An Integrated Cloud model for intelligent E-Learning system

Fahad A. Alghamdi

Dept. of Education Technologies, College of Education,
Imam Abdulrahman Bin Faisal University, Dammam 34212 – Saudi Arabia.

Abstract

Cloud computing is the emerging developing technology has provided changes and opportunities to the field of education and IT industry. E-learning platform is the online learning platform which provides education to distant and interested learners. Reliable availability and security are the significant challenges found in the eLearning system using cloud computing technology. Our study provides proposed integrated cloud model for intelligent eLearning system to ensure security and availability. This proposed model use cloud service delivery model and web 4.0 for avoiding the challenges in the eLearning and enhance the efficiency of the system. Furthermore, the proposed model provides possible solutions to the e-learners and educators to use the system effectively.

Keywords: E-learning, cloud service delivery, web 4.0

INTRODUCTION

E-learning is the learning activity using the approach of information transfer and knowledge utilization with specific attention to computer-based technology. It uses the technologies and information to generate the learning experiences. E-learning provides the dynamic learning content and effective learning opportunity in real time which supports the development of knowledge communities. Synchronous learning takes place in the real time where all participants interacting with each other but asynchronous learning allows the learner to share the ideas or data. E-learning is the significant part of education as it determines the way to learning communities. E-learning tools communities are reconnected through the internet and learning through the production of the online learning resources. Due to the integration of the digital media, the learning environment transforms into the virtual classroom that can be termed as a virtual learning environment. It offers anywhere or anytime learning concerning the geographical constraints. To fulfill the educational needs, E-learning has some significant features. However, the cloud computing of E-learning has faced some challenges in security, reliability, and availability. To make secured cloud environment, this study proposed integrated cloud model for effective eLearning system. This paper aims at proposing a integrate cloud model by using web 4.0 computing to enhance effective e-learning system.

PROBLEM DESCRIPTION

Cloud computing is the trending technology plays a significant role in the educational field. Recently, E-learning system has faced some concerns related to security, availability, and reliability. To overcome these challenges, a significant security framework is required to protect the data involves approach of e-learning system. It is significant to ensure the security and privacy of e-learning data which needs a consistent framework to avoid the security issues. Hence, the study aims at offering an integrated cloud model for intelligent e-learning system.

RELATED WORK

E-learning system renders consistent and customized information based on the need. Every learner should receive same content in the same form. It offers reliable and timely content and renders significant accurate content. This approach offers 24/7 learning where the learners can learn anywhere and anytime on the day. E-learning has web-based nature which can able to offer same content at the same time regarding the operating system and different platforms [1]. E-learning solutions are scalable where the programs can have more participants with low cost. It is the effective way to provide the information as it reduces the travel expense, teaching time and physical need for a teacher and classroom infrastructure. The system can enable learners to be integrated and form learning communities by creating knowledge society and sharing knowledge.

Service delivery model:

Cloud can communicate with the user or communication in various services. Cloud computing has three types of services which service delivery models provide throughout the web. They are infrastructure, platform, and software and other sub-services.

Infrastructure:

Infrastructure service is the basic form of cloud services. The cloud customers make use of information technology services like raw storage, firewalls, networks and computing resources provided in the virtual platforms [2]. Resources and applications are minimized the initial investments. The users make use of infrastructure as service and directly access the storage and resources through the network. Virtualization is used in IaaS to incorporate the physical resources to maximize or minimize the resources demand from the customers. It also

focuses on transforming the application software architecture into several instances from the cloud customers. VM ware, windows server and system center [6].

Platform:

Service model presents above Iaas on the stack and targets the end users but not developers. Cloud vendors need to extract the operating system and middleware. The vendors offer hardware technology like software for creating an application to a customer, network support, database solutions and development tools. It provides services in each stage of cycle like software development, maintenance, testing, programming languages that the users can create their applications. The examples are Google app engine, Microsoft Windows Azure.

Software:

Service provides a cloud foundation for software and applications over the network on demand. Web delivered contents are used in the organization as Saas [16]. The contents are found in the internet browser on pay for usage service. The benefits of Saas services are reducing the cost as a data center; the integration requires one browser and the scalability as the customers to receive the benefits of commercial licenses. It is significant to run the application on customer system and uses the software maintenance, support, and current operation. Saas host the completed cloud applications and Paas provide development platforms which host finished and present cloud applications. CRM online, Google Docs, Gmail, Business productivity online suite are the examples of Saas.

Human:

The upper layer of the cloud computing stack is human. This cloud model is not restricted to information technology services and includes the services offered by humans. Human has some skills and abilities which fight computer system, and creativity is the significant strength in some activities like design and technical services. The technical integration of resources is the specific interest. Crowdsourcing is the platform where the individual use the internet to manage activities of a different scope of the customer. Amazon Mechanical Turk is the example of crowdsourcing [17].

Data storage:

This service model is the special type where the user can access the data over the internet in various formats emerges from distinct perspectives and act as virtualized storage become a unique cloud service. Data storage device allows the user to pay for use than authorization for database [2]. In addition to this, the storage interfaces provide table style ideas which are focused on restoring a large amount of data in a limited timeframe.

Evolution of computing and web:

Web 1.0:

Web 1.0 is called as basic internet web related to the major companies. The usage of this computing is restricted to creating marketing, sales plan, establishing the corporate information and transaction with customers. It is considered as the first online strategy for the business [20].

Web 2.0:

Web 2.0 or social web act as a collaboration platform. It provided a new updated version of WWW to users concerning the updating of technical specifications of the web. It has we applications which manage the user-centered design, interoperability, information sharing and WWW collaboration. Web 2.0 has services of web applications, web communities', web services, wikis, blogs, video hosting services, social network services, and folksonomies. After the year of 1990, there is a landscape in the internet technology as they tend to develop the social value and content. They have used Facebook, LinkedIn, YouTube, and Wikipedia. The Internet has become a cooperative platform where the networking effects and collective power paved the way for developing effective value [10]. The social changes influence the business models which makes to attempt which makes an individual contribution to the virtual environment. It remains the challenges, and web 2.0 version has paved the way to web 3.0. It is also known as the semantic web.

Web 3.0:

Web 3.0 or semantic web, integrates the human and artificial intelligence to offer accessible and related information. It has effective language accessed from genetic algorithms, and neuronal networks focus on processing capacity and analysis. It also determines how to develop new innovative ideas on user created information [12]. It is used to make web transformation into database and make the content accessible through the artificial intelligence technologies, non-browser applications, geospatial web and semantic web. It used to enhance the developments concerning web 2.0. Over the years, the significant definition of web 3.0 is still in debate [11].

	1.0	2.0	3.0	4.0*
Meaning is	Dictated	Socially constructed	Socially constructed and contextually reinvented	Socially constructed, contextually reinvented and experiential
Technology is	Selected	Cautiously adopted	Everywhere	Everywhere (systemic)
Lecturing is	L/S	L/S; S/S	L/S; L/AA; S/S; S/L; S/AA	L/S; L/AA; S/S; S/L; S/AA; AA/L; AA/AA; AA/S
Classrooms location	Building	Building/online	Everywhere (infused society)	Everywhere (multidimensional society)
Lecturers are	Licensed experts	Licensed experts	Everybody	Everybody (including AA)
Hardware and software	Proprietary and costly	Open source with low cost	Low cost and used purposively	Low cost, used purposively through individual demand
Companies view of learners	Industrial workers	Like 1.0, despite a knowledge economy	Co-workers or entrepreneurs	Co-entrepreneurs

Figure 1. E-learning vs Technology

(Source: Moravec, 2009)

Web 4.0:

Web 4.0 is wireless communication for computers and mobile devices connecting objects and people wherever in the virtual or physical world in real time [4]. It helps the drivers to enhance planned route and handle it. Web 4.0 is ready to take off, and sensitive web 5.0 has introduced.

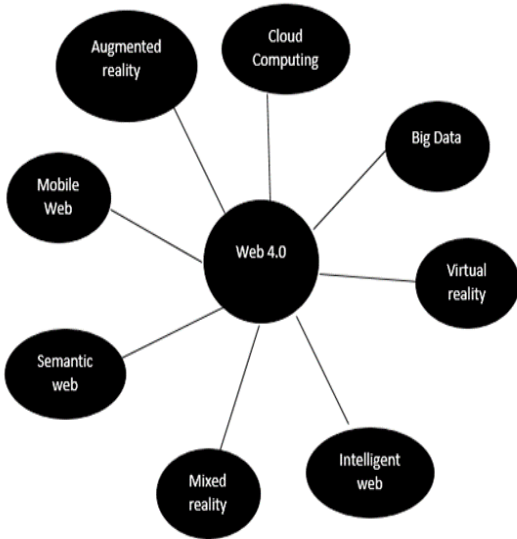Several technologies are available in web 4.0 application.

Figure 2. Technologies of Web 4.0

(Source: Czerkawski, 2011)

Cloud integration:

Only few studies indicated the integrating system of e-learning system and the cloud services. This integrated cloud model for the service delivery and web 4.0 computing services are recounted. E-learning framework requires effective analysis and determination of the resources available to a particular perspective [17]. To make a creative analysis of how to use the resources and attributes of digital technologies, the design, development, implementation, and evaluation of eLearning system needed. Several factors which affect the online learning approach. They are management evaluation, resources support, and technology interface design, pedagogical, institutional and ethical. It offers support to the design and implementation of the e-learning environment. This framework model used for creating the integrated eLearning culture in the organization. Learning environment, instructor learners, and roles, organizational priorities are the activities related to e-learning [13]. These activities are used for creating the integrated e-learning environment in the large organizations. The integration of e-learning is suitable for the organizations which need to embrace the e-learning integration. It is significant to know different organizations have distinct learning environments, priorities, needs and roles. Ultimately, the proposed e-learning framework used to solve the e-learning issues [5]. It does not determine the problems of learning integration with another teaching approach. The proposed

integration cloud model will offer following aspects. They are designing e-learning materials, managing the resources for eLearning environments, designing virtual universities, distributed learning environment, corporate universities and managing the learning management system and determining the e-learning programs and courses [14].
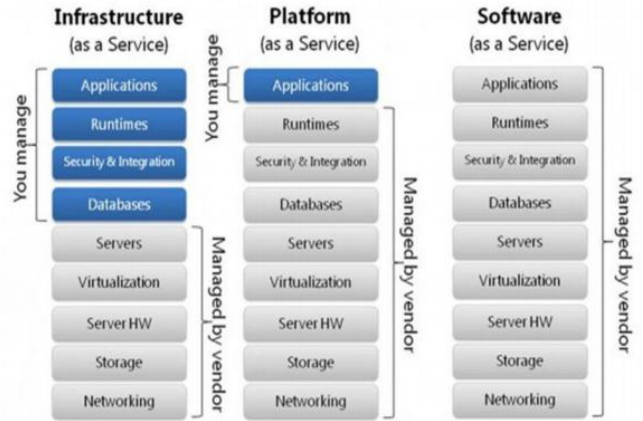

Figure 3. Cloud structure- Service delivery

(Source: Shin, 2013)

CONCEPTUAL FRAMEWORK

The proposed study uses the cloud service delivery model and web 4.0 as an application in the system of intelligent e-learning. This study uses web 4.0 applications which have significant features of the intelligent web, semantic web, effective interactions, and artificial intelligence and so on. This integrated model can reduce the issues of data security and data availability in the eLearning system using cloud computing.
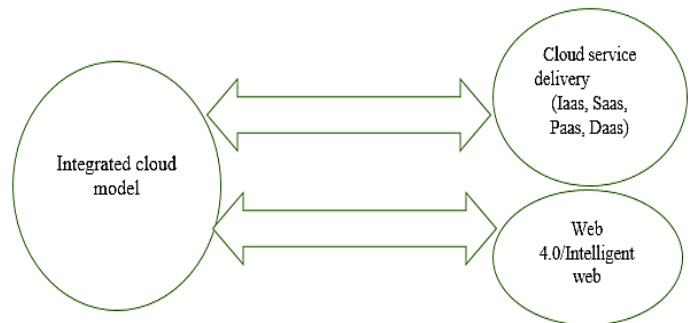

Figure 4. Conceptual framework

(Source: Author)

METHODOLOGY

The research methodology adopted in this study is qualitative research. Qualitative research is the research used to gain an understanding of opinion, reasons, and motivations [8]. It offers deep focus on the problems and helps to develop ideas for the effective quantitative research. It also uncovers the thoughts and opinions into the problem. This research may add ideas to the existing researcher problem statement. This research is known as exploratory research.

Data collection can be classified into two type's namely primary method and secondary method. The researcher's use these methods for collecting the data, and the results will be evaluated the collected data. Primary research used to collect the data physically by conducting surveys, interviews, and questionnaires. This research will have issues of confidentiality of the participants. Primary research focuses on observations, experimenting, and market research [8]. Primary research is not applicable to this study.

The secondary method is the process of collecting information from the secondary sources like journals, articles, magazines, and newspaper and the web forum. This secondary information uses the existing sources of different researchers. In this study, the secondary research method has been applied to collect data. The information has collected from existing literature and propose an integrated solutions for solving the issues emerges from e-learning approach using cloud computing.

The exploratory research design is applied to this research study. Exploratory research tends to explore the research question and does not provide final solutions to the existing problems [3]. To evaluate the research objectives, this research design provides a clear concept of problem. It explores the research topic with different levels of depth. Exploratory research solves new problems where no existing research has been done.

PROPOSED MODEL

ELearning in cloud computing:

Virtualization:

Virtualization offer a standard framework for the cloud located server with reduced cost. It does not affect the cost adversely. Cloud makes the process of creating a clone for virtual machines in an easy manner and reduce the expected time. Monitoring the data access becomes easier and security modification becomes simple and can be implemented and tested without any difficulty as the cloud refers to entry point for all clients. Specific hardware specifications are not required for the e-learning applications. They can implement the application to run in the cloud from a mobile phone, tablet, and computer through internet with low configuration. Cloud does not require to pay high free to upgrade the memory to store on local machines [17].

Centralized data storage:

In this system, the data and applications are deposited in the cloud whereas losing the client does not seems to be matter in the cloud computing. Because new users will be entered into the cloud faster. Students also receives more benefits from cloud based e-learning where they can take online courses and online test. They can view their test results and receive feedback from the teachers and sending the assignments and projects to their online teacher. Teachers have received benefits from cloud-based E-learning. Teachers can determine and answer the projects and assignments and communicate online with the students [6].
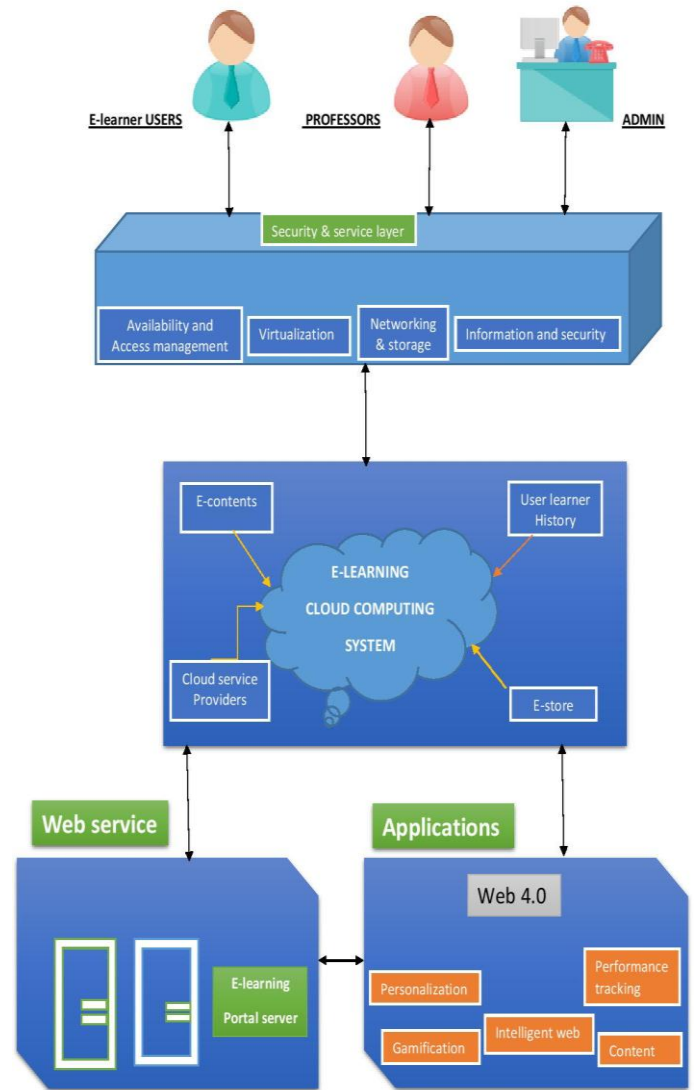

Figure 5. Integrated cloud model for intelligent e-learning system

(Source: Author)

Primary security considerations:

It is necessary to control over the resources are being shared by the third party in the system. The transformation of services from cloud to another system will be happened only if the user do not obtain any significant benefits from cloud computing. Also, the encryption and decryption keys are accessed by authorized users. Essential step needs to enunciate the phenomenon of storing, transferring and retrieving the information.

Availability:

Access to significant data and applications on the cloud servers with the inclusion of uninterrupted services to the users in the cloud computing is the crucial challenge. Denial of service (DOS) attack and Distributed denial of service

(DDOS) attack are called as the online attacks which influence availability of information in cloud services and affects data stored inaccessible to the users on the cloud servers. Cloud providers offer various application [17]. The services are used to solve problems whiles client tries to use the services. Customers do not transfer to other cloud service operator.

Information and security:

In this layer, the users can retrieve the information whenever they require. Also, the cloud can store the history of information and learner's history. Educators and learners can use the content available in the cloud. The cloud service delivery model and web computing 4.0 can provide security to both users and professors.

Security measures were taken in cloud computing:

To manage the security threats, there are some security initiatives are followed in the cloud computing. Some of the actions to overcome the security threats. They are as follows,

Software:

Service presentation model can be adopted to reduce the security issues in the cloud services. By using service model, the cloud service provider can ensure the security issues related to the software accessibility. Service model users should know about the data security and selling the data policies [9].

Surveillance consciousness:

Security committee has the significance of offering guidance about the security strategies. The committee has set of rules and responsibilities about the security functions. Insufficient security alert forces to disclose the significant data. Social engineering attacks can influence the effective financial losses and security events which can be resulted in the poor of security consciousness.

Education and training:

Training about the crisis management skills and security issues provided by the local partners and security team. It also offers mentoring and training skills for team members who have the confidentiality of knowledge management [12].

Features of e-learning 4.0:

Tracking performance:

Web 4.0 is monitoring the progress and behaviors of the students and determine the weaknesses. It also takes appropriate initiatives to manage the issues and implement the change in the framework [20].

Mobile technology:

The Younger generation has involved in the mobile ecosystem, and many teachers are thinking about the desktop. This web 4.0 turned their perception towards mobility should have asset or faculty. Modern education ruins the traditional school and college walls [19].

Personalized approach:

Relevant knowledge should be delivered to the recipient rightly than channeled with no specific targeting. Regarding technology, personalization can be described as the double-edged sword. The significant challenges found in web 4.0 is maintaining the right balance between the personalization, Consistent, and automation techniques [19]. While reviewing the behavior pattern, feedback and questions in the learning system we can deliver effective information to the A-plus students and underachievers. This new technology will eliminate the weakened automate and routine without considering the personal feedback. The instructor can make direct communication with the learner rather than trial errors.

Gamification:

Gamification is the approach which has been accepted by the business trainers that adds essence to the education community. It is significant to understand the fact that games are essentially entertainment or distractions [7]. E-Learning 4.0 can grant gamification at a rightful place in the future hierarchy. People are interested in creating the new learning framework which will provides effective knowledge collaboration and retention. Teachers must know where the content works and ways to share their ideas and views.

RESULTS AND FINDINGS

Many researchers focused on implementing the cloud computing services and how they integrate into eLearning systems. Cloud computing believes in substituting the technologies like virtualization, grid computing, web services to offer on-demand services. The cloud models of infrastructure, platform, and software as service are used in implementing the system. The infrastructure allows the cloud to use as the digital platform where the data can be protected and stored. It allows administrators to control the resources at low costs. The institutions or universities can provide access to huge storage space, processing power, and networking components. The platform allows the cloud used as a platform to access more advanced and dedicated applications [16]. Paas also allows the development of creative and new services which has hosted on the platform itself. This platform makes cloud computing effectively versatile and allows users to use cloud and access any application and services. To deploy cloud computing, the educational institution need to make business analysis and enforce cloud service provider, plan and manage the solution with the assistance of system integrator. It is significant to enunciate that cloud needs to meet the business requirements in perspective of performance,

functionality and offer high benefits and adhere to the legislator requirements. The study results predicted that the proposed model will enhance the process and security of data in e-learning system. It is necessary to implement this model in the e-learning framework to ensure integrity and security.

The educational institute should determine how they like to enforce the cloud service cancellation or disruption. At the analysis stage, the data characteristics like usage rates, size, quantity, transactions and scaling time will be considered. It makes the institutions to describe the quality of cloud solution and value for money. The business analysis offers to evaluate requirements concerning functionality and performance, security, manageability and regulatory obligations [15]. Paas will determine the development and operating framework from non-cloud solutions. Performance can be derived from the user perspective and various metrics like reliability, availability, throughput, and responsiveness. The security assessment should determine the authentication, integrity, confidentiality, and threat. The university or educational institutes should develop a business case which offers justification for the cloud solution against non-cloud solutions [18]. To manage the business continuity, the institutions need to manage the records securely from one solution to another solution. It is significant to manage how the data stored by the cloud service provider and methods to transfer the data and how it will be destroyed.

CONCLUSION

Web 4.0 is student-centered than the professor centered education of the traditional educations. Many research studies provide a substantial report about success with web-based educations. This detailed analysis will provide effective eLearning system to the online educators and trainers in a cost-effective and intelligent education. Due to the new technological innovations of mobile technology, intelligent agents and cloud computing, the services offered by these sources can enhance the education system for creative professors and universities. This proposed model provides a valuable solution to reduce the availability and security issues and offer intelligent education to the e-learners. The proposed model provides some solutions to enhance the effective e-learning system using web 4.0. For future study, the researcher can use the advanced version of web 5.0 in web-based education. Hence, the features of web 5.0 can increase the accessibility and personalization.

REFERENCES

[1] Ahmed, F. (2015). Comparative Analysis of Cloud-Based e-learning. *Procedia Computer Science*, 65, pp.368-376.

[2] Bosamia, M. and Patel, A. (2016). An Overview of Cloud Computing for E-Learning with its Key Benefits. *International Journal of Information Sciences and Techniques*, 6(1/2), pp.1-10.

[3] Chandra, S. and Sharma, M. (2013). *Research methodology*. Oxford: Alpha Science Internat.

[4] Chakraborty, A., Dey, S., and Dasgupta, G. (2014). The significance of Web 0.0-4.0, Semantic Web, Cloud Computing and Drupal in Concomitant to Library/ Information/ Knowledge Centres Management. *International Journal of Digital Library Systems*, 1(4), pp.1-15.

[5] Czerkawski, B. (2011). *Free and open source software for e-learning*. Hershey PA: Information Science Reference

[6] Fernández, A., Peralta, D., Benítez, J., and Herrera, F. (2014). E-learning and educational data mining in cloud computing: an overview. *International Journal of Learning Technology*, 9(1), p.25.

[7] Ghosh, A. (2011). *Web 4.0 Basics*. [online] The Customize Windows. Available at: https://thecustomizewindows.com/2011/09/web-4-0-basics/ [Accessed 3 Nov. 2017].

[8] Goddard, W. and Melville, S. (2011). *Research methodology*. Kenwyn, South Africa: Juta & Co.

[9] Hashemi, S. and Yasser Hashemi, S. (2013). Cloud Computing for E-Learning with More Emphasis on Security Issues. *International Journal of Computer and Systems Engineering*, 7(9), pp.1251-1256.

[10] Helmy, Y., Nasr, M. and Ouf, S. (2013). A Proposed Model for Using Cloud Computing and Web2.0 in Deploying E-Learning Ecosystem (ELES). *International Journal of Cloud Applications and Computing*, 3(4), pp.51-80.

[11] M.Nasr, M. and Ouf, S. (2012). A proposed smart E-learning system using cloud computing services: PAAS, IAAS and Web 3.0. *iJET*, 7(3), pp.19-23.

[12] Moravec (2009). *Toward Society 3.0: A New Paradigm for 21st century education*. [online] Slideshare.net. Available at: https://www.slideshare.net/moravec/toward-society-30-a-new-paradigm-for-21st-century-education-presentation [Accessed 3 Nov. 2017].

[13] Murphy, K. and Cifuentes, L. (2001). Using Web tools, collaborating, and learning online. *Distance Education*, 22(2), pp.285-305.

[14] Rilwan Muhammad, A. and Mamman Abdulrahman, S. (2015). Cloud Computing Based e-Learning: Opportunities and Challenges for Tertiary Institutions in Nigeria. *International Journal of e-Education, e-Business, e-Management and e-Learning*, 5(3), pp.144-152.

[15] Sandhu, R. and Sood, S. (2015). A commercial, benefit-driven and secure framework for e-learning in cloud computing. *Computer Applications in Engineering Education*, 23(4), pp.499-513.

[16]   SHI, P., WANG, H., YIN, G., LIU, X., YUAN, X. and Shi, D. (2012). The Dynamic Allocation Model for the Resources of Cloud Services Delivery Networks. *Chinese Journal of Computers*, 34(12), pp.2305-2318.

[17]   Shin, D. (2013). User-centric cloud service model in public sectors: Policy implications of cloud services. *Government Information Quarterly*, 30(2), pp.194-203.

[18]   Wang, C. (2013). A sharable platform for e-learning based on cloud computing architecture. *International Journal of Cloud Computing*, 2(1), p.89.

[19]   Winstead, S. (2016). *eLearning 4.0: Prospects And Challenges - eLearning Industry*. [online] eLearning Industry. Available at: https://elearningindustry.com/elearning-4-0-prospects-challenges [Accessed 3 Nov. 2017].

[20]   Tambe, P. and Vora, D. (2016). Evolution of the web and E-Learning application. Computing for Sustainable Global Development (INDIACom), 2016 3rd International Conference on.