Literature Review of Cloud Based E-learning Adoption by Students: State of the Art and Direction for Future Work

To cite this article: Mohammad Hassan Kayali et al 2016 IOP Conf. Ser.: Mater. Sci. Eng. 160 012087

View the article online for updates and enhancements.
Literature Review of Cloud Based E-learning Adoption by Students: State of the Art and Direction for Future Work

Mohammad Hassan Kayali, Nurhizam Safie, Muriati Mukhtar
Faculty of Information Science and Technology, Universiti Kebangsaan Malaysia

Abstract — Cloud computing is a new paradigm shift in information technology. Most of the studies in the cloud are business related while the studies in cloud based e-learning are few. The field is still in its infancy and researchers have used several adoption theories to discover the dimensions of this field. The purpose of this paper is to review and integrate the literature to understand the current situation of the cloud based e-learning adoption. A total of 312 articles were extracted from Science direct, emerald, and IEEE. Screening processes were applied to select only the articles that are related to the cloud based e-learning. A total of 231 removed because they are related to business organization. Next, a total of 63 articles were removed because they are technical articles. A total of 18 articles were included in this paper. A frequency analysis was conducted on the paper to identify the most frequent factors, theories, statistical software, respondents, and countries of the studies. The findings showed that usefulness and ease of use are the most frequent factors. TAM is the most prevalent adoption theories in the literature. The mean of the respondents in the reviewed studies is 377 and Malaysia is the most researched countries in terms of cloud based e-learning. Studies of cloud based e-learning are few and more empirical studies are needed.

1. Introduction
The emergence of cloud computing in 2007 has caused a paradigm shift in the technology and enables wide application of the cloud computing in business organizations, individual usage, and educational usage [1]. Cloud computing is the outcome of the innovation process that includes the software, hardware, and distributed computing among other [2]. Cloud computing is viewed as a dynamic platform that provides a cyber-infrastructure, access to software and hardware, and easier access to services and applications [3]. This has enabled cloud computing to develop as a technological innovation that can handle large amounts of information that are transferred and stored via electronic applications [4].

Previous studies attempted to identify the factors that affect the adoption of cloud computing. However, the majority was conducted on business organizations and the target respondents were IT professional and managers. In addition, previous studies deployed many models such as technology acceptance model (TAM), by [5] and the Unified theory of Acceptance and Use of Technology model (UTAUT) by [6], as well as the diffusion of innovation (DOI) by [7] and Technology-Organization-Environment (TOE) also have been used.

Previous studies are dominated by empirical studies and conceptual studies related to business organizations [31], [32], [33], [34] while few studies have been conducted in cloud based e-learning. Some studies related the adoption to trust side [8] while other related it to the ease of use and usefulness [9], [10], there is a need for a study to explore the literature. Thus, the objective of this study is to review, analyze, and integrate the literature to identify the factors that affect the cloud based e-learning as well as the most prevalent theories. The study also aims to provide direction for future works.

This paper consists of six sections. The first section described the background of the paper and highlighted the issues as well as the objectives. In the second section, the research methods of this paper is described. The
The literature review is presented in third section while the fourth section presents the findings of this study. Fifth section presents the limitation and direction for future works and the last sixth section concludes the study.

2. Research Methodology

A systematic process was adopted to refine and select the appropriate articles that suit the context of this study. This study aims to review the literature related to the adoption of cloud based e-learning to enrich the literature with statistic related to this area. Consequently, key words such as e-learning, cloud computing, cloud based e-learning, e-learning and cloud computing and a combination of these words were used to identify the articles. As a result, a total of 312 articles were found. A screening process was needed to refine the articles. First, a screening of the title was conducted. This has resulted in removing 231 articles, as they were more into technical aspects of cloud computing and e-learning. Second screening entitles the remove of unrelated articles. A total of 63 article were removed because they were conducted on business organizations or used IT professional as respondents. A total of 18 articles were considered suitable for the purpose of this study and they meet the inclusion criteria that set for this study. Figure 1 shows the process of refining the articles.

The articles are pertaining to the educational learning. The information of these articles are first extracted then a frequency analysis will be conducted to identify most frequent factors, theories used, methodology, and respondents.

3. Literature Review

3.1 Cloud Computing Background

Cloud computing has been defined by many researchers. However, the United States (US) National Institute of Standards and Technology (NIST) provides the most used definition. NIST described the cloud computing as a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction [11]. Cloud computing has three main layers that are the Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) [12]; [13] [14]. These layers are customized to suit different stakeholders. For example, SaaS is designed to serve the end users because it provides application on demand [12], [13]. In term of PaaS, it is designed to serve the developers because it provides access to computers and database on virtual basis [12];[13]. IaaS is designed to serve network architect who need access to services such as storage, servers, hardware, and networking components [12], [13].

Research also has categorized the deployment of cloud computing into four types that are the private clouds, which run and built within organizations while the public cloud is available for public and provide by large organizations such as Microsoft. In addition, the hybrid cloud is a mix between private and public while the community cloud is a strategic alliance cloud between organizations [15], [14].
3.2 Existing Models

The articles that have been identified as suitable for the context of this study are summarized in Table 1 which provides details of the studies that include the authors, years of the study, location, adoption theory, method and sample of the studies, unit of analysis and the a summary of the result.

Table 1: Survey of Literature

| Author(s)/Years/Country | Adoption theory | Method/Sample size | Unit of Analysis | Summary of Result |
|-------------------------|-----------------|--------------------|------------------|-------------------|
| [16], [17], [8], [18]  | No theories has been used in these studies | All the studies used a questionnaire to collect the data. | Student | Cost and benefits as well as the mobility, connectedness, security, quality of service, system and satisfaction are the most important factors. |
| [9], [10], [19], [20], [21] | All the studies have deployed the TAM | Questionnaire of 229 student using AMOS. | Students | Perceived usefulness, perceived ease of use, age, gender, subjective norm, and trust, computer anxiety, computer self-efficacy, and internet self-efficacy affect the adoption of cloud based e-learning. |
| [22] | TAM and TPB | 288 student using PLS | Student | The perceived usefulness and ease of use affect the intention to use which affected the usage behavior. |
| [23], [24], [25], [26] | All the studies have deployed the UTAUT | 225 respondents using AMOS | Students | Performance expectancy, effort expectancy, social influence, facilitating conditions, perceived risks, perceived cost, personal innovativeness are the factors that affect the adoption of cloud based e-learning. |
| [27] | TAM/UTAUT | Questionnaire from 128 in USA and 121 in Turkey | Student | TAM and UTAUT factors in USA and turkey are similar in their effect. |
| [28] | TOE/TAM/SQ/SE/DOI/TRA-TPB | 478 questionnaire | Student | TAM service quality (SQ), self-efficacy (SE), DOI, TRA-TPB are able to explain the variation in adoption individually and collectively. |
| [29] | Self-determinaton theory Channel expansion theory | 1064 questionnaire | Student | VLE content design, Attitude toward knowledge sharing, trust-in-website, school support and education significantly effects intention to use VLE |
| [30] | Channel expansion theory | 624 questionnaire | Student | All VLE related attributes (except content design), school support and attitude towards knowledge sharing on behavioural intention (BI). BI was found to have direct effect on instructional effectiveness (IE). |

4. Findings

This section presents the findings of this study. The findings reports the most frequent factors that have been used in the literature as well as the theories, respondents, location of the studies, and the methodological approach of the reviewed studies. The review and analysis of the articles resulted in extracting 52 factors that have been used frequently by previous studies. Figure 2 shows the most frequent factors. It shows that usefulness and ease of use the most frequent factors for the adoption of cloud based e-learning.
Figure 2: Most Frequent Factors

B. Adoption Theory
The theory that have been adopted by previous studies presented in Figure 3. It shows that TAM is the most adopted theoretical model in the literature of cloud based e-learning this is followed by UTAUT. Three of the studies has no adoption theories while the combination between more than two theories are found in four studies.

Figure 3: Adoption Theories

C. Place of Studies
Figure 4 shows the country of the studies. It shows that three studies were conducted in Malaysia while two studies in Vietnam and two in Korea. Two of the studies were conducted in two countries; developed and developing countries (Lebanon and UK, Turkey and USA). The remaining sixteen studies were conducted in a single country.
D. Statistic Software

All the reviewed articles are empirical and have used a questionnaire to collect the data from the respondents who are students at universities. Tools that have been used in data analysis are given in Figure 5. It shows that the 71% of the previous studies have used SPSS, which indicates that it is still one of the widely used software for data analysis. A total of 23% has used AMOS while 6% has used PLS.

E. Sample Size

All the previous studies have used the students as respondents of their studies, however, the sample size of the studies are varied. While some studies includes more than 1000 respondents, other has only 40 respondents. The mean of the sample size for all studies is 3.77 respondents. Figure 6 shows the sample size distribution of the studies.
5. Limitation and Future Works

The purpose of this study was to review, analyze and integrate the literature pertaining to the cloud based e-learning. The number of studies that were included is eighteenth and this is due to the lack of studies of cloud based e-learning as the field is still new and emerging. The articles were extracted mainly from the Science Direct, Emerald, and IEEE databases, thus, the findings could be carefully generalized. The study also included only the cloud based e-learning, other field such as e-learning alone was excluded from this study.

As a way forward, future researcher are recommended to investigate the cloud based e-learning because this field still in its infancy and more studies is required to cover the aspect and conceptualization of this field. Future researchers can use the model of TAM and UTAUT, DOI, TOE, and other acceptance models to develop a framework to explain the variation of the adoption of cloud based e-learning services. The researchers could also combine two theories of models to come up with strong model that can be used in the acceptance of new technology. It is recommended to combine the UTAUT with TOE as researchers combined TAM and TOE or TAM and TPB, and TAM and UTAUT, the TOE and UTAUT were not investigated together. UTAUT is the newer model and it has the highest explanatory power while the TOE is can classify the variables into constructs such as technological, organizational, and environmental.

SPSS is the first generation of statistics and it still widely used in the literature. However, newer software such as AMOS and PLS are more capable of testing complicated models that includes mediators and moderators. Thus, future research are advised to investigate the cloud based e-learning using the software such as AMOS or PLS.

It was found that most of the studies were conducted in one country and only two studies were conducted to compare the adoption in two countries. It seems that researchers have compared the adoption of cloud based e-learning between developed and developing countries. However, there is big gap between develop and developing countries in term of adoption. Thus, future researchers are advised to investigate the adoption of cloud based e-learning between developing countries and emerging economies. For example, countries such as Lebanon and Vietnam are developing countries while Malaysia, Korea, and Turkey are emerging economies. Thus, the comparison could give better image of the situation in the developing countries when it is compared with the emerging economies.

6. Conclusion

This study has reviewed the literature pertaining to the adoption of cloud based e-learning computing by students. Screening processes were followed to identify, select and review the related articles to cloud based e-learning. A total of 18 articles was included. The findings showed that TAM is still one of the widely used adoption theory in the cloud based e-learning. The factors of usefulness and ease of use are the most frequent factors. Malaysia is among the countries that has the highest percentage of studies in cloud based e-learning.
The findings of the study is limited to the reviewed articles. The field of cloud based e-learning is still in its infancy and more studies are needed to discover this field.

References

[1] U. Nasir and M. Niazi, “Cloud computing adoption assessment model (CAAM),” Profes '11, vol. 44, no. 0, pp. 34–37, 2011.
[2] R. Buyya, “Market-oriented cloud computing: Opportunities and challenges,” in 2013 17th IEEE International Enterprise Distributed Object Computing Conference, 2013, p. 7719.
[3] Z. Yang, J. Sun, Y. Zhang, and Y. Wang, “Understanding SaaS adoption from the perspective of organizational users: A tripod readiness model,” Computers in Human Behavior, vol. 45, pp. 254–264, 2015.
[4] M. Sarrab, M. Elbsair, and S. Alnæl, “Towards a quality model of technical aspects for mobile learning services: An empirical investigation,” Computers in Human Behavior, vol. 55, pp. 100–112, 2016.
[5] F. D. Davis, “Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology,” Source: MIS Quarterly, vol. 13, no. 3, pp. 319–340, 1989.
[6] V. Venkatesh, M. G. Morris, G. B. Davis, and F. D. Davis, “User acceptance of information technology: Toward a unified view,” MIS Quarterly: Management Information Systems, vol. 27, no. 3, pp. 425–478, 2003.
[7] E. M. Rogers, “A prospective and retrospective look at the diffusion model,” Journal of health communication, vol. 9 Suppl 1, no. July 2015, pp. 13–19, 2004.
[8] K. Atchariyachanvanich, N. Siripujaka, and N. Jaiwong, “What Makes university students use cloud-based e-learning?: Case study of KMITL students,” in International Conference on Information Society, i-Society 2014, 2015, pp. 112–116.
[9] D. Burda and F. Teuteberg, “The role of trust and risk perceptions in cloud archiving - Results from an empirical study,” Journal of High Technology Management Research, vol. 25, no. 2, pp. 172–187, 2014.
[10] A. Tarhini, K. Hone, and X. Liu, “The effects of individual differences on e-learning users' behaviour in developing countries: A structural equation model,” Computers in Human Behavior, vol. 41, pp. 153–163, 2014.
[11] P. Mell and T. Grance, “The NIST Definition of Cloud Computing Recommendations of the National Institute of Standards and Technology,” Nist Special Publication, vol. 145, p. 7, 2011.
[12] A. Goscinski and M. Brock, “Toward dynamic and attribute based publication, discovery and selection for cloud computing,” in Future Generation Computer Systems, 2010, vol. 26, no. 7, pp. 947–970.
[13] C. Low, Y. Chen, and M. Wu, “Understanding the determinants of cloud computing adoption,” Industrial Management & Data Systems, vol. 111, no. 7, pp. 1006–1023, 2011.
[14] J. W. Lian, “Critical factors for cloud based e-invoice service adoption in Taiwan: An empirical study,” International Journal of Information Management, vol. 35, no. 1, pp. 98–109, 2015.
[15] J. Yu, X. Xiao, and Y. Zhang, “From concept to implementation: The development of the emerging cloud computing industry in China,” Telecommunications Policy, vol. 40, no. 2–3, pp. 130–146, 2015.
[16] S. C. Park and S. Y. Ryoo, “An empirical investigation of end-users’ switching toward cloud computing: A two factor theory perspective,” Computers in Human Behavior, vol. 29, no. 1, pp. 160–170, 2013.
[17] E. Park and K. J. Kim, “An integrated adoption model of mobile cloud services: Exploration of key determinants and extension of technology acceptance model,” Telematics and Informatics, vol. 31, no. 3, pp. 376–385, 2014.
[18] E. Yadegaridehkordi, N. a Jahad, and N. Ahmad, “Task-Technology Fit and User Adoption of Cloud-based Collaborative Learning Technologies,” Computer and Information Sciences (ICCOINS), 2014 International Conference, pp. 1–6, 2014.
[19] A. Tarhini, K. Hone, and X. Liu, “A cross-cultural examination of the impact of social, organisational and individual factors on educational technology acceptance between British and Lebanese university students,” British Journal of Educational Technology, vol. 46, no. 4, pp. 739–755, 2015.
[20] I. Arpaci, “Understanding and predicting students’ intention to use mobile cloud storage services,” Computers in Human Behavior, vol. 58, pp. 150–157, 2016.
[21] S. Ashtari and A. Eydgahi, “Student Perceptions of Cloud Computing Effectiveness in Higher Education,” 2015.
[22] S. S. Al-Gahtani, “Empirical investigation of e-learning acceptance and assimilation: A structural equation model,” Applied Computing and Informatics, vol. 12, no. 1, pp. 27–50, 2014.
[23] Y. Cao, X. Bi, and L. Wang, “A Study on User Adoption of Cloud Storage Service in China: A Revised
Unified theory of Acceptance and Use of Technology Model,” 2013 International Conference on Information Science and Cloud Computing Companion, no. 2012, pp. 287–293, 2013.

[24] M. Bellaaj, I. Zekri, and M. Albugami, “The continued use of e-learning system: An empirical investigation using UTAUT model at the University of Tabuk,” Journal of Theoretical and Applied Information Technology, vol. 72, no. 3, pp. 464–474, 2015.

[25] T. D. Nguyen, T. M. Nguyen, Q. T. Pham, and S. Misra, “Acceptance and use of E-learning based on cloud computing: The role of consumer innovativeness,” in Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), vol. 8583 LNCS, no. PART 5, 2014, pp. 159–174.

[26] T. Nguyen, D. Nguyen, and T. Cao, “Acceptance and use of information system: E-learning based on cloud computing in Vietnam.” J. , 2014. 139–149.,” Information and Communication Technology, no. 4960, pp. 139–149, 2014.

[27] F. Ponsignon, P. Klaus, R. S. Maull, F. Ponsignon, P. Klaus, and R. S. Maull, “Factors influencing consumer purchase intention of cloud computing in the United States and Turkey,” 2015.

[28] W. L. Shiau and P. Y. K. Chau, “Understanding behavioral intention to use a cloud computing classroom: A multiple model comparison approach,” Information and Management, vol. 53, no. 3, pp. 355–365, 2016.

[29] [30] T. S. Hew and S. L. S. A. Kadir, “Predicting the acceptance of cloud-based virtual learning environment: The roles of Self Determination and Channel Expansion Theory,” Telematics and Informatics, vol. 33, no. 4, pp. 990–1013, 2016.

[30] T.-S. Hew and S. L. Syed Abdul Kadir, “Behavioural intention in cloud-based VLE: An extension to Channel Expansion Theory,” Computers in Human Behavior, vol. 64, pp. 9–20, 2016.

[31] N. Safie, " An investigation on the relationship between e-learning usability attributes towards motivation to learn". Unpublished Doctoral Thesis, International Islamic University Malaysia., 2009.

[32] N. Safie, & S. Aljunid, "E-learning initiative capacity building for healthcare workforce of developing countries". Journal of Computer Science,9(5), 583, 2013.

[33] R. M. T. Raja. L. Ahmad. M. F. M. Amran. Z. Othman &M. Mukhtar, "Validation of ERP Implementation Framework for Private Institution of Higher Learning (PIHL) in Malaysia: A Delphi Technique" International Journal of Computer Applications, 116(22), 2015.

[34] M. A. Mohammed, I. Huda, and M. N. Maslinda, “Electronic information sharing between public universities and ministry of higher education and scientific research: A pilot study,” Journal of Theoretical and Applied Information Technology, vol. 77, no. 2, pp. 151–163, 2015.