THE INTERNATIONAL JOURNAL OF BUSINESS & MANAGEMENT

The Impact of Cloud Computing System Technology Deployment on the Police E-learning: An Empirical Study in Police College, Abu Dhabi, UAE

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Abstract:
This study seeks to explore how the Cloud computing is bringing change in the E-Learning environment. In addition, it highlights the need, importance, and utilization of a Cloud computing-based E-learning platform. To achieve study objectives, Key variables were analyzed to measure Cloud computing effectiveness on the E-learning environment at the Police College and its challenges along with that. The study's findings clearly showed that all the variables had a significant impact on police college E-learning environment.
Furthermore, the findings clearly revealed that Cloud Computing technology positively impacted the overall E-learning environment. As indicated that the role of experts in imparting training and providing innovation at regular intervals will be required. The security system involving cloud-based technology needs to handle with more outstanding care. The selection of authoritative vendors for this purpose is essential; simultaneously, establishing a strategic knowledge-based system is necessary to provide a fantastic online learning experience.

Keywords: *Cloud computing, E-learning, online learning, digital learning, knowledge-based cloud system*

1. Introduction

There is no debate that the world is continuously changing and developing, especially in the Information Technology sector in various fields such as economics, security, health, and educations. Cloud computing is becoming an attractive technology due to its dynamic scalability and practical usage of the resources; it can be utilized under circumstances where resources' availability is limited (Masud& Huang,2012). In this time, the need for education has become a continually growing and developing and improving necessary e-learning solutions (Saini &Kaur, 2017).
Cloud Computing has dynamic capability in scalability, flexibility, and mobility while deploying a computing system for learning and teaching purposes. Furthermore, it facilitates much greater collaboration, resource sharing, and communication and at the same time allows institutions to establish learning commons involving various communities for teaching and learning environment. At the same, these institutions seek to enhance their competitiveness through their scholarly outputs through cloud computing. (Ali, Wood-Harper & Mohamad, 2018).

Cloud computing has brought in a paradigm change in how the construction of digital resources is stored and disseminated in real-time and has led to an e-learning environment. It has integrated resources and various centralized services, created an effective learning environment through a modern communication medium, and supports and promotes an e-learning environment. (Jiang et al, 2016). In a higher education setup, Cloud-based services are generally used to provide students with a medium to collaborate and interact over a distributed learning space. They can support advanced learning and teaching processes through social interactions in a real-time digital environment (Al-Samarraie& Saeed, 2018).

Cloud computing has been marred with several challenges, especially relating to the higher education context. There has been so far no clear understanding of how various cloud computing tools have impacted the concept of collaborative learning approach to provide access to resources to the students (Bouyer&Arasteh, 2014). It is essential to consider the benefits, constraints, and trade-offs of cloud computing to improvise teaching and learning, potentially motivating instructors and policymakers toward making it part of the curriculum. Studies have proved the tremendous benefits of collaborative learning and effectiveness in engaging students (Al-Samarraie& Saeed, 2018). The study seeks to evaluate the related parameters for the successful implementations at the Police College, Abu Dhabi.

2. Cloud Computing Concept

The National Institute of Standards and Technology (NIST) defined Cloud computing as 'a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort

or service provider interaction. This cloud model comprises five essential characteristics, three service models, and four deployment models (Mell&Grance, 2011). Cloud Computing is a kind of computing that is highly scalable and uses virtualized resources that can be shared by the users. (Mansour, 2013). According to Elgelany and Alghbban (2017) views, 'it is hard to define cloud computing, as there are many debates by researchers about the standard definition for it, while the discussions for the final definition continue to evolve.' Based on the researcher's view, cloud computing is a metaphor for the internet. It can be defined as storing and accessing data and programs in real-time over the internet rather than on the computer's hard drive.

Cloud Computing has become a viral means to deliver technology to both secondary and higher education environments and grow exponentially. (Behrend et al, 2011). The revenues from Cloud Computing companies will reach US$ 127 billion, and by 2020, it will surpass everything and will be a standard way of provisioning IT resources and services. (Sabi et al, 2016). Cloud computing indeed has propounded a paradigm shift in the way Information Technology resources and services are being delivered and has been rightly dubbed by experts as the fifth utility-related bills of water, electricity, gas, and telephone. It has practically changed the fundamental building blocks of computing, and it is being perceived and used in organizations, businesses, and individual operations (Sabi et al, 2016).

3. E- Learning Concept and Cloud Computing

E-Learning refers to all forms of electronically or digitally supported learning and teaching environment. This can involve both out of a classroom of in the classroom-based educational experiences through technology. Other standard terms that have been used to associate E-learning includes Computer Based Training (CBT), Internet Based Training (IBT) or Web-Based Training (WBT). In simple words, E-learning can be defined as the computer and network-enabled learning environment where the transfer of skills and knowledge takes place. Content is delivered over the internet, and it can be self-paced or instructor-led. It may include media in text, animation, image, and streaming audio and video (Bora & Ahmad, 2013). Three layers characterize an e-learning ecosystem based on Cloud computing infrastructure: infrastructure, content, and application layers. It also consists of four ad hoc modules, including monitoring, policy, arbitration, and provision (Dong et al, 2009).

E-learning systems evolve very fast and had to keep pace with the latest technological changes. The prominence of cloud computing has provided a new dimension to teaching and learning. Various e-learning solutions have been incorporated in the form of open source and commercial in nature. For e-learning to function, at least two entities, namely students and trainers, need to be involved. The student can perform various actions through the E-learning platform but is not limited to taking an online course, sending feedback, taking exams, sending assignments and projects. In contrast, the trainers' action involves content management, preparing and conduction exams or tests, assessing exams, tests, assignments, and projects, sending feedback to students, and communicating with students over forums. All these actions require confidentiality and a very high degree of security as the data involves is very sensitive (Pocatilu, Alecu&Vetrici, 2010). A service provider manages Cloud-based e-learning. It offers the service round the clock, including backup every day, and does not need an IT department or server resources from the organization. Adaptation of e-learning into cloud computing has brought about a paradigm shift in investment in infrastructures such as servers and in-house data storage. It has thus saved a significant amount of cost and increasing efficiency using cloud computing. Several universities have adopted cloud computing technologies in their e-learning platform due to their cost-effectiveness and providing reliable services in terms of data security, storage, and computing power to easily accommodate the growing number of students without additional investment and maintenance cost (Ansari, Alas & Guan, 2015). More and more college students rely on e-learning platforms to balance other roles and obligations such as finances, family, job, long-distance travel to college, etc. University students tend to appreciate and adopt learning tools that are flexible, cost-effective (Behrend et al, 2011). Although ICT as educational tools and resources has been in use for quite a while now and terms such as E-learning, distance learning, mobile learning, computer-assisted learning, and computer-based instruction has been described or associated with electronic instruction. The main advantage is the cost-effectiveness as it saves cost on the user's hardware and software requirements. Cloud computing can manage complex IT configuration, software systems, and maintenance, which institutions do not need to bother, and they can concentrate on their core business of teaching and research. All the IT infrastructure expenses can be shifted to a cloud vendor who can provide a blended model for e-learning. (Anshari, Alas & Guan, 2015). In terms of security of data, cloud computing is unmatched, and experts believe that security is the most enhanced feature of Cloud-based services. It can provide improved improbability, and it is almost impossible for any kind of data. In case the e-learning environment is used for a very short interval of time (trimester, semester, weeks), it provides a significant benefit in terms of costs (Pocatilu, Alecu&Vetrici, 2010).

4. Literature Review

In recent years, Cloud computing's adoption in the e-learning concept has seen a rise, and various studies have been done to address various issues concerning it. Al-Badei et al (2017) highlighted the financial benefits of adopting cloud computing in higher educational institutes. In contrast, Alharthi et al. (2015) covered the various challenges associated with adopting cloud-based services in Universities. Another study by Alsufyani et al (2015) highlighted the challenges of migration of cloud services and delivering it in higher education setup was dealt with in detail. In contrast, a study conducted by Amron et al (2017) and Wu et al (2013) highlighted the problem of acceptance factors in various educational institutes. Bhatiasevi and Naglis (2016) investigated the structural relationship for the various determinants in adopting cloud computing in education. A similar study was done by Mokhtal et al (2016) on a similar topic. A study by Hussein and Omar (2015) highlighted performance excellence with the adoption of Cloud computing in various higher education institutes in Egypt. Kihara and Gichoya (2014) did an extensive study in Kenya about using a cloud computing platform in

various higher education institutions, and a similar study on usage was done by Pandian and KasiViswanathan (2011). The studies were done by Seke (2015) and Mokhtar et al (2015) highlighted the various organizational factors in adopting cloud computing E-learning in Universities. Meske et al (2014) highlighted the cloud storage services in higher education as part of Germany's sync and shared the project. Yuvraj (2016) and Syya and Surendro (2014) studies dealt with the determining factors for the adoption of cloud computing in higher education, whereas Alassafi et al (2017) covered the security challenges associated with it.

5. Research Methodology

This research design is based on a quantitative approach, which has been defined by Creswell (2009, p.4) as 'a mean for testing objective theories by examining the relationship among variables.' Variables are measured with the use of instruments that are designed in such a way to collect the data to analyze using various statistical tools and tests.

5.1. Population and Sample

To collect the data, the researcher must identify the source of the data that can be represented through the study's findings. This data source will involve a population of which this study's results can be represented and identified (Cooper & Schindler, 2011). Here in this study, the populations involve the students and employees at Police College Abu Dhabi.

Here the employees included police staff, administrative staff, and the IT staff. The researcher in this study used a non-probability convenience sampling technique. This sampling technique helps achieve greater control over time, minimizes cost, and increases the study's accuracy (Cooper & Schindler, 2011). Due to the Covid19 scenario, it was difficult to collect a large sample size. As such, a sample of 100 participants was targeted, which was sufficient to achieve the study's reliability and validity. All the 100 surveys were valid and were included in the analysis.

5.2. Research Instrument and Data Collection

For this research, variables and constructs were identified based on the study's hypothesis, and a self-administrated survey design was used to collect the data. The surveys were done online using google forms, and it was self-administered to reduce biasedness or any kind of influence from the researchers on the sample population. The instrument comprises two sections, namely the demographics section, and the second part included 33 variables presented in five different variables. All the questions were multiple choices, and no open-ended questions were included. The questions related to various variables followed a 5-point Likert scale pattern and were based on their level of agreement with each statement. A total of 100 responses were received online, and all of them were valid and usable for analysis. It is essential to mention that the data collection process was undertaken during the COVID19 pandemic, and as such, the data collection process took more than usual.

5.3. Instrument Reliability and Validity

The instrument's validity involved various variables, which were derived from the review of the literature involving previous studies. The proposed model provided the framework to develop the research instrument, and as such, content validity was conducted, and it ensures clarity and accuracy of the instrument. The second step was to check the instrument developed by reviewing it with the supervisors and other faculty members Upon completion of the survey's validity, it was ready for pilot testing and checked for the reliability of the study. For Reliability testing Cronbach's Alpha Coefficient scores were calculated using the PSPP. The data collected for the pilot study (N=20) and each hypothesis were tested separately to ensure the reliability of all the variables and the study's overall reliability. According to Pallant (2007), The Cronbach Alpha results were promising and were far above the satisfactory levels for all the five variables.

5.4. Data Analysis

Descriptive analysis was done, and the data was presented for demographics analysis of the participants, using the mean and standard deviation. The hypothesis testing (H1-H4); the Pearson Correlation Coefficient test was done to study the continuous linear relationship between each of the five variables and level of support. Furthermore, standard multiple regression analysis was done to identify further the variance level in support of a particular Variable. This also enables establishing the hypothesis's results further and providing additional support to the results; here, the degree of level of support of key variables (design technology, the role of experts, security, knowledge system) is for the E-learning environment at Police College.

6. Research Model and Hypothesis

The conceptual model proposed in this study comprises Independent variables that included the four factors namely Technology Infrastructure, Experts, Security System and the Knowledge System. These factors were treated as enablers and facilitators and were believed that will have a positive impact on the E-learning dependent variables as shown in the figure below.

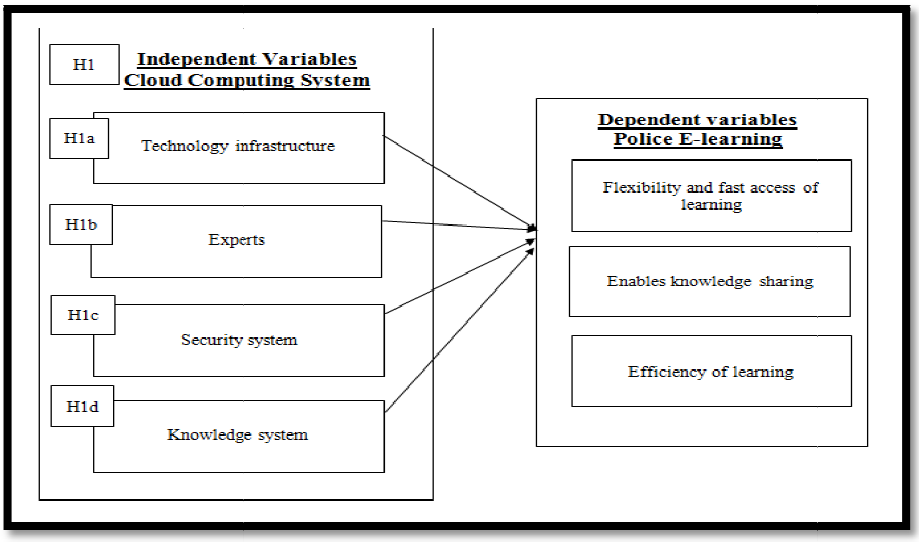

Figure 1

6.1. The Main Hypotheses

There is a positive impact for cloud computing system on police e- learning

6.2. The Sub Hypotheses

- H1a: The design of technology infrastructure for cloud computing system has a significant effect on police e learning.
- H1b: Experts involved in cloud computing has a significant effect on police e learning.
- H1c: The security system involved in cloud computing has a significant effect on police e learning.
- H1d: A knowledge-based system has a significant effect on police e learning.

7. Hypotheses Testing and Results

7.1. Descriptive Analysis

Table 3 clearly shows the Mean [M] and Standard Deviation [SD] and the rankings of all the 26 variables across 5 Variables. Technology design Infrastructure available at Police Academy the highest rated score was given to 'Cloud Computing System enables ease of access and managing files at all times' (M=1.51; SD=0.69). The least rank among them was the statement related to the user's skills for using a Cloud-based application system (M=1.77; SD= 0.79). Looking at results to the Role of Experts in the implementation and operation of a Cloud-based E-learning system, most respondents agreed that Cloud Computing fosters innovation and helps generate new ideas (M= 1.76; SD= 0.77) and was ranked number one. The two areas that impacted least with regards to experts' role were necessary as the respondents felt they need training for Cloud Computing (M= 2.71; SD=1.18 and the least they agreed on that they do not require training for the Cloud Computing courses from experts. The analysis suggests that the highest score was provided to the high standard of security system pertaining to Cloud Computing (M= 1.95; SD= 0.88) while the least concern was provided to the security level in a Cloud-based E-learning environment as mostly agreed and suggest that a cloud-based system is much secure and protects the interest of the user. For the Knowledge system construct, the highest-ranked score was the E-library support in the Cloud-based learning environment (M=1.73; SD=0.76) in major universities and colleges. The second-ranked on the list was knowledge sharing and the flexibility (M=1.74; SD=0.75) provided by the Knowledge-based System in the Cloud environment. The construct of level and standard of usage of Cloud Computing, the highest score ranked variable in this hypothesis was the availability of modern computer labs and resources (M=1.66; SD= 0.78). The least agreement was seen on the Modern E-Library (M=2.03; SD=0.93), ranked eighth on the least while the 9th ranked was the Standard Network present at the Police college (M=2.04; SD= 0.99).

Mean and Std. Deviation of Participants Level of Agreement with All Statements (N=100)				
Category	**Mean**	**Std. Deviation**	**Rank within Category**	**Rank Across All Categories**
Technology Infrastructure				
CC System requires Skill	1.77	0.79	5	10
CC System support education	1.52	.67	2	2
CC System efficiency and quality	1.70	0.80	4	5
CC System fast and reliable	1.62	0.69	3	3
CC System access and manage	1.51	0.69	1	1
Role of Experts				
CC don't require training courses	2.71	1.18	4	26
CC need experts for training delivery	2.01	0.92	3	21
CC enables innovate and new ideas	1.76	0.77	1	8
Experts updates and provides feedback	1.84	0.77	2	15
Security System				
High Standard Security System for CC	1.95	0.88	1	18
Storing data with confidence	2.07	1.04	3	24
CC System has high level of Security	2.12	0.98	4	25
Security enables effective learning	1.99	0.89	2	20
Knowledge System				
Flexibility enables knowledge sharing	1.74	0.75	2	7
Encourages sharing information	1.86	0.78	4	17
CC promotes cooperation among all	1.78	0.77	3	11
CC Support E-library at Universities	1.73	0.76	1	6
Police E-Learning				
Police College high standard network	2.04	0.99	9	23
Modern and Advanced Education System	1.85	0.86	6	16
Access files easily E-learning System	1.83	0.88	5	13
Modern computer lab and Resources	1.66	0.78	1	4
Security standard high for E-Learning	1.83	0.87	4	14
Modern E-Library	2.03	0.93	8	22
Quick response/feedback from experts	1.80	0.86	3	12
Experts quick to resolve system problem	1.76	0.77	2	9
Prefer E-Learning vs traditional learning	1.97	0.95	7	19

Table 1: Descriptive Analysis: Mean and Standard Deviation

7.2. Hypothesis Testing

Standard Multiple Regression analysis was used to assess the four Variables Namely Technology Design Infrastructure, Role of Experts, Security System and Knowledge-based System for the success, efficiency, quality, and implementation E-Learning environment at the police College. To further establish the relationship, standard multiple regression analysis tests were performed to predict supporting the hypothesis.

Predictors	**Beta**	**Sig**
CC System Support Education (CCMES)	0.43	0.001
CC don't require training courses (CCPTCSE)	0.18	0.039
CC enables innovate and new ideas (CCEUISI)	0.36	0.008
High Standard Security System for CC ((SSVHCBS)	-0.42	0.025
Storing data with confidence (SMDIICBSC)	0.51	0.002
Encourages sharing information (IPSIWUCCS)	0.30	0.019

Table 2: Multiple Regression: Police College High Standard Network (PCHSNS) and Other Variables Which Had Significant Relationship (P>.05)
Standardized Coefficient: Beta Value and P>.05

Predictors	Beta	Sig
CC enables innovate and new ideas (CCEUISI)	0.36	0.009
Experts updates and provides feedback (ECUIPFU)	0.39	0.005
Storing data with confidence (SMDIICBSC)	0.35	0.028
CC promotes cooperation among all (CCSJCIE)	0.37	0.016

Table 3: Multiple Regression: Modern and Advanced Education System (PCUMAESSES) and Other Variables Which Had Significant Relationship (P>.005)
Standardized Coefficient: Beta Value and P>.05

Predictors	Beta	Sig
CC System Support Education (CCMES)	0.28	0.010
CC don't require training courses (CCPTCSE)	0.15	0.037
CC need experts for training delivery (CCNEDITS)	-0.20	0.010
CC enables innovate and new ideas (CCEUISI)	0.44	0.000

Table4: Multiple Regression: Access Files Easily E-Learning System (CAMFPCESAWH) and Other Variables Which Had Significant Relationship (P>.05)
Standardized Coefficient: Beta Value and P>.05

Predictors	Beta	Sig
CC System Support Education (CCMES)	0.28	0.031
Experts updates and provides feedback (ECUIPFU)	0.33	0.014
Storing data with confidence (SMDIICBSC)	0.61	0.000
Security enables effective learning (SCCIOELAS)	-0.28	0.040
Encourages sharing information (IPSIWUCCS)	0.28	0.027

Table5: Multiple Regression: Modern Computer Lab and Resources (PCPMCLER) and Other Variables Which Had Significant Relationship (P>.05)
Standardized Coefficient: Beta Value and P>.05

Predictors	Beta	Sig
CC System Support Education (CCMES)	0.40	0.000
CC need experts for training delivery (CCNEDITS)	-0.23	0.003
CC enables innovate and new ideas (CCEUISI)	0.41	0.000
Experts updates and provides feedback (ECUIPFU)	0.24	0.035

Table6: Multiple Regression: Security Standard High for E-Learning (TSSPESVH) and Other Variables Which Had Significant Relationship (P>.05)
Standardized Coefficient: Beta Value and P>.05

Predictors	Beta	Sig
CC enables innovate and new ideas (CCEUISI)	0.32	0.041
Flexibility enables knowledge sharing (FOCBSSKASL)	-0.35	0.042
Encourages sharing information (IPSIWUCCS)	0.41	0.006

Table7: Multiple Regression: Modern E-Library (PCMELSSR) and Other Variables Which Had Significant Relationship (P>.05)
Standardized Coefficient: Beta Value and P>.05

Predictors	Beta	Sig
CC need experts for training delivery (CCNEDITS)	-0.19	0.041
CC enables innovate and new ideas (CCEUISI)	0.54	0.000
CC promotes cooperation among all (CCSJCIE)	0.32	0.030

Table8: Multiple Regression: Quick Response/Feedback from Experts (EDQRSSIPC) and Other Variables Which Had Significant Relationship (P>.05)
Standardized Coefficient: Beta Value and P>.05

Predictors	Beta	Sig
CC System fast and Reliable (CCSFF)	-0.41	0.011
CC need experts for training delivery (CCNEDITS)	-0.20	0.025
CC enables innovate and new ideas (CCEUISI)	0.46	0.000
Encourages sharing information (IPSIWUCCS)	0.30	0.014

Table9: Multiple Regression: Experts Quick to Resolve System Problem (EEDPRSPC) and Other Variables Which Had Significant Relationship (P>.05)
Standardized Coefficient: Beta Value and P>.05

Predictors	Beta	Sig
CC System requires Skill (CCSRIS)	-0.25	0.037
Security enables effective learning (SCCIOELAS)	0.45	0.004
Encourages sharing information (IPSIWUCCS)	0.38	0.009

Table10: Multiple Regression: Prefer E-Learning Vs Traditional Learning (IPUERTL) and Other Variables Which Had Significant Relationship (P>.05)
Standardized Coefficient: Beta Value and P>.05

To conclude, after the multiple regression analysis tests, all the above results indicate that there has been a significant relationship with the Variable, Namely Design technology infrastructure, Role of Experts, Security System and Knowledge System with the E-Learning at Police College. The hypothesis is further established and holds in all four cases.

8. Conclusion

Overall, there was a positive impact of cloud computing Systems on Police E-Learning. The adoption of cloud computing has a positive impact. This proves the studies by Saedi and Iahad (2013), and all the factors such as accessibility, scalability, cost-effectiveness, and security associated have a motivational effect on its adoption. Krelja et al (2014) mentioned the cost-effective solution for Cloud-based computing for imparting E-learning, and it was further conceptualized. It was supported in the study by Ali, Wood-Harper and Muhaamad (2018). It provides greater scalability, flexibility, and mobility in the effective utilization of resources for the online learning environment. The comprehensive study's findings established the fact that various variables that include the design technology infrastructure, the role of experts, security system, and knowledge management all showed a positive, strong significant relationship with the independent variable that supported the E-learning environment at Police College.

The findings of the study established the fact that investment in design infrastructure will lead to improved skills on working in a cloud-based environment, which is a fast and flexible system, will support modern advanced education system, improves the quality and efficiency of education delivery, and will allow the users to access and manages file in real-time as well as regardless of space and time. the study suggested that variables such as training requirements and their delivery should be done by experts only. Experts can also help motivate users to be innovative, generate new ideas, and support users by continuously updating the E-learning environment and providing support based on the feedback. All these factors showed a strong positive relationship with the E-learning environment at police college. The study findings revealed that security was the primary concern for the user, but most of them agreed that a Cloud-based system is highly secure. The respondents attributed a high level of confidence. Another finding from this study is that a secure cloud-based learning environment can help in resource sharing and cooperation among the team members, creating more opportunities for effective E-learning at police College. Findings also reveals that an excellent knowledge-based system can enhance E-learning as it fosters collaborations, sharing of information, and team-based learning approaches. Similar results were achieved in the study by Elgelany and Alghabba (2017) and Sabi et al (2016), which also emphasized a knowledge-based system that facilitates an E-learning environment.

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