Analysis of Control Security and Privacy Based on e-Learning Users

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Abstract **–The study objective is to analyze the control of security and privacy, the theory of planned behavior (TPB), i.e. attitude and behavioral intention factors to support the e-Learning users in Pamulang University of Indonesia. This type of research is causality with quantitative approach. The causality with questionnaires were used as instruments to collect data. The number of samples were 80 college students. The data analyzed using respondent of demographics and descriptive statistics, structural equation modeling to test the model fit, hypothesis test using path analysis technique. The results indicate that the control of security and privacy have a significant influence to the attitude and behavioral intention as well as its implication to the e-Learning users. Attitude and behavioral intention are an intervening variable in the effect of the control of security and privacy on e-Learning users.**

Keywords **– control security and privacy, e-Learning Users**

1. Introduction

Nowadays, Individual or organizations needs cloud computing technology to support their work. Cloud computing has been integrated with digitalization concepts which makes it much easier in terms of managing information systems [1].

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Cloud computing offers a platform, a set of software services and infrastructure that is focused on managing and coordinating data resources effectively to reach a certain scale. Database stored in the cloud can allow users to accesses such as PC's, laptops, "tablets" or smart-phones which are connected to the internet network.

Distinct advantage of using cloud computing is that it can manage document and file access to structured storage media, synchronize and share data, and reduce data redundancy. This system can be used without capital investment and maintenance that can be done as early as possible [2]. The user can make use of this service in certain applications such as Google Drive, Dropbox, Evernote, and else. According to IDG Enterprise's report in 2015 on the survey of 962 respondents of cloud computing of the CIO, Computer world, CSO, InfoWorld, IT-World and World Network circles, there are 72 percent of these organizations have at least one application or a part of cloud-based computing infrastructure.

Cloud computing services will be a challenge of an organization especially in developing countries such as Indonesia. The cloud computing users in Indonesia still rely on the role of other vendors to implement a group of servers in processing a data storage location that can be accessed co-together through terminals online and on multiple computers, thus hampering the development of cloud computing technology. The Ministry of Communication and Information through Law No.11 of 2008 pertaining to Information and Electronic Transactions (LN No. 58 of 2008, TLN 4843) has not yet fully regulated cloud computing, thus the SNI 27000 on Information Security System Standards has set to become a reference in application of this technology. The negative impact of the information age is the rise of privacy violations. The hoax news that occurred in social media at the end of 2016 was an example of privacy violations that set forth in the ITE Law of 2008 which was revised on November 26, 2016.

The use of cloud services, especially in higher education becomes very useful, this can reduce investment funding and routine operational operations of the organizing institutions, lectures can be held by reducing the number of face-to-face and

the use of e-books as material and library media that can be controlled via the web. Lecturers / instructors can reflect on planning through the Lecture Event Unit (SAP) and the Lecture Syllabus by uploading and interacting in lecture activities or known as e-learning so that it can expand discussions and reflections after learning is completed [3].

Security issues that often occur in the world of higher education are the spread of viruses between computers when transactions or file transfers occur between lecturers and students in the distribution of course material, assignments and other teaching aids. Another obstacle that will be faced by lecturers in collecting each student's assignment file is the capacity of the device must be prepared which takes up enough bandwidth capacity. Privacy issues also threaten the existence, responsibility, access of third parties for the protection of personal data (personal data) because it causes concerns that need attention for users of cloud computing services [4].

The Government Program set forth in the Strategic Plan of the Ministry of Research, Technology and Higher Education launched since 2015 in an effort to work up the quality of education both through conventional learning systems and the e-learning technology [5]. On the other hand, the reality of the lecture system in the world of higher education in Indonesia offers the concept of e-Learning with the aim of effectiveness and flexibility compared to conventional lecture systems, especially those that have implemented e-learning in the scope of the University. Some deficiencies / obstacles that arise such as limited infrastructure as computer and laboratory infrastructure facilities, computerized academic service systems, business commitment, lecturer readiness and the socialization of e-Learning system itself in all elements of the University.

This research was background by previous researchers through the technology acceptance model (TAM) in 1989 by Fred D. Davis whose purpose was determine the supporting and inhibiting factors of the cloud-based use in Learning Management System (LMS) services using the attitude towards perceived usefulness and perceived ease of use and technology factors. The data analysis method uses structural equation models involving 121 students in high school. The research findings indicate that the perceived ease of use by cloud file hosting services over LMS services represents better benefits compared to standard management learning [6]. Furthermore, the impact of security and privacy concerns from the use of cloud-based education services using theory of planned behavior (TPB) by Ajzen's in 1991. The data analysis method uses structural equation modeling with a survey of 200 early service users. Research findings are able to predict concern over security and privacy issues through students' attitudes and perceptions and behavioral intentions of users to use cloud-based services[7]. Cloud computing developed in education in classroom development uses six theories, i.e. the motivational model, service quality, the technology acceptance model (TAM), the theory of planned behavior (TPB) or theory of reasoned action (TRA), self-efficacy, and innovation diffusion theory (IDT). The data analysis method uses structural equation modelling with an online survey of 478 respondents. The research findings produce the importance of modelling from six theoretical that are put together to provide a comprehensive understanding factors that influence student intentions for the use of classrooms using cloud computing [8]. The e-Learning strategy used utilization in overcoming the limited number of lecturers at Pamulang University. The research method uses a descriptive approach with data collection techniques through direct observation, questionnaires, interviews, and documentations. The findings of the research results that the evaluation of e-Learning used at Pamulang University has been succeeded by using SUMI Questionnaire. [9].

Some of the reviews of the above research show that management of e-Learning services have benefits not only for individuals but also for organizations, especially among academics, for the use of e-learning technology as an interactive learning media for various applications and devices. Utilization of this technology can automatically streamline operational costs, installation and maintenance costs by offering stronger functional capabilities such as recovery and scalability. Besides that, the issue for security and privacy arrangement connected to trust is necessity by each user to share information that doing an important role in effect of behavior to sustain using cloud computing-based services. However, there is a background research gap to empirically examine the security and privacy factors that impact the attitudes and intentions of e-Learning services in Pamulang University.

Research Objectives

- To identify the sources of security and privacy are supportive to the institutions
- To investigate empirically the effect of control security and privacy, attitude, behavioral intention, and e-Learning users.

2. Theoretical Framework

Cloud Computing

Cloud computing is a combination of technology-based service oriented architecture (SOA), distributed computing and grid and virtualization techniques that were originally introduced since

1950. This technology has evolved to the present by combining computer infrastructure with internet-based development [10]. Generally, the cloud is divided into four categories based infrastructure viz. private cloud, public cloud, community cloud, and hybrid cloud. Hybrid cloud is a composite of two or more cloud infrastructures that are related by a portability mechanism and data inter-cloud applications [11].

The SOA-Cloud model integration was developed with adaptability to be more efficient in financing rather than developing an enterprise resource planning (ERP) system. In implementing the SOA, simplifying services for the current system and database and having a liaison (bus) to carry out data exchange activities, path selection, log recording and monitoring service management. The SOA must also develop business models with semantic models, system implementation and interface design services.

Software as a Service (SaaS) is a service model in cloud computing. Based on the National Institute of Standards and Technology (NIST), the SaaS consists of the physical layer and the abstraction layer that can be accessed by certain devices through a web service-based program interface, the user does not need to exercise management over the network, operating system, server, and the storage[12]. The SaaS architecture based on the Java Agent Development Platform (JADE) allows the application of a multi-intermediary system for the user interface in reducing the process of making, implementing and testing. This platform can move intermediary functions to instances of cloud systems that are on demand if the initial design can be applied to part of the work in the future [13]. As the first prototype, an intermediary service developed with 2 (two) layers consists of a running virtual machine (VM) intermediary and a cloud management intermediary that runs as a VM-specific information provider dedicated to security instruments illustrated.

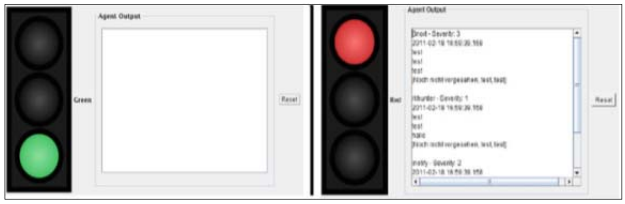

Figure 1. Illustration of security prototype [13]

Figure 1 describes a demo of a simple web front end with several attack scenarios on the VM. Before or after testing, validation is done that the attack is detected and not permitted though it depends on the configuration of the plug-in. The prototype version in the image on the left shows the status of the VM before the attack. After launching an attack, in the right "picture" the security dashboard indicator lights change color as defined in the matrix and provide brief information about the event being monitored.

Rackspace is one of the largest cloud service providers that provides cloud computing services that are tailored to the needs of the company's business. Rackspace recommends solving security problems with secure socket layer (SSL) techniques by taking copies of data on several PCs in a particular zone. The illustration of the cloud-based hosting model Rackspace service refers to the following picture:

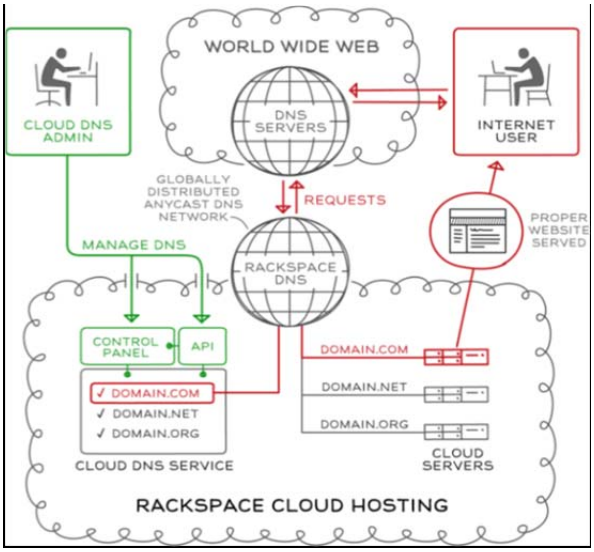

Figure 2. Illustration of cloud based DNS [14]

Figure 2 describes the hosting system developed by Rackspace using Anycast which is like a DNS and requests will enter quickly to the nearest area with the name server based on geographic area. Then, the DNS request will go to the best location on the next server when it fails in the transformation or sending data [14].

Theory of Planned Behaviour (TPB)

TPB is an advance of the Theory of reasonable action (TRA) which is a conceptual framework that aims to explain the primary of certain individual behaviours. Attitude, subjective norms and perceived behavioral control are individual factors that influence the users' behaviors through their behavioral intention.

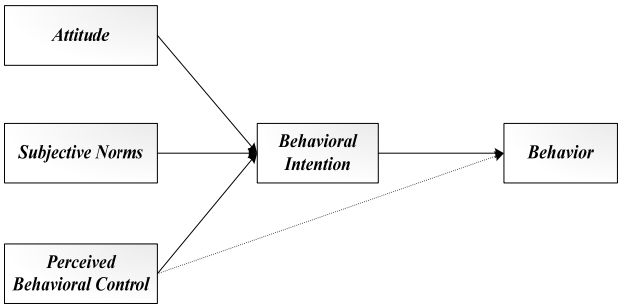

Figure 3. Theory of Planned Behavior [15]

Control of Security and Privacy

Security is information security which is the most important part in the context of physical assets, personal security, network equipment, and organizational data. According to Wincor Nixdorf (2013), 3 (three) components that need to be considered in a security, namely: (1) system protection that includes the operating system, service and controller; (2) incoming or out-coming IP based connections; and (3) check applications and blocks that are not allowed to be accessed [16]. Information security should pay attention to protecting the aspects of confidentiality, integrity and availability through policies, practices, procedures, organizational structure and software. Problems that occur simultaneously on access policies and data attributes allow users to delegate some data access controls to cloud servers that are considered unreliable without disclosing the contents of the underlying data [17].

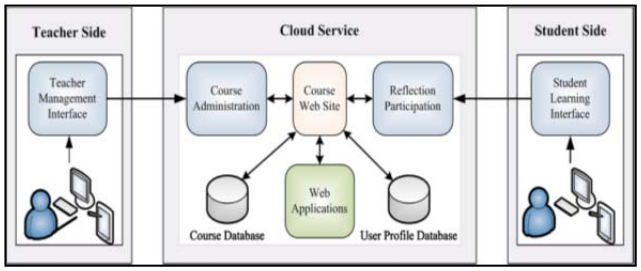

Figure 4. Theory of Planned Behavior [7]

Privacy is a direct concern to the level of safeguarding transactions via the internet and securing customer information with a certain condition of access to personal data. When a user uses a system or service there is a risk that monitors his personal information [7].

Attitude and Behavioral Intention

Satisfaction refers to the results of one's evaluation in responding to experiences before and after the use of a product or service [13]. In general, the performance of a product or service will be confirmed by comparing the initial expectation value whether the results will be better than expected or tend to be less than expected. Behavioral intention forms part of a person's actions to what extent they are to use or not a service [7], [17]. Utilization of the use of information systems is measured through the frequency which ultimately affects the level of satisfaction [18].

e-Learning Users

The e-Learning of users in this study is the success of using cloud services in the educational environment in e-Learning systems which are perceived through attitudes or reactions and intentions. The mind of a low level of security can affect one of the attitudes towards the user services, while cloud-based services are also perceived to guarantee security in protecting one's privacy from sensitive information [7], [8].

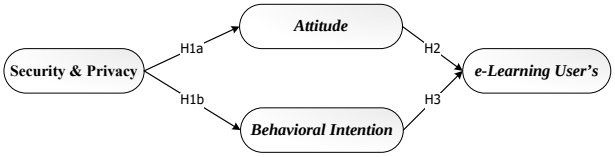

Figure 5. Theory of Planned Behaviour
Source: Constructed based on [15], [19], [7]

The above theoretical thought framework replicates the research model on attitudes and behavioral intentions towards the e-Learning users in the passage of Control Security and Privacy. The hypothesis purposed in this research can be let off as follows:

H_{1a} =Security and privacy will have a significant influence towards the attitude
H_{1b} =Security and Privacy will have a significant influence on the behavioral intention
H_2 =Attitude will have a significant influence on the attitude of the e-Learning users
H_3 =Behavioral intention will have a significant influence on the attitude of the e-Learning users
H_4 =Security and Privacy will have a significant influence on the attitude of the e-Learning users through attitude and behavioral intention factors

Research Design

The research used a quantitative approach, which is to investigate the control of security and privacy based on e-Learning users of the institutions. This research is using an empirical study with a subject in Pamulang University. Pamulang University (UNPAM) is one of the largest universities in Banten province and in Indonesia with approximately 85,000 college students so that the research about e-Learning users becomes very important.

Research Instrument and Variable Measurement

The survey questionnaire of this research was survey-based, which has employed well-mannered directly and using form provided from Google Docs. The instrument constructs were expanded according to previous research studies from theoretical and conceptual perspectives. Several items were created to verify the different aspects of the variables constructed for the framework. The specific questions concentrate on the control of security and privacy in e-Learning users services including the demographic of the respondents and the e-Learning features that are considered the most important. In

measuring data analytics technique, the data application will have implications for e-Learning based on users in Pamulang University.

In determining the first attitude which acts as a mediator, the questions concentrate on how data can motivate the control of security and privacy within institutions. The second mediator - behavioral intention was considered in terms of frequency and system usage. Referring to this study determines the e-Learning of users as according to the dimension of application and cloud service quality.

The questions in the capacity of entire variables in the research model and appertain 17 items measured on five points' scales ranging from "1" to "5". Composite measurement was originated viz. Control of Security and Privacy (X) using four items, Attitude (Z1) using three items, Behavioral Intention (Z2) using three items, and e-Learning Users (Y) using ten items.

Construct Validity and Reliability

The validity and reliability testing of instrument used to ensure the completeness by using the PLS tests. Convergent validity was measured by the confirmatory factor analysis (CFA) technique so that their standardized loading factors (SLF)score ought be greater than 0,6. The data got from 80 participants prove that all indicators on the research model scale are valid, except the Security and Privacy (X) variable with RQ1 indicator has a loading's factor less than 0,6. Therefore, these indicators are excluded from the model research and then convergent validity was re-testing (Table 1.).

Table 1. Validity test results

	Test Result		Test Result - *Modified*	
	Indicator	**SLF (Score)**	**Indicator**	**SLF (Score)**
Security and Privacy	RQ1	0,588	-	-
	RQ2	0,859	Q2	0,870
	RQ3	0,805	Q3	0,823
	RQ4	0,685	Q4	0,733
Attitude	RQ5	0,855	Q5	0,857
	RQ6	0,891	Q6	0,891
	RQ7	0,847	Q7	0,845
Behavioral Intention	RQ8	0,930	Q8	0,931
	RQ9	0,876	Q9	0,873
	RQ10	0,884	Q10	0,885
e-Learning of Users	RQ11	0,864	Q11	0,864
	RQ12	0,809	Q12	0,809
	RQ13	0,801	Q13	0,801
	RQ14	0,763	Q14	0,763
	RQ15	0,712	Q15	0,712
	RQ16	0,854	Q16	0,854
	RQ17	0,774	Q17	0,774

Source: Summarized based on PLS output, 2019

After the construct validity is gotten, the next is finding the reliability of the construct. In general, the limit score used to assess an acceptable level of reliability with the composite reliability (CR) has greater than 0,7 or the average variance extracted (AVE) has greater than 0,5 (Table 2.).

Table 2. Reliability test results

	Indicator	**SLF(Score)**	**R^2**	**CR (Score)**	**AVE (Score)**
Security and Privacy	RQ2	0,870	-	0,851	0,657
	RQ3	0,823			
	RQ4	0,733			
Total		2,426			
Attention	RQ5	0,857	0,553	0,899	0,748
	RQ6	0,891			
	RQ7	0,845			
Total		2,593			
Behavioral Intention	RQ8	0,931	0,465	0,925	0,804
	RQ9	0,873			
	RQ10	0,885			
Total		2,689			
e-Learning of Users	RQ11	0,864	0,655	0,925	0,637
	RQ12	0,809			
	RQ13	0,801			
	RQ14	0,763			
	RQ15	0,712			
	RQ16	0,854			
	RQ17	0,774			
Total		5,577			
Acceptable Borderline				**≥ 0,7**	**≥ 0,5**

Note: *Thus, all the variable scales are reliable.*
Source: Summarized based on PLS output, 2019

Subject and Data Collection

This research investigated a targeted sample of e-learning users to wit the college students in Pamulang University of Indonesia. Especially, since these are diverse from the entirety of faculty viz. economics of management, economics of accounting, law, educational of science, engineering, literature, post-graduate and health science. The questionnaires were sent to the respondents who were using e-Learning for more than a year. The respondents represent eight faculties with probably ten respondents, which comply the requirements of several expert investigators on how to determine the number of samples. Data collection methods used included survey questionnaires. The data were analyzed using descriptive statistics, the structural equation modelling and path analysis.

3. Results and Discussion

Demographic and Descriptive Statistics

The demographic data exhibits that the ordinary respondents included 60 females (75%). 65 (81,25%) were 18-25 years old, 51 (63,75%) were in-between accessing e-Learning using a smart-phone, 61 (76,25%) were apprehended the most important e-Learning features are in the component of the learning system compared with relevant content, instructional methods, use of media elements as well as build a new sight and technique (Table 3.).

Table 3. Descriptive of statistics

	Variable	*Mean* (χ)	*Standard Deviation* (σ)
Q1	e-Learning services have a high security policy to protect sensitive information	3,08	0,74
Q2	The overall, information provided on e-Learning services gives me a sense of security	3,09	0,51
Q3	I keep a personal information and documents in e-Learning services	3,13	0,62
Q4	e-Learning is a secure service typical for protecting sensitive information	3,13	0,72
Q5	Using e-Learning based on cloud computing is a good idea	3,14	0,52
Q6	Using e-Learning based on cloud computing is a wise idea	3,13	0,49
Q7	I prefer the idea of using the e-Learning based on cloud computing	3,05	0,57
Q8	I intend to use e-Learning based on cloud computing	2,96	0,61
Q9	I intend to use e-Learning based on cloud computing	2,91	0,60
Q10	I will recommend the use of e-Learning based on cloud computing	2,91	0,62
Q11	Data reporting and extracting features in the e-Learning based on cloud computing available	3,16	0,51
Q12	The configuration (e.g., user administration, etc.) features of an application are available in the e-Learning based on cloud computing	3,15	0,53
Q13	An application's help functionalities are provided in e-Learning based on cloud computing	3,24	0,58
Q14	An application's core features support the process steps/activities in e-Learning based on cloud computing	3,18	0,57
Q15	The quality of services in e-Learning based on cloud computing is excellent	3,14	0,52
Q16	The quality of services in e-Learning based on cloud computing is superior	3,11	0,62
Q17	The quality of services in e-Learning based on cloud computing has high standards	3,13	0,49

Source: Summarized based on SPSS output, 2019

Model Fit

The structural equation model based on path analysis must ensured that the model does fit the requirements of validating the Overall Structural Model with the Goodness of Fit Index (GoF) obtained through the following calculations:

$$\text{GoF} = \sqrt{Com \times R^2},$$

where in Com $= (0{,}657 + 0{,}748 + 0{,}804 + 0{,}637) \div 4$
$= 0{,}7115$

(*the average of communality* i.e. AVE score)

where in R^2 $= (0{,}553 + 0{,}465 + 0{,}655) \div 3$
$= 0{,}558$

so GoF value is:

$$\text{GoF} = \sqrt{0{,}7115 \; x \; 0{,}558}$$
$$= \sqrt{0{,}397017}$$
$$= 0{,}6301$$

The value of GoF indices is 0,6301, a ratio of more than 0,36 is good (large scale of GoF). The results of predictive relevance (Q^2) obtained through the following calculations:

$$Q^2 = 1 - (1 - R1^2)(1 - R2^2)(1 - R3^2)$$
$$= 1 - (1 - 0{,}553)x(1 - 0{,}465)(1 - 0{,}655)$$
$$= 1 - (0{,}447)(0{,}535)(0{,}345)$$
$$= 1 - (0{,}082505)$$
$$= 0{,}917495$$

The value of predictive relevance(Q^2) is 0,917495 greater than $0\,(zero)$ so that exogenous latent variables are suitable which means explanatory variables are very good predictive relevance. Overall, the model fits the data very well.

Path Analysis

The SEM analysis was testing a hypothesis influence. Consistent with the prior study, the results show that all proposed paths among the latent variables are statistically significant proper direct and indirect effect (Table 4).

Table 4. Regression results of direct and indirect effect

	Regression Coefficient (β)	t-statistics	P-value
Security and Privacy (X) →Attitude (Z1)	0,744	14,587	0,000
Security and Privacy (X) →Behavioral Intention (Z2)	0,682	9,406	0,000
Attitude (Z1) →e-Learning Users (Y)	0,398	3,625	0,001
Behavioral Intention (Z2) →e-Learning Users (Y)	0,469	4,671	0,000
Security and Privacy (X) → Attention (Z1) &Behavioral Intention (Z2) → e-Learning of Users (Y)	0,616	8,764	0,000

Source: Summarized based on PLS output, 2019

Based on the output of the SEM analysis with PLS (Figure 6.), the results indicate that the e-Learning users of cloud services relate to other factors. Security and privacy have a significant influence on both attitude and behavioral intention (β = 0,744 or p-value <0,000 and β = 0,6821 or p-value < 0,000). Attitude and behavioral intentions have a significant influence on e-Learning users (β = 0,398 or p-value < 0,001 and β = 0,469 or p-value < 0,000). The control of security and privacy have a significant influence on e-Learning users through attention and behavioral intention as a mediating variable (β = 0,616 or p-value < 0,000).

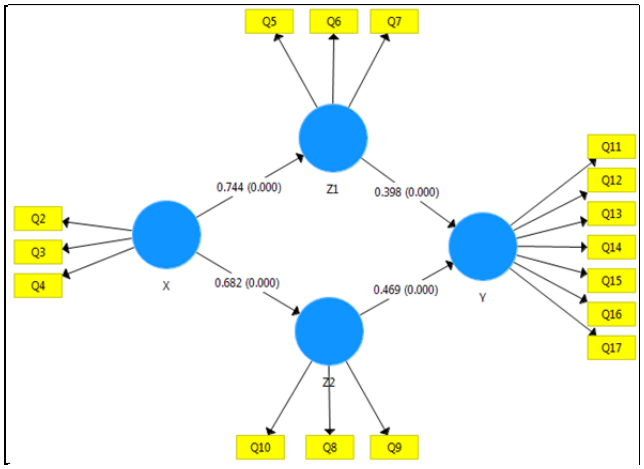

Figure 6. Research model results
Source: Summarized based on PLS output, 2019

Discussion

Consideration to the control of security and privacy developed from theory of planned behavior (TPB) and develop research model[15], [7], in the SEM analysis meet excellent good-of fit criteria and have a positive direction of influence. These results confirm the importance of the control Security and Privacy regulatory factors in predicting attitudes and behavioral intention models for e-Learning users. Private cloud that is designed and operated for users in the organization's data center and provides e-learning services is only limited in Pamulang University environment such as lecturers and students. With this arrangement, security and privacy issues perceived by users to share information can determine attitudes and intentions of users in using e-learning services. In the hypothesis previously mentioned that the control of security and privacy have a significant effect on the e-Learning users through attitude. Our results, based on prior studies are in line this hypothesis. This research has shown that the control security and privacy perceptions have a significant influence on attitude and behavioral intention [7]. Attention and behavioral intention variable has been found in prior studies as a significant expect of adoption behaviour by the Learning Management System (LMS), which provides better good consideration to conventional learning systems [6].

The e-Learning service that has been implemented by Pamulang University since 2016 and finds it that more than 80 percent of the respondents studied in the region of learning system and building insights, knowledge and techniques. This proves that students have trusted the security arrangements and privacy issues have been well managed for information that is sensitive or documents stored in the cloud application can't end irresponsible parties [7]. The security aspects that are formulated for the availability, confidentiality, and data integrity can be carried out simultaneously and evaluated on an ongoing basis such as configuration features (user admin password change), help or assistance features as well as academic data reporting and extraction features on e-learning services through management policies continuously to provide a sense of security and protect user information that is sensitive in predicting attitudes towards the e-Learning users of cloud services in development of the theory of planned behavior (TPB) framework [7], [8], [15].

4. Conclusion

The results of this study indicate that the control of security and privacy have a significant influence on attitude and behavioral intention support to the theory of planned behavior (TPB), attitude and behavioral intention on e-Learning users of cloud services yet. Attitude and behavioral intention is an intervening variable in the influence of the control of security and privacy on e-Learning users. Limitations of this study is on the prior research, there may be difficulties to measure participants' answer to questionnaire about data that involve too few samples. The results of this study may also recommend the track to work up the control of security and privacy of the institution by formulating the availability, confidentiality, and data integrity that can be carried out simultaneously and evaluated on sustainability.

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