

Learning Attitude and Its Effect on Applying Cloud Computing Service to IT Education

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Abstract

Computer Classrooms are always the major place where the education of information technology (IT) is executed in school. However, there exists a major problem that students were unable to practice after school with the same environment and there was no appropriate space to save their files for students, so it was not convenient for students' learning attitude of computer. The service of private cloud computing was adopted in this paper to establish the education environment of IT for resolving these problems. The quasi-experimental method was applied to the study of 110 fifth grade students who were selected from Tunglo Elementary School in Miaoli County, Taiwan. The technology acceptance model was adopted as the theoretical basis of research framework in this paper. The experiment results showed that students' acceptance for the environment of IT educational of cloud computing in elementary school was much better after the teaching. Besides, there was a positive correlation between user behavior and learning achievement for cloud computing service.

Keywords: *Information Technology (IT), Learning attitude, Cloud Computing Service, Technology Acceptance Model*

1. Introductions

Information technology education of schools was mainly conducted in computer classroom. The maintaining of dozens of computers in the computer classroom becomes a burden for the manager. The literature had discussed the way of improving management of computer classroom, for example: Computer Lab Management Using Free Software [15], Implementation of a Diskless Cluster Computing Environment in a Computer Classroom [9], and the Development of Teaching Network Management System in Computer Classroom [10]. The structures of computer classrooms discussed in these literatures were closed systems and students could not connect to them for operation from outside of school. The research about the effectiveness of computer usage frequency for students in the learning achievement of computer had found that more frequent use of computer leads to a better computer learning achievement [5]. Thus, if students could continue practice IT lessons taught at school when they were after school, it will be a great benefit to the learning achievement.

Students' learning is no longer confined within the classroom in the era of e-learning 2.0. The environment of IT education could be improved to let student access learning resources anywhere. The free software is adopted for constructing the private cloud computing service

for the environment of IT education to address the above shortcomings in this paper and to improve the environment of IT education for elementary and junior high schools, and provided students with various education services of information technology, such as word processing, spreadsheets, presentations, etc. Only a browser is needed for students to connect to the cloud computing service for learning.

This research proposed the following null hypothesis according to the above motivation and purpose of research.

(1) There is no significant difference between the computer attitude of before using the IT education environment of cloud computing service and the computer attitude of after using the IT education environment of cloud computing service for elementary school students.

(2) There is no significant difference between the learning behavior of before using the IT education environment of cloud computing service and the learning behavior of after using the IT education environment of cloud computing for after school learning for elementary school students is not established..

(3) There is no significant correlation between the computer attitudes of after using the IT education environment of cloud computing service and the computer learning achievement for elementary school students.

2. Related Works

The study of “vSaaS: A Virtual Software as a Service Architecture for Cloud Computing Environment” had provided a solution, and the solution is that platforms are built with virtual personal desktop environment and remote display technology [18]. Users use the client device to access the cloud operation system just like using the local computer so that the study showed the feasibility and effectiveness for the vSaaS system.

The IT education environment of elementary and middle school consist two parts: class IT equipment and computer class, as shown in Table 1.

Table 1. Current Status of IT Education Environment in Elementary and Middle School

Items		equipments	usage
class IT equipment		interactive whiteboard, personal computer, projector, wireless network access point	incorporate information technology into teaching plans
Computer classroom	System with disk	Client’s computer equipped with hard disk, operation system and application program were installed at local disk, recovery system was installed to protect data from been erased, broadcast teaching system was install in teacher’s computer to monitor students learning situation and broadcast teacher’s screen for instruction	1.incorporate information technology into teaching plans 2.information ability training
	Diskless system	Client’s computer do not have hard disk, operation system and application program were installed at diskless server as image files, student’s computer read servers image files through intranet to start. broadcast teaching system was install in teacher’s computer to monitor students learning situation and broadcast teacher’s screen for instruction	1.incorporate information technology into teaching plans 2.information ability training

Source : Organized by researcher

The current IT education environment of elementary and middle school consist two parts: class IT equipment and computer class. The class IT equipment had interactive whiteboard 、 personal computer 、 projector 、 wireless network access point. Mainly to provide teachers incorporate information technology into teaching. Computer classroom was a main place for training student's information ability. It also could be used for incorporate information technology into teaching. There were two systems that were used for implementing the computer classroom, system with disk and diskless system. The client's computer of with disk system equipped with hard disk, and operation system and application program were installed at local disk. Besides, recovery system was installed to protect data from been erased. Client's computer no need to install hard disk in diskless system, operation system and application program were installed at diskless server as image files, student's computer read servers image files through intranet to start.

Cloud operation system is an operation system on the Internet, and it provides platform as a service and user uses browser to access for service. For the cloud operation system which was adopted in this study must be suitable for IT education environment, the items of open source freeware, office software, file manager and file upload were considered. The comparison of current cloud operation system was as shown in Table 2.

Table 2. Comparison of Current Cloud Operation System

Cloud operation system	Open source	Office software			File manager
		Word processor	Spread sheets	Presentation	
Cloudo	-	Yes	-	-	Yes
eyeOS	Yes	Yes	Yes	Yes	Yes
GlideOS	No	Yes	Yes	Yes	Yes
iCloud	-	Yes	Yes	Yes	Yes
MyGoya	-	Yes	Yes	Yes	Yes
Startforce	-	Yes	Yes	Yes	Yes

The cloud operation system Cloudo, GlideOS, iCloud and MyGoya were open platform and users may use it after free registration, but program source was not opened in [4, 8, 11, 13]. The EyeOS cloud operation system was open source software. Users may download the program install in Linux or Windows operation systems. The system provides office software such as word processor, spreadsheets, presentation and the function of file manager and file upload [7]. The Startforce cloud operation system provides a complete office software and file manager function, even the Microsoft office software could run under this system. However, the system had to be paid for use [14]. Summarize above, EyeOS was the most suitable cloud operation system for this research.

The Theory of Reasoned Action (TRA) was developed by Icek Ajzen and Martin Fishbein in 1975. The key application of the theory of reasoned action is prediction of behavioral intention, spanning predictions of attitude and predictions of behavior. TRA posits that individual behavior is driven by behavioral intentions where behavioral intentions are a function of an individual's attitude toward the behavior and subjective norms surrounding the performance of the behavior [1]. The Technology Acceptance Model (TAM) was developed by Fred Davis and Richard Bagozzi. It is one of the most influential extensions of Ajzen and Fishbein's theory of reasoned action (TRA) in the literature. The model aimed to discuss that when users are presented with a new technology, the factors influence their decision about how and when they will use it, notably there were two specific beliefs: first, perceived usefulness (PU), Davis defined this as "the degree to which a person believes that using a particular system would enhance his or her job performance". Second, perceived ease of use

(PEOU), Davis defined this as "the degree to which a person believes that using a particular system would be free from effort" [6].

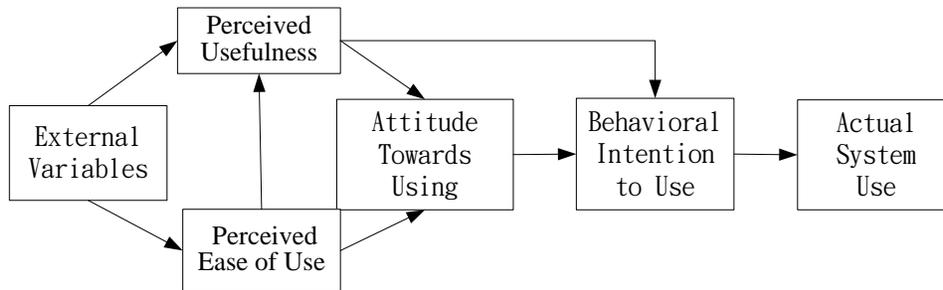


Figure 1. Technology Acceptance Model (TAM)

3. Methodology

The research design, research structure, private cloud computing system design, research instrument and data analysis will be described as follows.

3.1. Research Design

This research aimed to study the behavior of computer usage after using the environment of IT education of cloud computing service. The quasi-experimental method was adopted to study 55 fifth grade students from Tunglo Elementary School in Miaoli County, Taiwan. The schedule of experiment teaching had been executed for four weeks, one period a week. Before and after the four weeks experiment teaching, all participants had to fill out "Scale of Using Behavior for IT Education Environment of Cloud Computing", and the data analyses were conducted for the results at the end.

Private cloud was applied to constructing the environment of IT education in this paper, as shown in Figure 3 and Figure 2, and users need account and password to access the system. The cloud computing server located inside of school can be connected through the Internet, so students can connect to the service for learning even though they are home. The cloud server provides the following services: Infrastructure as a Service: server hardware, Platform as a Service: web operation system, Storage as a Service: file manager system, and Software as a Service: word processor, spreadsheets, presentation, calendar, internal message. All the software needed for construction of cloud server in this research was freeware (GPL), the Debian GNU/Linux 5.0.5 (GPL) was adopted for the operation system of server, the application package of Apache2.0, MySQL5.0 and php5 (Hypertext Preprocessor) was adopted for the web server, the eyeOS1.9(GPL) was adopted for the cloud operation system, and the zohoSuite(GPL) was adopted for the office software. Besides, the functions of zohoSuite are close to Microsoft office and openoffice.org.

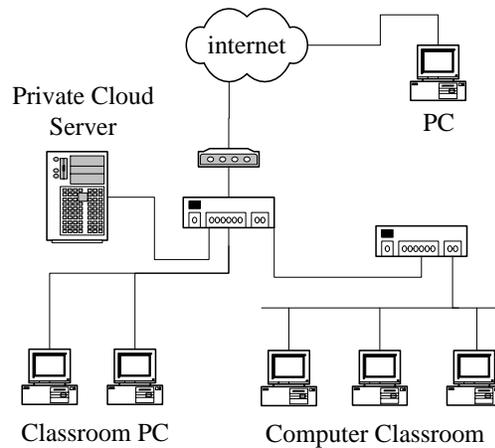


Figure 2. System Architecture Diagram of Private Cloud Computing Service for the Environment of IT Education

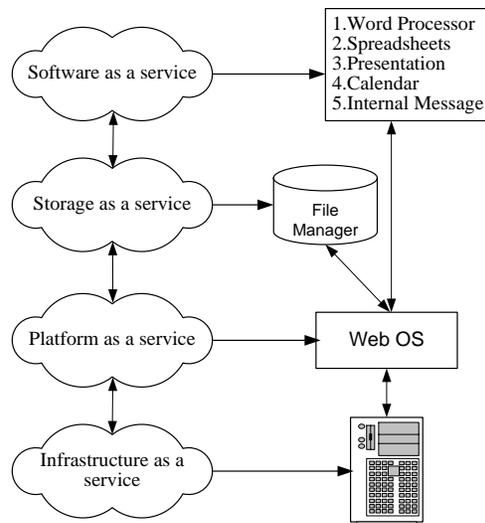


Figure 3. Structure of Cloud Computing Service

3.2. Research Instrument

The “Scale of Using Behavior for the Environment of IT Education of Cloud Computing” was designed in this paper as the research instrument. The scale had 29 items which was modified from the scale developed by Loyd and Gressard [12]. The content includes “perceived usefulness”, “perceived use of ease”, “attitudes toward using: confidence, love and anxiety”, “behavioral intention to use” and “situations of after school learning”. This scale adopts the format of five point of Likert scale for measurement [17].

Most of the researches on computer attitude scale were based on the “Computer Attitude Scale” developed by Loyd and Gressard [2]. The “Using Behavior Scale of IT Education Environment of Cloud Computing” for this research was modified from the scale developed by Loyd and Gressard. The content includes “perceived usefulness”, “perceived ease of use”, “attitudes toward using: confidence, love and anxiety”, “behavioral intention to use” and

“after school learning situations”. This scale adopted the format of five point of Likert scale for measurement. A Likert scale is a psychometric scale commonly used in questionnaires and is the most widely used scale in survey research. The scale is named after its inventor, psychologist Rensis Likert [7].

The reliability and feasibility of the scale was executed with the following analyses:

A. Item Analysis

The critical rasion (CR) is adopted for discriminate criterion of item analysis, and the CR value should be greater than three for a good discrimination. Test for homogeneity was also done to calculate the correlation between scores and items. The correlation coefficient of the item less than 0.4 was deleted due to a low homogeneity of the item and the referenced scale is in [3]. The items which did not reach the significant level were deleted after the item analysis.

B. Factor Analysis

The remaining 29 items was selected from the original 30 items of the scale after item analysis and was conducted factor analysis to examine construction validity of scale. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett’s test of sphericity were used for relevance judgments of factor analysis. KMO value is between 0 and 1, and KMO value should be greater than 0.60 for factor analysis [16]. The analysis result showed KMO value was 0.758 which is greater than 0.60 as shown in Table 3, it is acceptable to proceed with the factor analysis.

The analysis method of principal component was adopted to investigate the responses of scale questions at all levels for the factor analysis of the scale. The reference standards are the factor loading which is greater than 0.50 and the eigenvalue which is greater than 1 for the retained items and all the questions are met the standard of reference topics after analysis.

Table 3. Kaiser-meyer-olkin Measure of Sampling Adequacy and Bartlett’s Test of Sphericity

Kaiser-Meyer-Olkin measure of sampling adequacy		0.758
Bartlett’s test of sphericity	Approximate chi-square distribution	1311.217
	degree of freedom	435
	significance	0.000

C. Analysis of Reliability

The Cronbach α coefficient which was created by the LJ Cronbach was commonly adopted for test method of reliability for Likert Attitude scale, and a good Cronbach α coefficient should be above 0.70 [16]. The pretest of this scale was done by fifty sixth grade students from Tunglo Elementary School, Miaoli, Taiwan, and the test method of reliability was to observe the Cronbach α coefficient for internal consistency. The result showed the scale had Cronbach α coefficient of 0.953 that indicates a very good level. After item analysis, factor analysis and reliability analysis, there was one item deleted and 29 items retained as the formal questionnaire of this research.

3.3. Data Analysis

First, the pretest and posttest of “Scale of Using Behavior for the Environment of IT Education of Cloud Computing” were arranged for further data analysis. The invalid questionnaires were stricken out and valid questionnaires were numbered, and then statistical analysis software SPSS 12.0 was applied to the following statistical analysis.

A t-test of independent sample was conducted to compare if there exists significant difference between before using and after using for using behavior of overall computer when the students used the environment of IT education of cloud computing for learning.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the learning achievement and the overall computer using behavior of experiment group students.

4. Results

Among the 55 questionnaires of “Using Behavior Scale of IT Education Environment of Cloud Computing” samples collect from participants, two were deleted for invalid samples and 53 samples were remaining.

4.1. Using Behavior of IT Education Environment of Cloud Computing

The Using Behavior Scale of IT Education Environment of Cloud Computing consists of 29 questions which adopted the Likert-type instrument of five-point scale. The participants indicate the degree to which they agree with the statement on a five-point scale. Each response is given a value of 1 to 5, where 5 indicates a more positive towards the environment of cloud computing and the average value of 3 is the reference value for positive or negative attitude towards the environment of cloud computing. If the value is above average value, it means participants had positive attitude, in other hand it means a negative attitude. The Results of questionnaire showed the means of pretest and posttest at each scale are greater than reference value as shown in Table 4.

This indicates participants were positive toward the environment of IT education of cloud computing both before and after the experiment.

Table 4. Reference Value for Positive and Negative Attitude Toward the Using Behavior

Scale	Number of questions	Average value for positiveness and negativeness	Pretest mean	Posttest mean
Perceived usefulness	6	18	24.64	26.02
Perceived ease of use	4	12	15.6	16.4
Attitudes toward using	11	33	43.04	45.94
Intention of using behavior	4	12	15.87	16.91
Situations of after school learning	4	12	14.87	16.7
Behavior of overall using	29	87	114.02	121.96

4.2 Difference of “After School Learning Situations” Before and After Teaching

An independent-samples t-test was conducted to compare significant difference for after school learning situations in before and after the experiment group students use the IT education environment of cloud computing for learning. There was a significant difference in the scores for before and after conditions; $t(92.395) = 5.689$, $p = 0.000$, $MD = -1.830$, as shown in Table 5. These results indicate that after use the IT education environment of cloud computing students had more positive attitude toward using it after school.

According to above analysis, the hypothesis 2 that assumes there is no significant difference between the learning behavior of before using the IT education environment of cloud computing service and the learning behavior of after using the IT education environment of cloud computing for after school learning for elementary school students is not established.

Table 5. Independent-samples t-test for the Scale of After School Learning Situations

Levene's Test for Equality of Variances			t-test for Equality of Means				
	F	Sig.	t	df	Sig (2-tailed)	Mean Difference	Std. Error Difference
Equal Variance assumed	9.905	0.002	-5.689	104	0.000	-1.830	0.322
Equal Variance not assumed			-5.689	92.395	0.000	-1.830	0.322

4.3. Difference of “Overall using Behavior” Before and After Teaching

A t-test of independent sample was conducted to compare if there exists significant difference in overall computer using behavior between before using and after using the environment of IT education of cloud computing for learning. There was a significant difference between before and after conditions for the scores; $t(93.408) = -3.046$, $p = 0.003$, $MD = -7.943$ (as shown in Table 6). These results indicate that students had more positive attitude toward using the environment of IT education of cloud computing for overall using behavior when they adopted it.

According to above analysis, the hypothesis 1 that assumes there is no significant difference between the computer attitude of before using the IT education environment of cloud computing service and the computer attitude of after using the IT education environment of cloud computing service for elementary school students is not established.

Table 6. T-test of Independent Sample for the Scale of Overall using Behavior

Levene's Test for Equality of Variances			t-test for Equality of Means				
	F	Sig.	t	df	Sig (2-tailed)	Mean Difference	Std. Error Difference
Equal Variance assumed	7.183	0.009	-3.046	104	0.003	-7.943	2.608
Equal Variance not assumed			-3.046	93.408	0.003	-7.943	2.608

4.4. Correlation Analysis of Computer using Behavior and Learning Achievement

Pearson product-moment correlation coefficient also refers to as Pearson's r is used to know whether two variables are related to one another. The correlation coefficient is ranging from negative one to positive one. If correlation coefficient closes to 1, there is a strong relationship between the two variables. If it is close to 0, there is a weak relationship between the two variables. A positive coefficient means two variables had a positive correlation. A negative coefficient means two variables had a negative correlation. A Pearson product-moment correlation coefficient was computed to assess the relationship between the learning achievement and the overall computer using behavior of experiment group students, as shown in Table 7. There was a positive correlation between the two variables, $r = 0.423$, $n = 53$, $p = 0.002$. Overall, there was a moderate, positive correlation between learning achievement and the overall computer using behavior. Increases in overall computer using behavior were correlated with increases in learning achievement.

For the hypothesis 3 that assumes there is no significant correlation between the computer attitudes of after using the IT education environment of cloud computing service and the computer learning achievement for elementary school students is not established.

Table 7. Summary of Pearson Product-moment Correlation Coefficient between the Learning Achievement and the Overall Computer using Behavior of Experiment Group Students

	Overall using behavior
Pearson correlation	0.423**
Sig. (2-tailed)	0.002
N	53

5. Conclusions

The environment of IT education based on the infrastructure of cloud computing had been constructed for students who can login anywhere by using browsers in this paper and there is significant difference in the attitude of computer usage between before and after using the environment of cloud computing service IT education for elementary school students. After using the environment of IT education of cloud computing, students had more positive attitude toward it.

There is a positive correlation between the using behavior and learning achievement for the IT education environment of cloud computing. This means that if the using behavior increase, the learning achievement will also increase for the IT education environment of cloud computing.

Summarize above, it is feasible to use cloud computing service in construction of IT education environment and also improves shortcomings of current IT education environment.

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