Development of Cloud-Based E-Learning Users' Information Privacy Concerns instrument

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ABSTRACT: *Cloud computing is a phenomenon of last few years on the technology field. This phenomenon has a positive effect on the education process which represents cloud-based e-learning system. However, the new technologies require collect, share and exchange a large amount of information frequently without users even being aware of it. The main objective of this paper is to develop universal Cloud Based E-Learning Users' Information Privacy Concerns Instrument. The development involves of selecting the right elements that are assumed to determine the privacy concerns and examining the impact of every element in measurement. The instrument is divided into 5 parts, 16 factors and total of 61 items. The results of this study showed that first part of the instrument that examined trust beliefs and risk belief has high internal consistency and satisfactory factor loadings. The second part of the instrument, which contained 4 factors, and total 11 items that examined concern for information privacy (CFIP), all 3 factors had high internal consistency and satisfactory factor loadings. The third part of the instrument, which contained 5 items that examined the Global Information Privacy Concern (GIPC), all 5 items is significantly disrupted internal consistency. The fourth part of the instrument consisted of 3 factors and total 10 items that measured User Information Privacy Concern (IUIPC), had high internal consistency and satisfactory factor loadings. The fifth part of instrument, which examined 7 factors and total 25 items that measured that Cloud Computing privacy Concerns (CCPC), had high internal consistency and the privacy breaches factor should consist of 3 items (one item had low factor loading). Even though developing instrument needs more effort and validation, initial results illustrated that this instrument would be an excellent and reliable to evaluate cloud-based e-learning users' information privacy concerns.*

Keywords: Cloud Computing, E-learning, Information Privacy, Cloud Based E-Learning

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1. Introduction

Currently, most of the traditional learning styles are not suitable for the significant development in education and is unable to catch up the rapid growth of technology on time. Education institutions are challenged to keep pace with technological advances. E-learning provides many benefits to educational institutions such as flexibility, variety, and capacity. However, the current basic infrastructure cost of e-learning systems increases consequently, as a result, educational institutions are starting to adopt cloud computing as an infrastructure, software and platform which allowing them to perform their tasks without worry about software licences, hardware and maintenance. Cloud-based E-learning provides all provisions to e-

learning systems to improve traditional e-learning technologies and its methodologies. The educational materials are stored in cloud servers; these materials are available for education institutions by renting from Cloud Services Providers (CSP) [1]. This technology allows education institutions to focus on their learning process rather than focusing complex computer configuration and systems complexity can be reduced with cloud computing [2].

However, the digital world is becoming highly complex with the fast-growing of technology, people around the globe have rapidly adopted new digital technology and they face many new issues, such as privacy [3]. Recently protect an individual's privacy is becoming more and more complex. The new technologies require large collections, analysis, exchange, search, sharing, storage, transfer personal data often without individuals realizing it [4]. On the other hand, scientific researches on this field are rare and there are requiring for worldwide dimension instruments. These instruments should make possible to measure user's concerns on cloud-based e-learning privacy for state analysis and future studies. The main propose of this study was to build up a reliable general instrument which will measure the information system's users' privacy concern, as general as possible. Development of this type of instruments involves of select proper item and studies the impact of every element. The impact of all the elements that are supposed to measure the level of privacy concern between users is measured by factor analysis, and reliability analysis. The result of this analyzed, the items with low impact will be excluded and the items with higher impact will be adopted which show well clear questions. However, the result of this study will enhance the current studies that focus to the user information privacy of cloud computing in the education field.

2. Methodology

Development of questionnaire is involved of selecting appropriate instrument which consisting of a series of questions to a measure of what it supposed to measure. In this study, the level of cloud-based e-learning users' information privacy concerns was measured by using descriptive statistics, factor analysis and reliability analysis. As shown in Fig.1; the whole research follows 4 Phases progressive procedure.

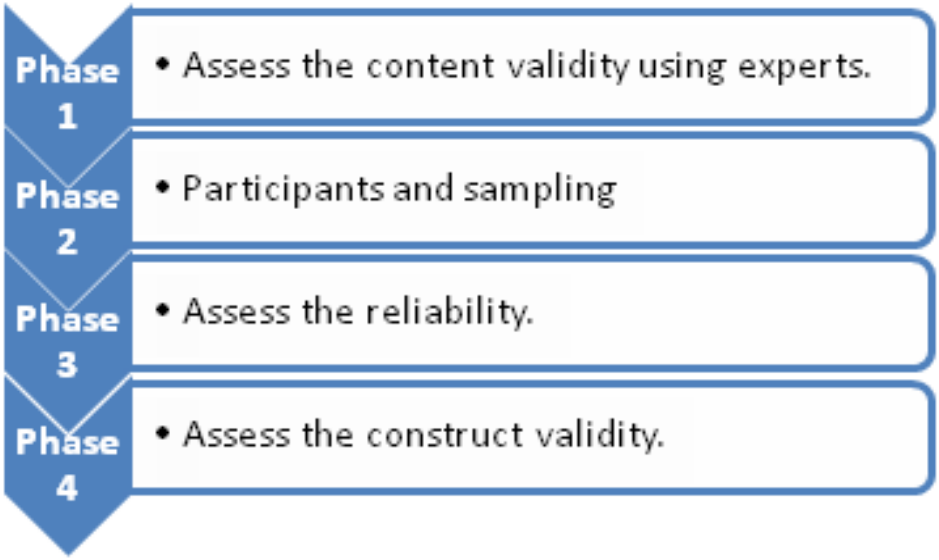

Figure 1. Instruments development phases

2.1 Instrument of Cloud-based E-Learning User's Privacy Concerns

The start point of this research was developing privacy instrument which have been found in various privacy aspects of previous studies in the research area. Thus, this research contained five parts. The first part which contained two factors with 8 items measuring trust beliefs and risk belief. The second part of the instrument contained 4 factors and total 11 items that measured concern for information privacy (CFIP)[5]. The third part of the instrument contained 5 items that measured the Global Information Privacy Concern (GIPC)[5, 6]. the fourth part of the instrument contained 3 factors and total 10 items that measured User Information Privacy Concern (IUIPC)[6]. The last part of the instrument contained 7 factors and total 25 items that measured that Cloud Computing privacy Concerns (CCPC).

2.2. Content Validity

For the sake of ensuring the content validity of the instrument, the first draft was reviewed by a panel of experts. It was reviewed by the supervisors Dr Najwa Hayaati Binti Mohd Alwi and Dr Roesnita Ismail who provided valuable suggestion and instruction, and then it was sent to experts to acquire their notes with respect to the following aspects:

- The adequacy of the scale statements
- Statements in terms of clarity and consistency.
- Suggestions and improvement of statements.

Three experts participated in the review process. The experts were offered with a cover letter introducing the background and purpose of the study. Then, minor changes were made based on their suggestions.

2.3 Participants and Sampling

The participants of this study involve e-learning administrators and e-learning staff which they are experts on e-learning, information security and cloud computing. Because they are the most effective people who know the issues of cloud computing and e-learning. Moreover, e-learning centres administrators are responsible for implementing e-learning and they are close to e-learning issues. For this study, the data was gathered via survey distributed to practitioners from e-learning centres of two Malaysian public universities (Universiti Sains Islam Malaysia (USIM), and Universiti Pendidikan Sultan Idris (UPSI)). Each participant is asked to fill out the questionnaire indicating her agreement or disagreement with each question on a 7-point Liker-type scale (Strongly disagree, Disagree, Somewhat disagree, Neither agree or disagree, Somewhat agree, Agree, Strongly agree). The surveys were distributed to 20 practitioners; 16 responded, resulting in 80% response rate.

2.4 Reliability of Questionnaire

According to Creswell, reliability means that "scores from an instrument are stable and consistent"[7]. The survey was replicated with same samples drawn from the population two times. The most common method to check reliability is by using Cronbach's alpha. Cronbach's Alpha test can be carried out on all scales in this study to verify the internal reliability.

NO	Paragraph	Number of Items	Cronbach'sAlpha
1.	**Trusting Beliefs**	**4**	**0.939**
2.	**Risk Beliefs**	**4**	**0.966**
3.	**Errors**	**4**	**0.958**
4.	**Unauthorized Secondary Use**	**4**	**0.957**
5.	**Improper Access**	**3**	**0.624**
6.	**Global Information Privacy Concern**	**5**	**0.488**
7.	**Collection**	**4**	**0.933**
8.	**Control**	**3**	**0.760**
9.	**Awareness**	**3**	**0.945**
10.	**Access**	**3**	**0.663**
11.	**Compliance**	**3**	**0.880**
12.	**Storage**	**5**	**0.873**
13.	**Retention**	**3**	**0.914**
14.	**Destruction**	**3**	**0.966**
15.	**Audit and monitoring**	**4**	**0.838**
16.	**Privacy breaches**	**4**	**0.960**
	All paragraphs of the questionnaire	**59**	

Table 1. Cronbach's Alpha for each field of the instrument

Construct	Items	Factor loading	AVE
Trusting Beliefs	TB1	.928	0.723097207
	TB2	.821	
	TB3	.875	
	TB4	.844	
	TB5	.775	
Risk Beliefs	RB1	.874	0.673894527
	RB2	.653	
	RB3	.808	
	RB4	.923	
Control	CO1	.867	0.78878794
	CO2	.968	
	CO3	.822	
Collection	CL1	.695	0.641733233
	CL2	.881	
	CL3	.837	
	CL4	.779	
Errors	ER1	.808	0.598546005
	ER2	.707	
	ER3	.801	
	ER4	.774	
Unauthorized Secondary Use	US1	.801	0.750613555
	US2	.895	
	US3	.884	
	US4	.882	
Improper Access	IA1	.741	0.67332028
	IA2	.881	
	IA3	.834	
Awareness	AW1	.775	0.646957037
	AW2	.917	
	AW3	.707	
Access	AC1	.872	0.687551782
	AC2	.819	
	AC3	.794	
Compliance	CM1	.884	0.787336365
	CM2	.929	
	CM3	.847	

Storage	ST1	.760	0.637382808
	ST2	.835	
	ST3	.873	
	ST4	.716	
Retention	RE1	.861	0.801342584
	RE2	.948	
	RE3	.873	
Destruction	DES1	.869	0.816019658
	DES2	.941	
	DES3	.887	
	DES4	.915	
Audit and monitoring	AM1	.813	0.648310143
	AM2	.759	
	AM3	.877	
	AM4	.766	
Privacy breaches	PB1	.903	0.760317667
	PB2	.862	
	PB3	.850	
	PB4	.312	

Table 2. Factor loading for each for each Item of the instrument

The range of Cronbach's coefficient alpha value is between .00 and +1.00 Higher values reflect a higher degree of internal consistency. Generally, it is accepted for Cronbach's Alphas to have a value higher than 0.7. However, occasionally it may be accepted for values that are higher than 0, 5.

As showing in the table (1), the Cronbach's Alpha test for each field is more than 0.5 except the field of (Global Information Privacy Concern). Thus, in this study the scale of (Global Information Privacy Concern) will be removed.

2.5 Construct validity

Construct validity refers to the ability of a measurement tool (e.g., a survey, test, etc) to actually measure what was designed to measure[8]. There are two types of construct validity: convergent and discriminant validity[10]. In this paper, factor loading and Average Variance Extracted (AVE) was conducted to assess the convergent validity. However, all of the factors had at least three questions (the questionnaire item). According to [10] The acceptable factor loading should be greater than 0.5. However, factor loading with higher than 0.7 is considered excellent [10]. (AVE) was calculated manually based on the formula given by [11] Where (AVE) is average variance extracted, ë is the standardized factor loading and n is the number of items.

$$AVE = \frac{\sum_{i=1}^{n} \lambda_i^2}{n}$$

Discriminant validity was assessed by comparing the shared variance (squared correlation) between each pair of constructs against the average of the AVEs for these two constructs[11]. On other word, the square root of AVE should much larger than the correlation of constructs. The value of AVE for each construct should be at least 0.50[11].

2.5.1 Results of Convergent Validity

Factor analysis was used to measure the basic structure for the fifty-four items and fifteen factors. Table (2) illustrated the items and factor loadings for the rotated factors, any loadings less than 0.60 will be will be obsolete to increase the clarity. As showing in the table (2), all the items are more than acceptable level factor loading (> 0.5) except the item (RB4). In addition, this study was used AVE to test the convergent validity However, as showing in the table (2) all factors were at an acceptable level of AVE which were between ranges of 0.598546005 to 0.816019658 except the item RB4.

2.5.2 Results of Discriminant Validity

Table 3 illustrated comparing the shared variance (squared correlation) between each pair of constructs against the average of the AVEs for these two constructs. As shown in the table (3) the square root AVE of any two constructs are much larger than the correlation of them Thus, the results of measuring convergent validity revealed good construct validity

	TB	RB	CO	CL	ER	US	AI	AW	AC	CM	ST	ST	DES	AM	PB
	TB	0.85*													
RB	-.088	0.82*													
CO	.475	.147	0.88*												
CL	-.129	.573	.264	0.80*											
ER	.185	.579	.388	.488	0.77*										
US	.741	-.020	.540	.150	.177	0.86*									
AI	.501	.473	.562	.572	.600	.485	0.82*								
AW	.543	.146	.548	.403	.524	.695	.672	0.80*							
AC	.281	.333	.583	.492	.687	.447	.642	.771	0.82*						
CM	.695	-.217	.534	.059	.233	.849	.554	.694	.553	0.88*					
ST	.674	.251	.420	.399	.295	.851	.674	.765	.530	.665	0.79*				
RE	.515	.253	.677	.462	.437	.847	.733	.707	.614	.741	.803	0.90*			
DES	.533	.018	.371	.213	.329	.851	.540	.691	.362	.762	.755	.845	0.90*		
AM	.677	.136	.612	.331	.320	.862	.689	.736	.428	.741	.808	.894	.881	0.90*	
PB	.563	.026	.515	.277	.192	.668	.665	.580	.257	.641	.655	.721	.781	.860	0.87*

Notes:* presents the square root of AVE

Table 3. Discriminant Validity

3. Conclusion

Even though cloud computing has various features; there are still some real issues that need to be solved. Data privacy concerns are the most important issues that need to be addressed. Data privacy concerns exist in all stages of data life cycle. This study discusses the instruments of privacy cloud-based e-learning concerns; the study was conducted to modify the item pool which carries out to verify the average variance extracted correlation and factor loading. The results indicate that the questionnaire has the ability to be valid and reliable instrument for measurement of cloud-based e-learning users' information privacy concerns. This instrument could become the first assessment tool on this area as a basis for ongoing research. Moreover, with the questionnaire education institution will be able to analyze cloud-based e-learning systems in order to identify issues relating to the user privacy.

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