Pervasive Knowledge, Social Networks, and Cloud Computing: E-Learning 2.0

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Embedding Web 2.0 in learning processes has extended learning from traditional based learning-centred to a collaborative based learning-centred institution that emphasises learning anywhere and anytime. While deploying Semantic Web into e-learning offers a broader spectrum of pervasive knowledge acquisition to enrich users' experience in learning. In conventional learning practices, a student is perceived as a recipient of information and knowledge. However, nowadays many institutions involve students in learning processes that play an active role in improving collaborative learning platform and knowledge sharing as well as participation. For education provider, choosing a collaborative learning platform is becoming more important than choosing a tool in the new paradigm. Implementing collaborative learning through Web 2.0 is attributed to e-learning 2.0 as an approach for an online learning solution. Researchers have employed contents analysis for reviewing literatures in peer-reviewed journals. In fact, researchers found e-learning 2.0 is not only addressing the need redefining technologies like cloud computing in e-learning but also the need of redefining value added through pervasive knowledge generated from Semantic Web and Social networks. E-learning 2.0 can be a solution to make learning systems in a higher education is flexible in terms of resources adoption, pervasive knowledge acquisition, and cloud computing implementation.

Keywords: cloud computing, social network, e-learning, pervasive knowledge, semantic web

INTRODUCTION

A higher institution is taking benefit of the recent development in Information and Communication Technology (ICT) embracing e-learning as an integral part of online learning architecture. A higher education refers to education beyond the secondary level, especially education at the college or university level (Cite, 2011). E-learning is a generic term to refer to technology-supported learning, rather than similar terms such as online learning, web-based learning, distributed learning and technology-mediated learning (McGill & Klobas, 2009). Depicting the history of e-learning was explained by Bersin (2012) that the evolution of learning solutions focusing on adoption of technology in education from years 2000 and on it can be seen in Figure 1. Information Technology (IT) has been used in learning process

known as e-learning. At that time, e-learning was a system where university store learning materials online and students retrieved those materials for learning. Then, IT evolved which enable simple one to one interaction through chat rooms. Then, the concept of blended learning method was introduced. It is interesting to note that the evolution is not totally replacing previous technology rather it extends from the previous one with more features and occasionally different approach in delivering. From 2011, the rich content media and collaborative concept were embedded into online learning tool. From technological perspective, what make different is how the information and knowledge generated. Users are empowered to generate contents into the media (online learning tools) and they share with others. Therefore, the idea of pervasive knowledge comes to the light for further studies of e-learning.

Recently, e-learning has become a critical system for a university in embedding ICT into the learning process (Bhuasiri, Xaymoungkhoun, Zo, Rho, & Ciganek, 2012). E-learning offers a promising method for working adults who want to upgrade their education level. With e-learning, anybody can upgrade their education without leaving their job. For regular students, e-learning is seen as supporting tools of learning. One of the crucial factors in e-learning is knowledge management. This paper addresses the need to accommodate the concept of Semantic Web in e-learning scenario to a form of pervasive knowledge based system.

State of the literature

- The literature points out that there is a need to integrate the technology with the teaching and learning practice.
- The use of Social Networks and Media can be utilized to sustain the process of university learning.
- Adopting e-learning with cloud computing approach provides many advantages to the maintenance of infrastructures and flexibility of the systems.

Contribution of this paper to the literature

- The study contributes in integrative approach of the technology highlighting the role of Web 2.0, Semantic Web, and Social Networks for students, teachers as well as researchers in universities for collaboration and knowledge sharing.
- The study proposes dynamic interactive and alternative learning experiences to students where pervasive knowledge management from multi-channels and social networks are blended to provide comprehensive learning experiences.
- Cloud computing enables a university to react faster to the needs of education teaching, and research easily without expensive changes to existing IT infrastructure.

With the emerging Web 2.0 technology, the capability of current e-learning can be enhanced further. It is believed that Web 2.0 has shifted user behaviour due to the use of social network and media (Anshari, Almunawar, Low, Wint, & Younis, 2013) For instance, many people will not make a decision before referring to information in social sites (Hudson & Thal, 2013). Students exchange information and ideas in social networks that make potential students to seek opinions before taking any action. Therefore, in an educational institution, a university needs to understand that behaviour and expectations of students continue to change over time. As such, matters pertaining to student behaviour, culture transformation, personal agendas, and new ways of interactions between students and groups must be incorporated in e-learning initiatives. Consequently, e-learning must address the dynamic nature of users' needs and adjustment strategies embedded in e-learning.
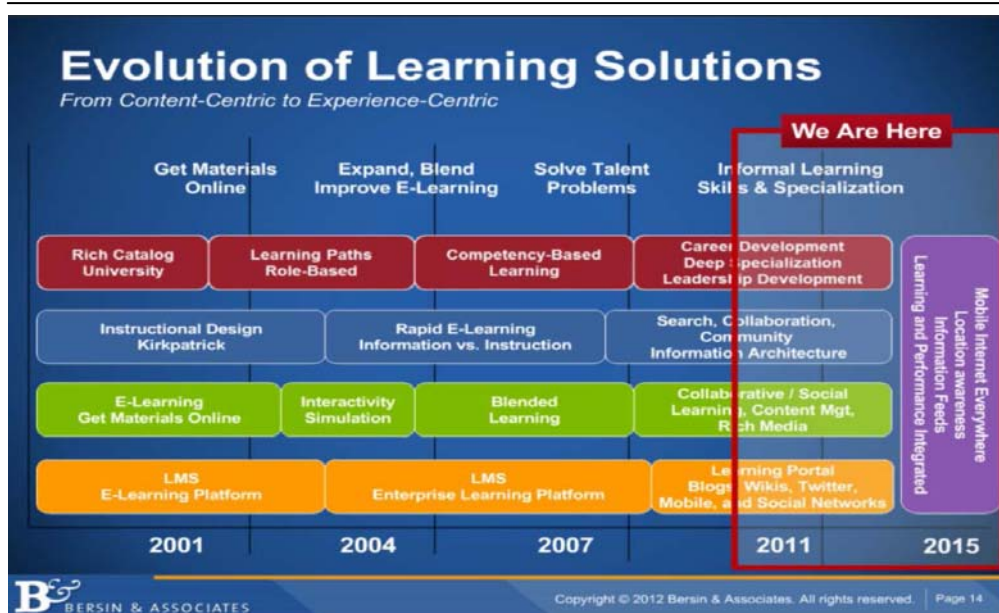
In addition, the emergence of cloud computing has improved capabilities of learning processes which are more cost efficient, easily accessed, and reliable. Cloud computing is more responsive when there are problems and all issues will be on cloud service provider. Service outages are critical and outages are unacceptable. When the learning management system goes down, student learning is disrupted and instructors have to question whether to trust such a system, therefore reliability is competitive advantage of cloud computing in e-learning service. Though, there are challenges on some issues when organizations consider cloud computing as a

Figure 1. Technology and learning solution
Source: Bersin (2012)

service provider such as dependency's factor to the provider, security and privacy issues, and cost effectiveness in the long run planning.

Why do researchers propose a model? Recent discussions of social networks, pervasive knowledge and cloud computing have been used in business organizations. However, integrating that technology is expected to enhance existing theory and implementation of online learning. The model is expected to lay the perspective for a higher learning institution in considering cloud computing, Social Network, and Semantic Web in offering pervasive knowledge acquisition in e-learning initiative. The analysis and discussion are based on recent literature analysis in applying cloud computing in e-learning scenario. This paper is organised as follows: the next section will discuss in more detail the literature analysis on e-learning and cloud computing, Section 3 explains research methodology, the discussion is in Section 4, and Section 5 is the conclusion.

LITERATURE REVIEW

The use of ICT as educational tools and resources is not a new approach. Terms like computer-based instruction, e-learning, mobile learning, distance learning, computer assisted instruction and computer assisted learning were used to describe earlier applications of electronic instruction. However, the generic model that accommodate social networks, pervasive knowledge acquisition and management through cloud computing is a topic to enhance learning experience for students. With the advancement of ICT, young generations were born with various gadgets. In effect, a higher learning institution faces challenges and pressure to improve the quality of academic programs and make important changes in their quality of teaching, learning, as well as research through ICT (Alas & Anshari, 2014).

How ICT is transforming higher education? Universities show utilizing an advance ICT to revolutionize the way to deliver the knowledge and contents. For example, online degree program is a niche channel of expending revenue opportunities to enable to those who cannot attend a degree through brick and mortal mode. A study at one university in USA that there is a strong relationship between a student's performance and time spent on e-learning (Whitmer, 2012).

The result showed that the more the students spent on e-learning, the higher their final grades.

From students' perspective, yet there are challenges for the students' behaviour in online learning such as feeling isolated, lack of effective advice, cost and motivation, feedback and teacher contact, student support and services, lack of experience, irrelevance of online studies, frustration in learning and training (Hara & Kling, 1999) which in turn led to higher dropout rates than among traditional students (Falowo, 2007).

While from organization's perspective, regardless of the benefits, technology is still a disruptive innovation and expensive investment for some higher institutions (Jayson, 2013). Many higher institutions deploy "technology in trend" is not merely for their business or functionalities, but institutions require to demonstrate a commitment towards advanced ICT in order to attract community trust, better branding and image, partnership and corporate funding. An institution needs to adapt strategically and to create new possibilities for e-learning through the benefits of technology to widen students' choices in the learning process. As a system, e-learning can be viewed as a strategy to retain existing users and attract new ones. User retention is important for growth and sustainability of the organization. With the growing competition among higher institutions, a university is challenged not only to retain existing trends of demands but also to improve demands for the education services, retaining them in using the services, and extending various services in the future, and emerging technologies like social networks, cloud computing, and semantic web are worthy to be considered for development.

Social networks

This was according to Pombriant (2009) customers who recently have acquired more control of their relationships with organization due to the fact that customers have greater access to new levels of education and information. The Web 2.0 could be used as enablers in creating close and long term relationships between organizations with its customers in this case is students (Almunawar & Anshari, 2014). Web 2.0 provides opportunity for students as well as researchers in universities for collaboration and knowledge sharing. It helps to find collaborators for research and possibility to communicate with other researchers in the same research interest. Web 2.0 technologies that facilitate interactivity, comments on articles, and open peer review process among scholars.

The use of Web 2.0 can be utilized to sustain the process of a university learning (Baxter, Connolly, & Stansfield, 2011). Web 2.0 tools are important for developing of social network to encourage knowledge sharing. Web 2.0 has enabled a mechanism to extend the e-learning by accommodating students' empowerment such as enabling them to participate more actively in the sharing information and generating knowledge through social media. The advantage of Web 2.0 has the capability to track conversations about business operations. A university can benefit from connecting directly with existing and potential students through various social networks, tracking students' comments, opinions or suggestions and then approach them with a more personal touch (Anshari, Almunawar, Low, & Al-Mudimigh, 2012).

For instance, in 2014, researcher used Schoology, a web-based Learning Management System (LMS) with 200 students. The initial aim of using the LMS was to have a medium to share notes with the students. The reason to use Schoology was because the system has similar features with Facebook, where students are familiar with. After few months using it, because of the vast features of the system, researcher not only used the system for sharing notes, but also for giving assignment, grading their work, taking attendance and giving them online discussion. The students' comments were that they found it easier to use as it is

similar to Facebook. Furthermore, its application can be downloaded and installed in their smart phones. Instead of printing their notes, they have used it to view their notes. They also used it for saving their work as it also acts as online storage. One of the main reasons students like the system is that they can view the notes from anywhere and anytime they want.

E-Learning

E-learning is a widely used terminology to address online based learning because it covers information systems which include technology, users, strategies, and business processes (Caret, 2013). Online learning systems enhance instructors and students to share instructional materials, make class announcements, submit and return course assignments, and conduct conversations with each other online. E-learning is an information system that facilitates online learning and processes, stores and disseminates educational material and supports administration and communication associated with teaching and learning (McGill & Klobas, 2009).

The roles of e-learning have been well recorded in many studies. Early adopters of e-learning were convinced that it made teaching more efficient (Morgan, 2003) and most early e-learning systems are used only for the distribution, management, and retrieval of course materials (Lonn & Teasley, 2009). For instance in 2007 over 90% of US universities and colleges had established one or more e-learning -type products for student and faculty use (Hawkins & Rudy, 2007). In the last decades, e-learning has been one of the most significant developments of ICT in universities to support the teaching and learning process (Coates, James, & Baldwin, 2005).

However, next e-learning's adoption should accommodate dynamic interactive and alternative learning experiences to students where knowledge management from multi-channels and social networks are blended to provide comprehensive learning experiences. The aim of this paper proposes a framework of e-learning with cloud computing based integration.

Semantic web and pervasive knowledge

The concept of Semantic Web is originated from the concept of Semantic Network Model. Semantic Network Model is a model as a form to represent semantically structured knowledge (Collins & Loftus, 1975). The Semantic Web is a web of data that can be processed directly and indirectly by machines. Web of data is driving the evolution of the current Web by enabling users to find, share, and combine information more easily (Berners-Lee, Hendler, & Lassila, 2001).

Semantic Web is an effort to enhance current web so it can process the information presented on Web based, interpret and connect it, to help users (students) to find required knowledge. The main idea of Semantic Web is to share data instead of documents. In other word, social websites can serve as rich social data sources for the Semantic Web. People are creating rich information through their everyday interactions with social websites that can support Semantic Web data by connecting things together forming the source of knowledge for people.

One of the roles for e-learning systems is delivering knowledge contents to the students through online media (Anderson, 2008). The focus of pervasive knowledge management is recognized in different areas of data and information management, including accessibility, collaboration, information utilization, integration, and process automation of data (Gebert, Geib, Kolbe & Brenner, 2003). Semantic Web can be an approach for acquiring pervasive knowledge in e-learning systems (Sampson, Lytras, Wagner & Diaz, 2004). Researchers use the Semantic Web to describe people, content objects and the connections that bind them all together so that social sites can interoperate via semantics (Stojanovic, Staab, & Studer, 2001).

Semantic Web enables to exchange of knowledge and resources across multiple channels (Gandon, 2002).

Cloud computing

Cloud computing has emerged with new paradigms attributable to Web 2.0 (Esri, 2013). A university may avoid over-investing in IT infrastructure and training staff to serve the need for e- learning but find it more beneficial to consider renting the system and resources to keep a university focus in their core on teaching, learning, and research. Cloud computing eliminates the need to install and run the application on the users' own computers. Moreover, it lessens the internal IT staffs' burden of maintenance, monitoring operations, and 24/7 support for any incident that may occur.

Moving e-learning into cloud computing brings many benefits when current IT investments are directed to the maintenance of infrastructures such as servers and in house data storage devices (Armbrust, Fox, Griffith, Joseph, Katz, Konwinski, & Zaharia, 2010), so it can be significantly decreased by the use of cloud computing to save the data storage from their current budget. In general, reducing cost and increasing efficiency are primary motivations for moving towards cloud computing. Many universities deploy cloud computing due to a cost-effective solution to the problem of providing reliable services, data storage, and computing power to a growing number of students without investing more in physical machines and maintenance costs (Al-Zoube, 2009). A university takes advantage of using a cloud when the ICT capacity needs extensibility, customizability and scalability (Vouk, Averritt, Bugaev, Kurth, Peeler, Schaffer, Sills, Stein, Thompson, 2008; Doelitzscher, Sulistio, Reich, Kuijs, & Wolf, 2011). Cloud computing provides the advantage of the ability of working and communicating in the educational environment without taking into account space and time (Vouk et al., 2008).

There are many benefits for cloud computing in education. Those benefits range from providing educational resource storage and databases, e-mail, educational applications and tools for students and teachers and clients located all over the world involved in an educational program (Sultan, 2010; Cappos, Beschastnikh, Krishnamurthy, & Anderson, 2009). However, the main advantage is cost effectiveness for the implementation of the hardware and software and this technology can improve the quality of current systems of education at an affordable cost (Ghazizadeh, 2012). Furthermore, with cloud computing, universities can focus on their core business of teaching and research while cloud computing manages complex IT configuration, maintenance, and software systems through quick deployment (McCREA, 2009; Tout, Sverdlik, & Lawver, 2009).

IT expenses generally associated with developing, procuring, administering, and maintaining in-house IT infrastructure can be shifted to the cloud vendor (Symantec, 2011). Cloud computing that introduces an efficient scale mechanism can let the construction of an e-learning system be entrusted to suppliers and provide a bended mode for e-learning (Laisheng & Zhengxia, 2011). Cloud computing can reach efficiency if the same work is performed with fewer resources.

Previous studies (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009; Vouk, 2008; Zhang Cheng, & Boutaba, 2010) have suggested that cloud computing is more reliable than building in-house systems as follows: first, data centralization can inhibit less risks to universities with mobile users than having data separately on portable computers, mobile devices, or removable media. Second, cloud service providers equip them with staffs that are specialized in security, privacy, and other areas of high interest and concern to the organization. Third, uniformity and homogeneity of cloud computing platforms enable better information security management like configuration of security control, vulnerability audits, penetration

testing, and security patching (Subashini & Kavitha, 2011). The platform support requires meeting operational standards, compliance, and certification (Brandic, Dustdar, Anstett, Schumm, Leymann, & Konrad, 2010). Forth, data stored within cloud computing can be more accessible, more available, faster to store and retrieve, and more reliable in many conditions than managed data internally in an organization data centre (Sultan, 2010). Finally, robustness and the scalability of cloud computing services enable greater availability (Computing, 2008). Redundancy and disaster recovery plans are built into cloud computing infrastructures and on-demand resource capacity can be extended for better flexibility when service demands are increased and for faster recovery from serious incidents (Mell & Grance, 2009).

In addition, an information system in a university always evolves as a natural progress in accordance with changes. New software causes significant capital investments in new hardware whereas students frequently need both the software and development platforms during their study (Madhumathi & Gopinath, 2013). With cloud computing, a university can utilize demand access to scalable and complexity of ICT and cloud computing has fundamentally changed the way in which organizations pay only what they use information systems or resources. It enables a university to react faster to the needs of business easily without expensive changes to existing IT infrastructure, while driving greater operational efficiencies and allowing organizations to support business growth by upscaling or downscaling IT requirements when required. Because of scalability of cloud computing, many universities are now relying on managed data centres for easy allocation of resources in a trusted environment.

METHODOLOGY

It is theoretical study where the objective of the study is to propose model of an e-learning that accommodate Semantic Web to facilitate pervasive knowledge management, Web 2.0 for social network and collaboration, and cloud computing. To develop such a model, this article builds on recent reviews of cloud computing, e-learning and semantic web. The Google Scholar search was conducted using keywords Semantic Web AND E-learning, cloud computing and e-learning, Social network and e-learning. After removing duplicates and articles beyond the scope of this study, researcher selected 70 articles for review. These articles were reviewed to extract the arguments of pervasive knowledge from three possible technologies. Researchers employ a thematic analysis of definitions, that is, the most important linked papers and articles. Then, researchers extract ideas are then applied to review pervasive knowledge in e-learning services. Researchers enhance and integrate various possible solutions into proposed model. We chose only English-language articles published in peer-reviewed journals.

E-LEARNING 2.0

Recognizing the critical resources is the factor for a university to survive and obtain the proper mix of resources. The resource in a university is ranging from IT infrastructure, knowledge acquisition technique, learning management systems, and human resource readiness. In fact, a university can minimize the effects of single scenario dependency and thus increase their likelihood of survival. The recent development of Web 2.0, cloud computing and their related technologies contributes towards the tendency to utilize pervasive knowledge management. In addition, Web 2.0 offers students the ability to have greater control of information flow and ownership in social networks, hence active participation is highly possible.

The old fashion of e-learning has managed and maintained the systems using an internal or on-site hosting model that requires a significant amount of resources from IT personnel as well as a massive infrastructure deployment. The system has not designed to acquire multiple source of knowledge that is relevant to the students based on subject matter due to closed systems approach. Inflexibilities of those features can be referred to the first generation of e-learning systems (Table 1).

Due to inflexibility of the systems, a university needs to set up a new mechanism whereas the e-learning systems should allow flexibility in term of a context of technology like cloud computing and Web 2.0 but also a content of knowledge that is pervasive knowledge acquisition. In regard to the context of technology, many universities are dependent on infrastructures and closed systems approach that is hardly to manage and maintain for future need. Inflexibility over resources can create uncertainty for a university to respond in for changes. Thus, a university must develop ways to exploit these resources in order to ensure their survivability.

One of the important advantages of e-learning 2.0 is a university does not need to invest extensive ICT infrastructures in order to deliver e-learning. For instance, e-learning can be managed by outsourcing of ICT resources, which are readily available in the cloud so that a university can focus on core functions. The idea of utilizing cloud computing is in parallel with the recent trend of workflow models characterized by the concept of Web 2.0. Cloud computing offers simplicity in delivering mobile contents as it runs the services in on-demand basis with minimum maintenance. Introducing Web 2.0 in e-leaning can be expanded to incorporate the students' capability not only to receive but also to generate information. Web 2.0 has energized students to have better control of information flows in e-learning systems especially in generating contents in social network interactions.

Figure 2 shows the model of e-learning 2.0 with features of social networks, pervasive knowledge management, and cloud computing approach. Semantic Web will support cloud service provider in delivering e-learning service to users. Web 2.0 has enabled students to dynamically enrich their personalized information. Traditionally students have relied solely on static information provided by service provider. However, they are now being empowered with the ability to conduct conversations with other students to share and exchange experiences through discussions in their social networks.

In addition, e-learning 2.0 enriches their knowledge through Semantic Web as a platform for pervasive knowledge management and an acquisition that is incorporated through cloud computing. E-learning 2.0 offers students to have a greater role in active learning process as they are empowered with the ability to control and generate flow of information that fits with their personalized needs. Pervasive knowledge in e-learning 2.0 is proposed to enhance all actors in the systems (students, tutors, management, etc.) to acquire content's rich of knowledge

Table 1. Comparison of E-Learning 1.0 and E-Learning 2.0

Type	E-Learning 1.0	E-Learning 2.0
University needs extensive IT Source & Infrastructure	Yes (development, procurement, maintenance, update system/technology)	Not necessary
Risk & Responsibility	Internal within University	Cloud Service Provider
Offer Specialized (Extra) Service	Possible if there is specialist (i.e security) staff internal	Yes, mostly they have dedicated staff for specialized (extra) service.
Process and Behaviour	Possible to change with more effort from the beginning	Dynamic (when technology or users' the demand change easily deploy)
Cost	Development, machines, maintenance	Pay only the service
Perception	Complete modules but complicated	User friendly, easy to navigate and use
Knowledge Acquisition	Limited access of knowledge providers	Rich contents from multi-channels of interactions and knowledge sources
Internet Platform	Web Syntax	Web 2.0 and Semantic Web
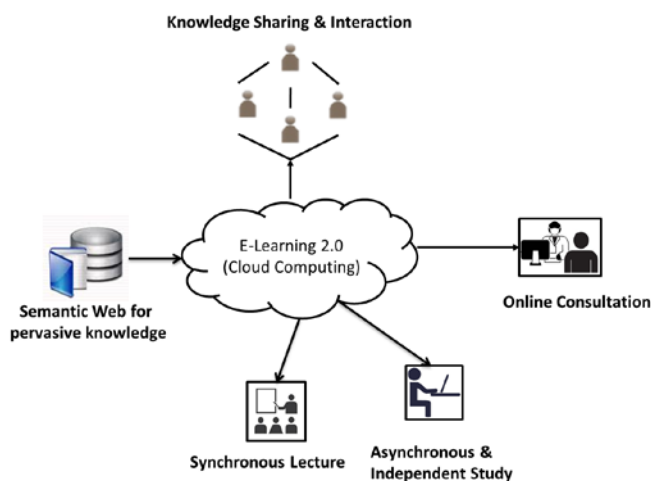
Figure 2. Model of E-Learning 2.0
Source: Authors' Compilation

from various channels that is relevant per subject basis. E-learning 2.0 allows users to bring their data with them and mobile from one service to another. The concept of pervasive knowledge in the model is to enable multi-channel knowledge that is available in Internet brought by Application as a Service in cloud computing to the users so that learning experience in e-learning 2.0 is richer due to comprehensive knowledge. Semantic web can link information across different online sources to form comprehensive knowledge to support synchronous lecture, asynchronous study, online consultation, knowledge sharing in social networks.

The model proposes implementation of Semantic Web and cloud computing for new approach in e-learning because we sometimes need new implementations to adapt. Instead of a university is focusing on developing internal ICT resources, the university can consider strengthening knowledge and contents through Semantic Web. In addition, cloud computing is able to bypass and significantly reduce the amount of time, money, and resources required from the ICT's dependencies.

A university can secure business on full distance learning or online certification programs to serve the needs of the public officers and the private sector, which regularly need to improve their knowledge and skills but have no time to attend classes. While, the biggest advantage from e-learning 2.0 is that a university can move quickly in adopting the latest and reliable e-learning technology to grab the market share by offering quality content of online learning through pervasive knowledge technology.

Finally, there is no single solution fits for all scenarios, higher institution should carefully decide at which direction that the institution is going to upgrade for online learning system before understanding the needs of users towards the systems. This study triggers research directions that e-learning can embed pervasive knowledge multiple sources like social networks and semantic web through the support of cloud computing is key to competitive advantage. The concept of pervasive knowledge in e-learning opens a new opportunity to maximize the potential of resources knowledge into online learning system. Pervasive knowledge is not only from social networks generated data. Social networks can become data source that is voluntarily generated by students. While, Semantic Web are huge data sources from multi types that can be integrated into huge and relevant knowledge resources. Though, there are always challenges for the realisation of value added from

pervasive knowledge in online learning through, therefore next stage of study is important to configure its feasibilities

CONCLUSION

It is important for a university to consider strategies to survive. Changes may take place in the university because the demands of interested parties must be addressed to make a university stay at the competitive state. Higher institution especially universities need to develop strategies that will allow them to acquire these resources. The resources can be seen in the context of technology adoption and quality of knowledge management. E-learning has adopted the Internet as a platform through Web 2.0 and cloud computing, however e-learning needs to build a technology stack to support a Web of data. Web of data enables users (students) to generate data stores on the Web, build vocabularies, and write rules for handling data. Next generation of e-learning needs to enabling students to find, share, and combine information more easily through Semantic Web. E-learning 2.0 offers a great extent by advancing technology such as cloud computing technology, Web 2.0 and Semantic Web into proper strategies to gain control of their the benefits. Meaning that e-learning 2.0 enhances the recent e-learning into more functionalities and features like multi-ways users' interactions, mobile learning, and pervasive knowledge acquisition through Semantic Web. The model is expected to extend the ability to acquire and maintain pervasive knowledge is the key for a university to stay in competitive landscape. Derivation of the proposed model, which is e-learning 2.0, will be prototype for next generation of online learning that accommodate pervasive knowledge for students as well as facilitators.

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