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Privacy awareness on cloud storage among students at tertiary level: A case study

*Z D Eri[1], S Yusoff[1], K L Ngo[2], S N H Ishak[1], and N Ahmad[1]
[1]Faculty of Computer and Mathematical Sciences,
[2]Academy of Language Studies
Universiti Teknologi MARA, 21080 Kuala Terengganu, Terengganu, Malaysia

*zetid415@uitm.edu.my

Abstract. In recent years, the usage on cloud storage has grown, including students at tertiary level. Cloud storage helps students to store and share academic materials without additional costs. However, not many studies investigate on the students' awareness level particularly in privacy related issues. This study examined the privacy awareness on cloud storage among students at Universiti Teknologi MARA (UiTM), Kuala Terengganu. The study examined the students' privacy awareness, through its level of agreement on the five elements which were cloud service awareness, privacy protection, risk analysis, security awareness and data availability participants. 90 respondents from three different programs were selected from the Faculty of Computer and Mathematical Sciences (FSKM). An independent t-test and ANOVA test were conducted using SPSS. The results revealed that there was no significance difference between both genders on the privacy awareness on cloud storage. While, there was a significance difference amongst the three different programs in FSKM about privacy protection. This study concluded that these Computer Science degree students were concerned and aware about the privacy on the cloud storage, but they were not aware about the privacy related issues in the cloud storage.

1. Introduction

In this new era of technologies, there are many cloud storage services available online to help people manage their data storage daily. These cloud storage services such as Dropbox, Google drive, iCloud and many others. Cloud storage reduces the usage of physical devices such as pen drives and external hard disks. And, this method has become a trend in recent years including students at tertiary level [1].

Since cloud storage is gaining popularity, most students will find this service as an advantage. Based on a preliminary study among the degree students in FSKM Kuala Terengganu, result shows that 51% of the students are using cloud storage.

Privacy is a basic form of liberty. Privacy on the information is crucial to safety and free from unauthorized access so that liberty will be kept secure [2]. The privacy awareness issues comprise of constructs including cloud service awareness, privacy protection, risk analysis, security awareness and data availability participants.

Nowadays, students are more familiar with cloud services and there are tendency that the students may have more than one account. Despite having many accounts, they still have little knowledge and

awareness in managing these accounts while using the IT facilities in university. For example, they forgot to log off the account which exposed to the risk of data theft and they also tend to use saved password feature in the web browser, that reveal to other user to signing their accounts.

Therefore, a study is conducted among students from degree programs namely Business Computing (CS244), Computer Science (CS230) and Computational Mathematics (CS247). This study aimed to investigate the privacy awareness level on cloud storage usage among these degree students.

2. Literature Review

2.1. Cloud Computing and Storage
Cloud services arises from a mixture of traditional computing and network technology for example grid computing, distributed computing, parallel computing, just to name a few [3]. Based on that, service such as cloud storage allows users to store data remotely over multiple devices [1].

Cloud storage can be defined as the storage in cloud computing and can also be a cloud computing system equipped with large capacity storage [3]. According to [4], cloud storage is defined as "*the storage of data online in the cloud*," where in a company data is stored in and accessible from multiple distributed and connected resources that comprise a cloud.

Cloud storage are also available for public with the term pay as you go manner or known as Utility Computing including Amazon Web Service, Google AppEngine and Microsoft Azure [5]. Generally, cloud storage can be defined as a system that provides data storage in the cloud. Many companies, such as Google, Microsoft, and Apple accelerate their speeds in developing Cloud Computing systems and improving its services to larger number of users.

2.2. Privacy and Awareness
Not every user found it safe to store their data in cloud storage even with advanced technology in cloud. Plus, many incidents occur on a cloud computing system that could keep away user of this service, for example, the flaw of accidentally share user documents (Google Docs), phishing attacks and leaked customer list (Salesforce.com), and Epic.com lodged a formal complaint to the FTC against Google for its privacy practices [6]. Many cloud systems have introduced their own security policies, but it is hard for users to completely trust these policies [7].

2.3. Cloud Storage at Tertiary Level
Cloud storage usage is gaining popularity in a wide range of users such as employees and students [8]. At the tertiary level, the use of cloud storage can be used as medium to share and store personal or academic materials that allow students to share their information easily and to discover new experiences of the education system.

However, despite the comprehensive literature, there is still limited studies related to the applied factors that influence the adoption of cloud technology at higher education institutions. Odeh, Garcia-Perez & Warwick (2017) applied an interpretive paradigm with a qualitative research method to investigate the main enablers of and barriers to cloud computing adoption at the universities in developing countries in general.

3. Methodology

3.1. Instrument
The instrument used in this study was a self-developed questionnaire. The items were constructed in relation to the research objectives. There were 45 questions in the questionnaires, 10 questions in Part A and 25 questions in Part B. The questionnaire was distributed to 90 respondents from three different programs who studied in FSKM UiTM, Campus Kuala Terengganu.

Part A contained all the demographic information such as gender, age, marital status, program, part, educational level, what is your level of knowledge about cloud storage, types of cloud storage that you used, types of data or information to store in cloud storage or not and user's general feelings about cloud storage. Part B contained five sections. Every section contained five questions. Five sections in this part were information about cloud service awareness, privacy protection, risk, security awareness and data availability participants.

Respondents were required to consider each possible reason for the user awareness on usage cloud storage and rate how important it was for them by using a 5-Point Likert scale (strongly disagree; disagree; undefined; agree; strongly agree). Table 1 shows the elements and items of the structured questionnaire.

Table 1. Constructs and Item List

No.	Constructs	Items
1	Cloud Service Awareness	● You know many cloud storage services out there. ● You often use cloud-based storage. ● Cloud storage is reliable as today's storage technology. ● You prefer to use cloud storage rather that hardware storage. ● Cloud storage will enhance our life and reduce our work.
2	Privacy Protection	● Are you sure your data is protected on cloud storage? ● You really trust the cloud storage services provider to hold your data. ● You are the only one that can access your data on your storage. ● You know how your data are protected on cloud storage. ● You aware that cloud storage provider can use your data for other purpose.
3	Risk Analysis	● You could lose your data on cloud storage. ● Lack of control regarding your data on cloud storage. ● Someone else has the data on cloud storage. ● Your data may be hacked. ● You may not retrieve your data.
4	Security Awareness	● The cloud provider employs encryption during transmission of your data. ● Server for cloud storage is trustworthy on security level. ● User password makes a huge impact on cloud security. ● All cloud storage has SSL that protect your data from intercepted. You have a full control of your data on cloud storage.

5	Data Availability Participants	- Your data remains available, even in the events of a disaster. - A cloud service provider has multiple storage location over your data. - You have a backup of your cloud data on your hardware storage. - The data retrieved from cloud are always on usable format. Your data can be retrieved even when you want to terminate the service.

3.2. Analysis & Result

SPSS was used to analyze the data gathered. Independent t-test analysis and Analysis of variance (ANOVA) were carried out to test the hypotheses as in Table 2 and Table 3. This paper aimed to examine the privacy awareness on cloud storage usage among different genders and programs of FSKM, UiTM Campus Kuala Terengganu.

3.2.1. Part A: Demographic Information

The doughnut charts in Figure 1, shown the percentage of gender, programs, and education levels of the respondents for demographic results. Out of 90 respondents, 67% were female and 33% were male.59% of them were from CS244 program, followed by 26% of CS247 and 14% were from CS230. 99% of them were degree students with 1% of post-graduate student.

The bar chart in Figure 2 presented the age group of the respondents. The result shows that more than 60% of the respondents in the category were 22 to 23 years old. This study comprised of all degree program students from Part 1 to Part 6. In Figure 3, the researchers focused at Part 6 students on the study of the privacy awareness on the cloud storage.
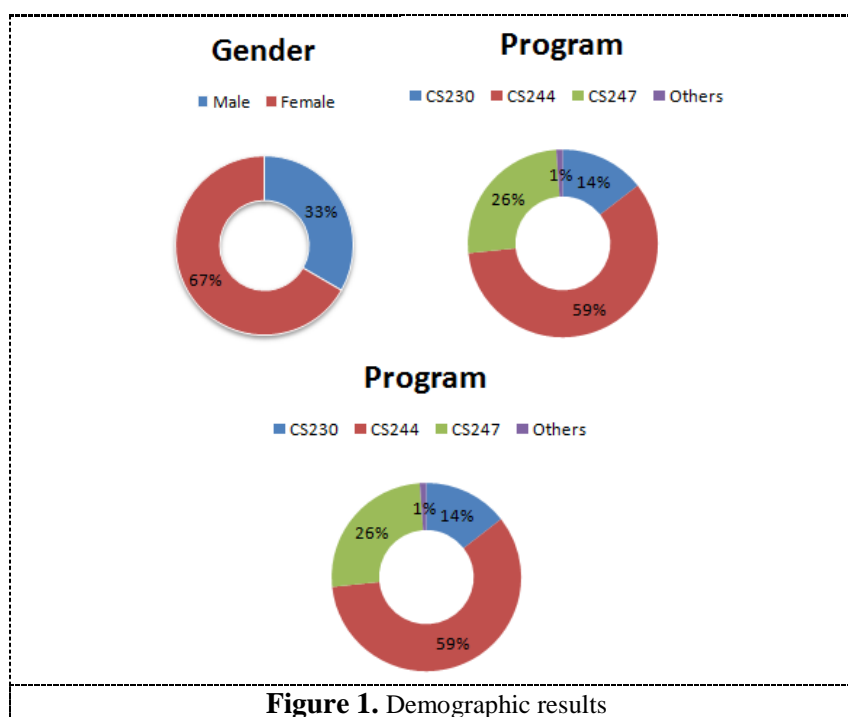

Figure 1. Demographic results

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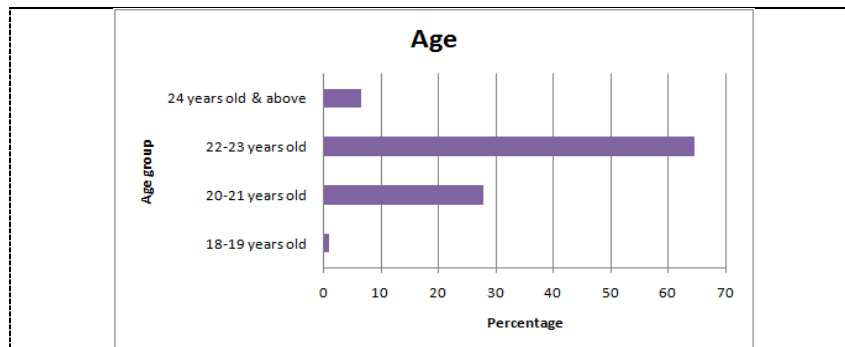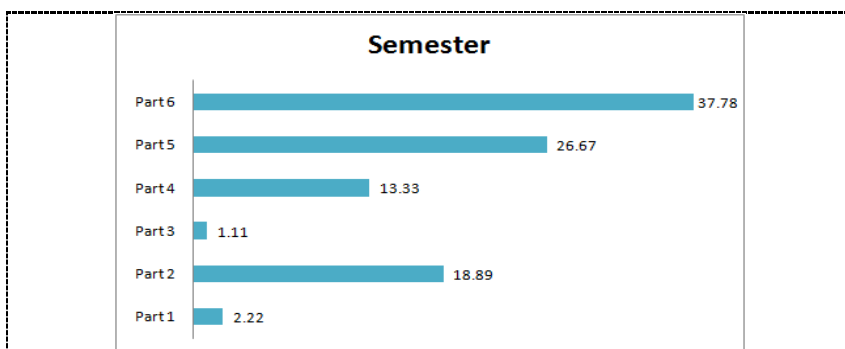

Figure 2. Age Group

Figure 3. Students' part of program

3.2.2. Part B: Mean Difference Analysis

The data was analysed to see whether there was a significance difference of mean for each section in Part B between gender and programs. Table 2 shows the result of Independent t-test between mean of privacy awareness of each section with gender. Surprisingly, there was no significant difference of mean of privacy awareness on gender. Meanwhile, the result in Table 3 shows the result on Analysis of Variance (ANOVA) between privacy awareness on cloud storage and three different programs (CS247, CS244, and CS230). The results in the table below shown that all the means of cloud service awareness, risk, security awareness, and data availability participants had no significant difference in programs. Only the significant values of mean in privacy protection showed a significance difference with programs.

Table 2. T-test result analysis

Hypotheses	Sig. value	Result
There is a significance difference of mean Cloud Service Awareness and Gender	0.178	Not Significance

There is a significance difference of mean Privacy Protection and Gender	1.000	Not Significance
There is a significance difference of mean Risk Analysis and Gender	0.458	Not Significance
There is a significance difference of mean Security Awareness and Gender	0.919	Not Significance
There is a significance difference of mean Data Availability Participants and Gender	0.539	Not Significance

Table 3. ANOVA results analysis

Hypotheses	Sig. value	Result
There is a significance difference of mean Cloud Service Awareness and programs	0.730	Not Significance
There is a significance difference of mean Privacy Protection and programs	0.026	**Significance**
There is a significance difference of mean Risk and programs	0.892	Not Significance
There is a significance difference of mean Security Awareness and programs	0.391	Not Significance
There is a significance difference of mean Data Availability Participants and programs	0.188	Not Significance

4. Discussion

The rapid changes in technology promote user to use the internet with their gadgets (Smartphone or tablet) other than a laptop or desktop. Everyone is updating their live through the variety of social media available such as Twitter, Facebook and Instagram, just to name a few. By using smartphones with the availability internet connection, they just snap the picture and share it instantly with the social media. It is common nowadays. But our concern is about the privacy awareness on cloud storage among students in the Faculty of Computer Science and Mathematics.

This study hypothesizes that the cloud service awareness, privacy protection, risk analysis, security awareness, and data availability participants towards different programs and gender. The results indicated that only the privacy protection is significantly difference towards programs. These suggest that the students agree the data is protected on cloud storage and know how the provider manages the data storage. Additionally, the students who save the data on cloud storage really trust their provider to

hold the data and believe that they are the person who can access the cloud. Most importantly, the students are aware that their privacy data can be used for other purposes.

The results reveal no significance difference on gender for cloud service awareness, privacy protection, risk analysis, security awareness, and data availability. This implies that gender and their awareness level on cloud storage cannot be questionable and not become as a factor of privacy awareness. In other words, the students were not aware about the privacy on the cloud storage regardless of gender.

As a Computer Science student, this study is expected to see that the students are more concerns when storing data on the cloud and interested to compare their awareness between four different programs and gender. Similar study was conducted by [10] among computer science students about awareness of storing data on the cloud. They found that Dutch user is more aware about the privacy and security risk compare to Macedonian users of cloud storage.

5. Conclusion

It can be concluded from the ANOVA test that examines the differences among the three programs with the mean of privacy awareness on cloud storage. Only, Privacy Protections showed a significant difference among the three different programs. They believed all the data in the cloud storage were well protected and trustable by the service providers. Additionally, they also believed that the data can be accessed only by the users themselves.

This study has several limitations. First, the sample size is limited to degree students only. Future study can also include students from diploma level and make a comparison between them. Second, this study can be expanding to different programs in different faculty and access their awareness level rather than focus on computer science students only.

In conclusion, most of the students from these three different programs only pay attention on the issue of the Privacy protection awareness used in their cloud storage service. By assuming that the content of the data stored in the cloud storage is only for their personal used. Due to that, they may have significant privacy protection awareness compared to other variables, namely cloud service awareness, risk analysis, security awareness and data availability participants. Hence, everyone should have the knowledge on privacy awareness even though you have no background knowledge on computer.

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