced innovations in the adoption process. As a technological innovation, the online examination should be diffused by applying the technology acceptance model. To maximize students' acceptance of the technological innovations, it becomes pertinent to emphasize the usefulness and easiness in terms of students' perception. Mkhize *et al.* (2016) has concluded that "Technological innovation has been the pillar of success in many organisations in the knowledge age, irrespective of the organisation type" (p. 298).

In addition, it is recommended, to the developer of learning resources for the students of ODL, that all the learning resources should be developed and evaluated with students' expectancy-value in mind (Sugilar, 2016). The following factors should be noticed: easiness, students' ability, importance in the students' view, possible intrinsic values of students, and cost. It is also recommended to encourage the students of ODL to have the feeling of easiness, self-confidence, and importance of using online examination, especially for the new students joining ODL. To achieve this objective, regional office staffs can guide the students to try out the online examination in the new student orientation study activities.

As this research is a case study in Bengkulu Regional Office of UT, further study is needed to compare adoption pattern of the online examination among regional offices of UT, since Indonesia consists of more than 10,000 inhabitant islands with cultural varieties. The analysis should include some variables that represent the uniqueness of each region in Indonesia. Further study is also necessary for comparing the adoption of new learning technologies among ODL students of various nations.

References

Campbell, B.G. (2015), "Diffusion of innovation of videoconference technology: an instrumental case study concerning undergraduate degree-seeking nontraditional learners", doctoral dissertation, Nova Southeastern University, Fort Lauderdale, FL, available at: http://nsuworks.nova.edu/fse_etd/ (accessed December 23, 2016).

Darmayanti, T. (1993), "Readiness for self-directed learning and achievement of the students of Universitas Terbuka", unpublished master thesis, University of Victoria, Victoria, BC.

Ganiyu, R.A., Patrick, L. and Adeosun, K. (2013), "Perceived attributes of successful and unsuccessful innovations", *International Journal of Innovative Research in Management*, Vol. 1 No. 2.

Iftakhar, S. (2016), "Google classroom: what and how?", *Journal of Education and Social Sciences*, Vol. 3, February, pp. 12-18.

Iriani, D. (2010), "Evaluasi penyelenggaraan sistem ujian online di UPBJJ-UT Surabaya", *Jurnal Pendidikan Terbuka dan JarakJauh*, Vol. 11 No. 2, pp. 108-116.

Khare, A. and Lam, H. (2008), "Assessing student achievement and progress with online examinations: some pedagogical and technical issues", *Journal of International on e-Learning*, Vol. 7 No. 3, pp. 383-402, available at: www.learntechlib.org/noaccess/23620

Lane, A. and van Dorp, C.A. (2011), "Diffusion and adoption of open educational resources", *eLearning Papers*, Vol. 23, March, pp. 1-9.

Mkhize, P., Mtsweni, S. and Buthelezi, P. (2016), "Diffusion of innovations approach to the evaluation of learning management system usage in an open distance learning institution", *International Review of Research in Open and Distributed Learning*, Vol. 17 No. 3, pp. 295-312.

National Centre for Research Methods (n.d.), "Using statistical methods in education research", available at: www.restore.ac.uk/resources/statisticalRegression.html (accessed December 23, 2016).

Norusis, M.J. (n.d.), "Ordinal regression", available at: www.norusis.com (accessed November 16, 2016).

Penjor, S. (2016), "Predicting virtual learning environment adoption: a case study", *The Turkish Online Journal of Educational Technology*, Vol. 15 No. 1, pp. 69-81.

Rogers, E.M. (2003), *Diffusion of Innovations*, 5th ed., Free press, New York, NY.

Sapriati, A. and Pardede, T. (2015), "Ujian online", in Belawati, T., Damayanti, N.S. and Puspitasari, K.A. (Eds), *Universitas Terbuka di Era Informasi*, Universitas Terbuka, Jakarta, pp. 227-248.

Sapriati, A. and Zuhairi, A. (2010), "Using computer-based testing as alternative assessment method of student learning in distance education", *Turkish Online Journal of Distance Education*, Vol. 11 No. 2, pp. 161-169.

Sugilar, S. (2016), "Determinants of students participating in online examination", *Journal of Education and Learning*, Vol. 20 No. 2, pp. 119-126.

Zhang, X., Yu, P., Yan, J. and Spil, T. (2015), "Using diffusion of innovation theory to understand the factors impacting patient acceptance and use of consumer e-health innovations: a case study in a primary care clinic", *BMC Health Services Research*, Vol. 15 No. 71, pp. 1-15.

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