Exploratory Factor Analysis Toward Adoption of Cloud Computing by Faculty Members In Saudi Arabian Universities For Teaching And Learning

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Abstract
Cloud computing applications are learning platforms used in universities to enhance teaching and learning. For cloud computing applications to be taken up and used effectively, it is necessary to identify the factors influencing user acceptance of this new technology. The modified version of the 'Unified Theory of Acceptance and Use of Technology' (UTAUT2) model (Venkatesh et al., 2012) demonstrates great promise for understanding user acceptance of information systems. In this study, an enhanced UTAUT2 model is proposed, incorporating new variables such as awareness, perception of security, and bandwidth speed. The main goal of this study is to evaluate the predictive relevance of this proposed conceptual model to understand and describe academics' actual and intended adoption of cloud computing apps. This inquiry conducted a quantitative study via an online survey which targeted academics in Saudi universities. Data was collected from all state universities and involved 460 faculty members. Explanatory factors analysis has been used to examine this conceptual model. Findings indicate that the proposed model is a good fit for the Higher Education Context of Saudi Arabia. However, the variable pertaining to the freely-available apps failed to load in the proposed conceptual model.

Keywords: *UTAUT2, cloud computing, Google cloud, Office 365, higher education, Technology adoption, Saudi Arabia*

1. Introduction

In these educational institutions, a technology that enables us to connect with other individuals facilitates the mentoring required between students and external partners to upgrade their skilled work (Wood & Breyer, 2016). Although that technology comprises helpful tools, it should be realised that pedagogy comes first and technology second, or "Pedagogy is the driver, technology is the accelerator" (O'Neill, 2016). One of these technical tools is cloud computing. Cloud computing is a new trend in the global market of technology that offers great potential for education. Some universities have signed contracts with large enterprises such as Microsoft and Google with the aim of using cloud computing to create a new trajectory in teaching and learning.

There are some difficulties in defining cloud computing by any particular term as there are many arguments and challenges by researchers about such a standard definition (Ashtari & Eydgahi, 2017). However, there is some agreement that cloud computing is a new model related to development systems as well as technology that represents a new horizon of telecommunication knowledge and extensive information sharing. The advancement of the Internet and the computational evolution have produced innovative IT and cloud computing services, such as the delivery of pay-as-you-go computing services, the running of various applications, and remote data storage from remote data centres over the Internet (Toosi, Calheiros, & Buyya, 2014). Cloud user information is stored on servers, thus allowing users access to their information at any time and from any Internet-enabled device.

The research reported in this study fills a gap in the literature by exploring the fit model with number of underlying factors and their relationships to observed items in higher education in Saudi context.

2. Literature review

Previous studies have offered definitions of cloud computing. One of the most well-known definitions came from the National Institute of Standards and Technology (NIST) in the United States "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing

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resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Mell & Grance, 2011). Armbrust et al. (2010)have described cloud computing as a large system that delivers help across the online network, and the hardware and software that provides these services as based on Intelligent Data Centres. So, cloud computing offers a style of scalable and elastic IT-enabled abilities that are delivered as a service using Internet technologies, in addition to a new technology platform for developing and deploying applications for end-users (Bittman, 2009). According to Sultan (2010), cloud computing is a gathering of computers that deliver on-demand resources and services over a networked medium (usually the Internet). The main function of cloud computing is to create readily available, "technology resources" (systems, applications and/or data) in the form of services that users can call on and consume "on-demand" via the internet or an intranet/extranet, where they only pay for actual consumption" (IBM, 2012). Tian and Zhao (2015) have defined the cloud as "the computing resources operating that provide computing, storage, and networking resources" by third parties.

3. Types of cloud computing

Many researchers have divided cloud computing into three models. These types of cloud computing are defined regarding who is benefiting from it, and the degree of control required. For example, Arshdeep and Vijay (2014) have categorised cloud computing as follows: software as a service (SaaS), infrastructure as a service, and platform as a service (PaaS). Details of the three types are as follows:

3.1 Using cloud computing as Software as a Service (SaaS)

This means that SaaS provides the capability for using applications supplied by the service provider without giving control of the platform or the infrastructure (Marinescu, 2013). This model relies on only the username and password. The present study focuses on this type of cloud computing due to its affordability and accessibility. Bosch (2017) was citing Marc Andreessen when he wrote in The Wall Street Journal that "software is eating the world". According to Ebert and Jones (2009), the size of the software increases tenfold, every five to ten years. Software entirely drives well-known companies, for example, Google, Microsoft, and Apple. As a result, the world of software develops educational applications in different areas. For example, software such as Office 365 facilitates enhanced communication and interaction between teachers and learners (Rowe, Bozalek, & Frantz, 2013).

3.2 Using cloud computing as Infrastructure as a Service (IaaS)

According to Arshdeep and Vijay (2014) in their book Cloud Computing: A Hands-On Approach, "… computing resources as a service include virtualized computers with guaranteed processing power and reserved bandwidth for storage and Internet access". Grossman (2009) argued for a cloud-based infrastructure, which covers a wide area, performance networks and supported important data mining applications. Cloud computing infrastructures accelerated the adoption of different technological innovations in academia resulting in colleges being able to access facilities and resources on-demand.

3.3 Using cloud computing as PaaS Platform as a Service (Platform)

Arshdeep and Vijay (2014) have defined this approach similarly to IaaS; however, PaaS consists of operating systems and specific applications that require services. In other words, PaaS is IaaS with a custom software stack for the given application.

Marinescu (2013) in his book Cloud Computing: Theory and Practice gives another view. He has defined characteristics of the new philosophy for bringing computing services as:

- Cloud computing operates efficiently (elastic service) by using external technologies to deal with electronic transactions and can support variable workloads.
- The resources deliver metered services for its customers who are only charged for the resources they use.
- Cloud service providers offer guaranteed maintenance and security.
- Service providers have the economy of scale which assists in the running of more applications for specialisation and centralisation.
- Cloud computing always minimises costs because it possesses resource multiplexing that facilitates the use of its services.
- The application provided by cloud services stores users' data more rapidly to the site where it will be used in a device, and a location-independent manner.

Cloud computing applications (SaaS) are one of the technical tools that deal with end-users directly. These applications principally make use of the web client and network to remotely provide applications, in addition to

multimedia and web services, to users. At its core, it is not necessary in cloud computing to have the burden of installing applications. Examples of SaaS are Microsoft Office 365, and Google Apps for Education. Additionally, cloud computing applications help to create content, and provide virtual friends, collaboration, file sharing, live streaming, etc. for students and teachers (Mustapha, 2016).

There are four key advantages for using cloud computing apps in education. First, cloud computing saves time and the expense of costly licenses, by offering software application for computers without installing the applications across all university sites. Subsequently, all documents created with these applications can be downloaded, saved and accessed from any device linked to the Internet or Wi-Fi providers (Alharbi, 2012; Dawson, 2015; eman, 2016; Ercan, 2010; Kovacevic, Spoljaric, & Heði, 2012; Strachan & Faltens; Sultan, 2010). Similarly, cloud computing avoids traditional obstacles; conventional computer labs as an example. There are many challenges such as limitation of work hours and peak hours, fixing and maintaining software hardware, moving between campuses, cost of equipment and upgrading the software manually (Bahga & Madisetti, 2013; Erl, Puttini, & Mahmood, 2013; Furht & Escalante, 2010; James & Weber, 2016; Marinescu, 2013; Strachan & Faltens).

Microsoft's Office 365 is considered to be one of the most professional tools derived from cloud computing. It provides a group of applications which are considered with collaboration in mind (Katzer, 2015). Collaboration with Office 365 is the sharing of information with a learner and with others as well in an external visual environment. Office 365 permits students to collaborate everywhere. For instance, teachers could work on a project in a Word document on their personal devices, save the document to the cloud, and then invite students to collaborate in Office 365, in real time. Moreover, everyone in the collaboration is notified of the latest editing of the shared document. (Katzer, 2015). Office 356 keeps each person up to date and working together as a team (Products.office.com, 2017). their files from any location, and share and collaborate with each other on Word, Excel, PowerPoint and Access files using a personal computer (PC), smartphone device, and your browser (Onedrive.live.com, 2016). Currently, many well-known companies are hosting their services in the "Cloud" using such applications as Office 365, more than ever before.

In the past, when teachers needed to collaborate with their students, they would have encountered multiple problems such as the management of time, absent students, storage of students' ideas, evaluation of students and ensuring that everyone understands the learning experience. These issues are the fundamental strengths of cloud computing tools. Learners can run different software applications on their mobile devices, anytime and anywhere. Teachers can provide various software applications, available in a cloud environment, without additional installation efforts or costs. Additionally, teachers can test a variety of apps from different providers to find out which ones are best for them.

4. Cloud application in Saudi Arabia

Saudi Arabia is one of the well-known members of the G20 group of nations where it has the largest oil reserves in the world in addition to having a significant impact and volume of investment and economy and in the world (Ramady, 2010). Saudi Arabia is one of the largest markets for communication and technical information in the Middle East. This market has recorded high levels of adoption of communication techniques and technical event information (Arabia, 2015). Thus, many Saudi universities have contracted with two particular companies—Google and Microsoft. In addtiontion that Microsoft and Google that work in Saudi educational institutions have been providing cloud computing services such as Software-as-a-Service (SaaS). Most Saudi universities contracted with Microsoft to operate a series of services that support their faculty members and students; for example, Outlook Mail, OneDrive, Office 365, Yammer. This kind of technical support came with 1TB of free cloud storage usage. While others contracted with Google services including core services, include Gmail, Google Calendar, Drive, Hangouts, and more. Many studies have been published that study the factors involved in integrating ICTs in education from the viewpoint of the perception of academic staff. However, the implementation of cloud computing apps in teaching and learning especially in Saudi Arabia are an under-researched area of study. This research will be one of the first studies that explores the academia voice in terms of exposing the factors impact to them. This study will be the first study of implementing cloud computing from faculty member's perspective in the context of higher education, Saudi Arabia covering both gender male and female in all Saudi universities.

This study has developed the conceptual framework regard to the verities and issues that come across implementation technology in Saudi Arabia. Several studies have revealed that technical issues has significant aspects to apply technology in education such as internet infrastructure, security issues (Alharthi, Alassafi, Walters,

& Wills, 2017; Lawan & Kashif, 2018; Noor, 2016; Syed, 2016; Xanthidis, Xanthidou, & Nicholas, 2016; Yong, 2018). Furthermore, previous research findings into social and cultural issues have been consistent and coherent in this context. For example, Weber and Hamlaoui (2018) confirmed Arabian Gulf region's customary and general concern paly important role for employ technology in education. In addition to awareness, self-efficacy and languages issues (Alshammari, Jr, & Parkes, 2016; Asiri, 2012; Weber & Hamlaoui, 2018; Xanthidis et al., 2016).

5. Theoretical framework

In the last decades; technology acceptance research has developed models that measure the evaluation, acceptance and perceptions of technological schemes (Biermann, Himmel, Offermann-van Heek, & Ziefle, 2018). This conceptual model tries to determine the faculty members' intention to use cloud apps in teaching and learning. This current study model of these models is the Unified Theory of Acceptance and Use of Technology (UTAUT2), developed by Venkatesh, Thong, and Xu (2012) . This model is based on eight technology acceptance theories. The UTAUT model examined the extent to which an array of behavioural intentions predicts technology use behaviour. Based on previous studies, this paper has built some new factors: Perceived security, awareness and perceived the speed of internet (Alharthi et al., 2017; Changchit & Chuchuen, 2016; Dawson, 2015; Sabi, Uzoka, Langmia, & Njeh, 2016) as well as modifying the elements of the UTAUT2 in accordance with the Saudi context. These factors are (1) Performance expectancy is defined as "the degree to which an individual believes that applying the technology will help him or her to attain gains in job performance" (Venkatesh et al., 2003), (2) Effort expectancy (EE) Effort expectancy can be defined as "the extent of ease connected with the use of a system"(Venkatesh, Morris, Davis, & Davis, 2003), (3) Social influence (SI) is "the extent to which an individual perceives that important others believe he or she should apply the new system" (Venkatesh et al., 2003), (4) Facilitating conditions (FC) is "the degree to which an individual believes that an organisational and technical infrastructure exists to support the use of the system" (Venkatesh et al., 2003), (5) Hedonic motivation (HM) is "the fun or pleasure derived from using a technology, and it has been shown to play an important role in determining technology acceptance and use" (Venkatesh et al., 2012), (6) Price value (PV) is defined as "the consumers' cognitive trade-off between the perceived benefits of the applications and the monetary cost for using them" (Venkatesh et al., 2012,). This conceptual model excluded the factor habit. This was based on the fact that faculty members in Saudi Arabia most likely have no rich experience in using such new technical cloud apps. Moreover; This current model included: (7) perceived security which is defined as faculty members' perception of how they are protected from risks related to security, (8) awareness: is defined as the extent to which faculty members are conscious of implementing cloud computing apps in education, (9) perceived the speed of the internet is defined as the effective or preference of the internet for using cloud computing apps. See figuer 1.

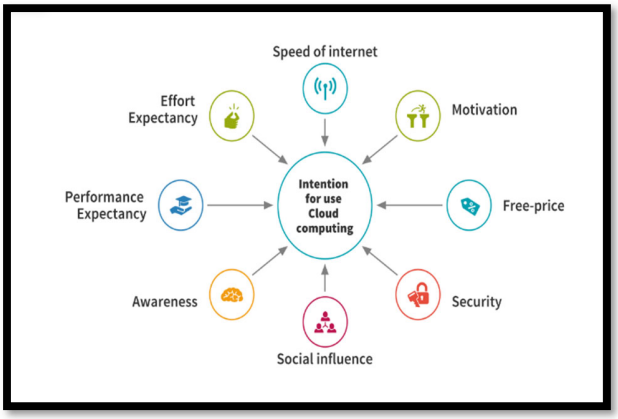

Fig. 1 Research Model.

6. Methodology

The purpose of this study was to develop a suitable model to determine the influence of nine factors on faculty members' intentions to implement cloud computing in education in the context of higher education in Saudi Arabia. The proposed model is based on a revised version of the Unified Theory of Acceptance and Use Technology (UTAUT2). This revised model incorporates a range of factors associated with Saudi culture, including societal and institutional mores.

For this quantitative research, a questionnaire was distributed to a random sample of male and female faculty members in a selection of Saudi universities. All UTAUT2 [except Habit] and external factors constructs were measured via a set of items rated by participants on a seven-level Likert-type scale. Response choices included strongly disagree (1), moderately disagree (2), slightly disagree (3), neutral (4), slightly agree (5), moderately agree (6) and strongly agree (7). Questionnaires were distributed to the selected participants via social media (Twitter, social networks and Facebook), newsgroups, forums, and an instant texting application email group. The researcher collected

828 responses from faculty members. However, only 468 responses were valid.

The collated and cleansed dataset was entered into Exploratory Factor analysis (EFA) with the aim of identifying a legible (sensible) and simple factor structure (items loading at 0.300 or above on no more than a single factor).

7. Results

Item responses by the 468 participants were entered into IBM's SPSS 24.0, factor analysis procedure to determine how well these items loaded onto separate and distinct factors. An EFA with Principal Axis Factoring (PAF: (see Costello & Osborne, 2005 for explanation of PAF)) and Promax rotation procedures were conducted on the pruned sample of 468 participant responses to a total of 47 items. Factor analysis methods such as PAF divide the total variance into shared variance and error variance, with the aim of generating factor loadings that are less likely to be unduly inflated (Gorsuch, 1990). An oblique rotation method (Promax) was selected because it provided the cleanest solution. A drawback with doing so is that when factors are rotated non-orthogonally, the variance explained by specific factors can overlap. It follows that oblique rotation (unlike orthogonal rotation methods) cannot provide a reliable estimate of the total percentage of variance explained.

A rule of thumb was that factor with fewer than three items were excluded from consideration after an initial EFA. Another was that only items with factor loadings of 0.300 or above were retained in subsequent iterations of the factor analyses. Based on these rules of thumb, the final analysis generated a pattern matrix that comprised 43 items clustered into nine distinct factors (see Appendix B).

While EFA lacks goodness of fit indices as such, beyond the criteria of legibility and simple factor structure, it does include some necessary measures indicative of the dataset being suitable for factor analysis. That is, 43 items loaded with values above the threshold (.300), the Cronbach-Meyer-Olkin (KMO) test of sampling adequacy was highly acceptable (.921). The Bartlett's test of Sphericity was appropriately significant ($p<.001$). Finally, the Cronbach's Alpha for each of the nine factors fell within an acceptable range (.8-1).

8. Discussion and conclusions

As stated above, the purpose of this research was to develop and test a suitable model for determining the influence of nine factors on faculty members' intentions to implement cloud computing in education in the context of higher education in Saudi Arabia.

As also stated above, item responses by 468 participants were entered into IBM's SPSS 24.0, factor analysis procedure to determine how well these items loaded on separate and distinct factors. The final analysis generated a pattern matrix that comprised 43 items clustered into nine legible and distinct factors, with a simple factor structure (See Table 1).

The outcomes of this successful EFA, in principle, have set the scene for a test of the extent to which the nine factors identified in the EFA would predict the global construct, Intentions for the use of cloud computing.

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Table 1 :Factor loadings of items related to cloud computing**.**

Constructs & items	Loading
Performance Expectancy	
I find cloud computing apps useful in my daily life. (1)	.856
Using cloud computing apps increases my chances of achieving things that are important to me. (2)	.852
Using cloud computing apps increases my chances of achieving things that are important to me. (3)	.824
Using cloud computing apps increases my productivity. (4)	.820
Overall, I would find cloud computing apps to be advantageous. (5)	.676
Cronbach's alpha =.918	
Effort Expectancy	
Learning how to use cloud computing apps is easy for me. (1)	.961
My interaction with cloud computing apps is clear and understandable. (2)	.857
I find cloud computing apps easy to use. (3)	.852
It is easy for me to become skilful at using cloud computing apps. (4)	.823
I find it easy to get cloud computing apps	.503

to do what I want it to do. (5)	
Cronbach's alpha = .917	
Social Influence	
People who are important to me think that I should use cloud computing apps. (1)	.851
People who influence my behaviour think that I should use cloud computing apps. (2)	.761
People whose opinions that I value prefer that I use cloud computing apps. (3)	.747
Friend's suggestion and recommendation will affect my decision to use cloud computing apps. (4)	.714
I would use cloud computing because the proportion of my friends uses cloud computing apps. (5)	.624
Cronbach's alpha =.850	
Facilitating Conditions	
I have the resources necessary to use cloud computing apps. (1)	.687
I have the knowledge necessary to use cloud computing apps. (2)	.21**
Cloud computing apps are compatible with other technologies I use. (3)	.559
I can get help from others when I have difficulties using cloud computing apps. (4)	.545
Using cloud computing apps is entirely within my control. (5)	.687
Cronbach's alpha =.77	
Hedonic Motivation	
Using cloud computing apps is fun. (1)	.910
Using cloud computing apps is enjoyable. (2)	.886
Using cloud computing apps is entertaining. (3)	.871
Using cloud computing apps give me pleasure. (4)	.800
Cronbach's alpha =.932	
Price Value	
Cloud computing apps are reasonably priced. (1)	.894
Cloud computing apps are a good value for money. (2)	.848
At the free price in your institution, cloud computing apps provide good value. (3)	0.31**
I have never given up purchasing its apps. If necessary. (4)	0.28**
Cronbach's alpha =.880	
The speed of internet	
When using cloud computing the Internet service is available in the classroom (1)	.920
Wi-Fi access points are available during using the cloud (2)	.908
I can access the Wi-Fi points in my institution effortlessly. (3)	.891
The speed of the Internet is appropriate when using the cloud in education. (4)	.876
Bing Internet exist helps me use the cloud in education. (5)	.848
Cronbach's alpha =.952	
Awareness	
I receive enough information about cloud computing applications in education (1)	.990
I receive enough information about the benefits of using cloud computing applications in education (2)	.959
I receive enough information about using cloud computing applications in education (3)	.886
My institution provided many activities to increase awareness about using cloud computing in education. (4)	.596
Cronbach's alpha =.935	
Perceived security	
I believe that my gadgets have enough safeguards to make me feel comfortable using it to interact with the cloud computing applications. (1)	.932
I believe I trust the ability of my gadgets to protect my privacy when using cloud computing applications. (2)	.896
I believe I'm not worried about the security when using cloud computing applications. (3)	.824
I believe using cloud computing applications are secure. (4)	.794
I believe that I'm adequately protected by law in Saudi Arabia from problems that could be caused when using cloud computing applications.(5)	.679
Cronbach's alpha = .905	

Behavioural Intention	
I intend to continue using cloud computing apps in the future. (1)	.942
I will always try to use cloud computing apps in my daily life. (2)	.936
I plan to continue to use cloud computing apps frequently. (3)	.798
I will often use cloud computing apps in the future. (4)	.752
I will recommend others to use cloud computing apps. (5)	.744
Cronbach's alpha =.941	
****Items with loadings <0.30 have been deleted.**	

References

[1] Alharbi, S. T. (2012). Users' acceptance of cloud computing in saudi arabia. *International Journal of Cloud Applications and Computing, 2*(2), 1-11. doi:10.4018/ijcac.2012040101

[2] Alharthi, A., Alassafi, M. O., Walters, R. J., & Wills, G. B. (2017). An exploratory study for investigating the critical success factors for cloud migration in the saudi arabian higher education context. *Telematics and Informatics, 34*(2), 664-678. doi:http://dx.doi.org/10.1016/j.tele.2016.10.008

[3] Alshammari, R., Jr, V. C. R., & Parkes, M. (2016). Faculty attitudes towards the use of mobile devices in efl teaching in a saudi arabian setting. Communications and information technology commission report information centres services and managed services and services cloud computing in saudi arabia, (2015).

[4] Armbrust, M., Fox, A., Griffith, R., Joseph, A. D., Katz, R., Konwinski, A., . . . Stoica, I. J. C. o. t. A. (2010). A view of cloud computing. *53*(4), 50-58.

[5] Arshdeep, B., & Vijay, M. (2014). *Cloud computing : A hands-on approach*. United States: Vijay Madisetti.

[6] Ashtari, S., & Eydgahi, A. (2017). Student perceptions of cloud applications effectiveness in higher education. *Journal of Computational Science*. doi:http://dx.doi.org/10.1016/j.jocs.2016.12.007

[7] Asiri, M. (2012). Factors influencing the use of learning management system in saudi arabian higher education: A theoretical framework. *2*(2), 125-137.

[8] Bahga, A., & Madisetti, V. (2013). *Cloud computing: A hands-on approach*: CreateSpace Independent Publishing Platform.

[9] Biermann, H., Himmel, S., Offermann-van Heek, J., & Ziefle, M. (2018). *User-specific concepts of aging–a qualitative approach on aal-acceptance regarding ultrasonic whistles.* Paper presented at the International Conference on Human Aspects of IT for the Aged Population.

[10] Bittman, T. (2009). Cloud computing inquiries at gartner. *Online],[Retrieved May 2, 2012] http://blogs. gartner. com/thomas_bittman/2, 9*, 10-29.

[11] Bosch, J. (2017). *Speed, data, and ecosystems: Excelling in a software-driven world*: CRC Press.

[12] Changchit, C., & Chuchuen, C. (2016). Cloud computing: An examination of factors impacting users' adoption. *Journal of Computer Information Systems*, 1-9.

[13] Costello, A. B., & Osborne, J. W. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical Assessment, Research and Evaluation (A peer-reviewed electronic journal), 10*(7), 1-9.

[14] Dawson, H. G. (2015). *Clearing the clouds: Factors of technology adoption and their relationship to cloud computing adoption in united states higher education - an extended tam study.* (3714403 Ph.D.), Capella University, Ann Arbor. Retrieved from http://search.proquest.com/docview/1708991259?accountid=14723

[15] https://resolver.library.uq.edu.au/?&genre=article&sid=ProQ:&atitle=Clearing+the+clouds%3A+Factors+of+technology+adoption+and+their+relationship+to+cloud+computing+adoption+in+United+States+higher+education+-+An+extended+TAM+study&title=Clearing+the+clouds%3A+Factors+of+technology+adoption+and+their+relationship+to+cloud+computing+adoption+in+United+States+higher+education+-+An+extended+TAM+study&issn=&date=2015-01-01&volume=&issue=&spage=&author=Dawson%2C+Hartford+G. ProQuest Dissertations & Theses Global database.

[16] Ebert, C., & Jones, C. (2009). Embedded software: Facts, figures, and future. *Computer, 42*(4). eman. (2016). The school service saas a as schoolthe modern term to employ computingcloud in education. *Afaq*.

[17] Ercan, T. (2010). Effective use of cloud computing in educational institutions. *Procedia - Social and*

Behavioral Sciences, 2(2), 938-942. doi:http://dx.doi.org/10.1016/j.sbspro.2010.03.130

[18] Erl, T., Puttini, R., & Mahmood, Z. (2013). *Cloud computing: Concepts, technology, & architecture*: Pearson Education.

[19] Furht, B., & Escalante, A. (2010). *Handbook of cloud computing* (Vol. 3): Springer.

[20] Gorsuch, R. L. (1990). Common factor analysis versus component analysis: Some well and little known facts. *Multivariate Behavioral Research, 25*(1), 33-39.

[21] Grossman, R. L. J. I. p. (2009). The case for cloud computing. *11*(2), 23-27.

[22] IBM. (2012). *Applying the cloud in education an innovative approach to it*. Retrieved from

[23] James, C. N., & Weber, J. (2016). *Cloud computing in education*.

[24] Katzer, M. (2015). *Moving to office 365: Planning and migration guide*: Apress.

[25] Kovacevic, A. P., Spoljaric, M., & Heđi, I. (2012, 2012 Jun 13-16 Jun 13-16, 2012). *Cloud-based collaboration in higher education*, Zagreb.

[26] Lawan, A. M., & Kashif, M. (2018). Security challenges for cloud computing development framework in saudi arabia. In *Cyber security and threats: Concepts, methodologies, tools, and applications* (pp. 485-500). Hershey, PA, USA: IGI Global.

[27] Marinescu, D. C. (2013). Chapter 1 - introduction. In *Cloud computing: Theory and practice* (pp. 1-19). Boston: Morgan Kaufmann.

[28] Mell, P., & Grance, T. (2011). The nist definition of cloud computing.

[29] Mustapha, A. (2016). Massive open online courses: A success of cloud computing in education.

[30] Noor, T. H. (2016). Usage and technology acceptance of cloud computing in saudi arabian universities. *International Journal of Software Engineering and its Applications, 10*(9), 65-76. doi:10.14257/ijseia.2016.10.9.07

[31] O'Neill, B. (2016). Thirty terrific technology tools for teaching personal finance. *Journal of Family and Consumer Sciences, 108*(1), 39-43.

[32] Ramady, M. A. (2010). *The saudi arabian economy: Policies, achievements, and challenges*: Springer Science & Business Media.

[33] Rowe, M., Bozalek, V., & Frantz, J. (2013). Using google drive to facilitate a blended approach to authentic learning. *British Journal of Educational Technology, 44*(4), 594-606. doi:10.1111/bjet.12063

[34] Sabi, H. M., Uzoka, F.-M. E., Langmia, K., & Njeh, F. N. (2016). Conceptualizing a model for adoption of cloud computing in education. *International Journal of Information Management, 36*(2), 183-191. doi:https://doi.org/10.1016/j.ijinfomgt.2015.11.010

[35] Strachan, A., & Faltens, T. A. Nanohub: Cloud scientific computing in materials education and research.

[36] Sultan, N. (2010). Cloud computing for education: A new dawn? *International Journal of Information Management, 30*(2), 109-116. doi:http://dx.doi.org/10.1016/j.ijinfomgt.2009.09.004

[37] Syed, K. (2016). *Cloud computing in education sector*. Paper presented at the Society for Information Technology & Teacher Education International Conference 2016, Savannah, GA, United States. https://www.learntechlib.org/p/172172

[38] Tian, W., & Zhao, Y. (2015). 1 - an introduction to cloud computing. In *Optimized cloud resource management and scheduling* (pp. 1-15). Boston: Morgan Kaufmann.

[39] Toosi, A. N., Calheiros, R. N., & Buyya, R. J. A. C. S. (2014). Interconnected cloud computing environments: Challenges, taxonomy, and survey. *47*(1), 7.

[40] Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478.

[41] Venkatesh, V., Thong, J. Y., & Xu, X. J. M. q. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. 157-178.

[42] Weber, A. S., & Hamlaoui, S. (2018). *E-learning in the middle east and north africa (mena) region*: Springer.

[43] Wood, L. N., & Breyer, Y. A. (2016). Success in higher education. In L. N. Wood & Y. A. Breyer (Eds.), *Success in higher education: Transitions to, within and from university* (pp. 1-19). Singapore: Springer Singapore.

[44] Xanthidis, D., Xanthidou, O. K., & Nicholas, D. (2016). Elearning penetration, challenges and opportunities in saudi arabia. *Indian Journal of Science and Technology, 9*(47). doi:10.17485/ijst/2016/v9i47/85900

[45] Yong, C. (2018). Security issues related to cloud applications in stem education. In *Cyber security and threats: Concepts, methodologies, tools, and applications* (pp. 1222-1234). Hershey, PA, USA: IGI Global.