E-LEARNING 3.0 = E-LEARNING 2.0 + WEB 3.0?

Fehmida Hussain
Middlesex University, Dubai

ABSTRACT

Web 3.0, termed as the semantic web or the web of data is the transformed version of Web 2.0 with technologies and functionalities such as intelligent collaborative filtering, cloud computing, big data, linked data, openness, interoperability and smart mobility. If Web 2.0 is about social networking and mass collaboration between the creator and user, then the Web 3.0 is referring to intelligent applications using natural language processing, machine-based learning and reasoning. From the perspective of advancements in e-Learning, the Web 2.0 technologies have transformed the classroom and converted a passive learner into an active participant in the learning process. This paper posits that the way both previous generations of e-Learning (1.0 and 2.0) have emerged with the prevalent technologies in their kin Web versions (1.0 and 2.0, respectively), it can be argued that e-Learning 3.0 will provide all earlier generations' capabilities enhanced with the Web 3.0 technologies. Furthermore, in this paper, reviewing all the theories of learning and examining closely the theory of connectivism (considered to be the theory of learning for the digital age), it is argued that since most of the technologies that are to be a part of e-Learning 3.0 are addressed by these principles, a call for a new learning theory for e-Learning 3.0 is not justified. Finally, a review of the secondary literature shows that there will be various challenges and issues related to prevalence and adoption of e-Learning 3.0 technologies, for example increased privacy and security risks, web accessibility, readiness of the users, requirement for further standardization of e-Learning technologies and social issues in term of increase of the digital divide.

1. INTRODUCTION

E-Learning 3.0, is it the way ahead in educational technology or just another buzz word in the digital-spaces and education? At a prestigious IEEE conference, an interesting paper was published titled *"E-Learning 2.0 = e-Learning 1.0 + Web 2.0"* (Ebner, 2007, p. 1235)? After five years of incredible technological advancements, a reappraisal of the digital spaces is due; it is only fair to ask the question: *Is E-Learning 3.0 = E-Learning 2.0 + Web 3.0?* Exploring what entails e-Learning 3.0, there are three parts of this paper: (1) How Web 3.0 technologies will be incorporated in the existing e-Learning 2.0? (2) Is there a need for a new learning theory for e-Learning 3.0? (3) What are the challenges and issues related to adoption of e-Learning 3.0?

This paper first describes the three generations of Web, usually referred to as, the Web 1.0, Web 2.0 and the recently used neologism, Web 3.0. After explaining how the educational technologies and the information systems used in each are different, these are related to the concept of e-learning. E-Learning literature also broadly distinguishes between e-Learning 1.0, e-Learning 2.0 and e-Learning 3.0; hence the paper draws a parallel between the generations of the Web and e-Learning.

Next, in relation to e-Learning 3.0, as education researchers are questioning (Wheeler 2009b; Meichel, 2009) whether a new learning theory is required for e-Learning 3.0; so in the light of the existing learning theories, a preliminary attempt is made to address this. This paper does not indulge in the debate of whether connectivism is a theory or a phenomenon, nor does it go into responding to the critique that has been done about it. The simple approach taken in this paper is to make the basis of the argument all the important principles of the connectivist theory of learning and then examine how the technological shift maybe supported by these principles.

Nevertheless, with any advancement and more so, the technological advancement, there are associated challenges in terms of technological, ethical and social issues which are briefly discussed and highlighted in the end of the paper.

2. HOW WEB 3.0 TECHNOLOGIES CAN BE INCORPORATED IN THE EXISTING E-LEARNING 2.0?

2.1 Evolution of the Web

This section briefly covers the three generations of the Web in terms of the capabilities, technologies and its usage. The Web has evolved from the early days of the ENQUIRE project to the transformation of Web 3.0 (Berners-Lee et al., 2001; Berners-Lee 1995) Broadly speaking, where the Web 1.0 connects real people to the world wide web (www), the Web 2.0 connects real people who use the www, the Web 3.0 will connect the virtual representatives of the real people who use the www. So, it is believed that Web 1.0 is about providing information, Web 2.0 is about overload of information and the Web 3.0 is about control of information (Rego, 2011).

Web 1.0 is generally referred to as the "read-only Web" making content available online for viewing. Authors of the web generally write what they want others to view and then publish it online. The reader can visit these web sites and can contact the writer or publisher if contact information is available. There is no direct link or communication between the two. Examples of these are static web sites and web pages created using HTML. (Rubens et al., 2011)

The term Web 2.0 is usually associated with the O'Reilly Media 2.0 conference (O'Reilly, 2004), but was actually used for the first time in early 1999. (DiNucci, 1999) As opposed to the Web 1.0 which is referred to as the static web, Web 2.0 is considered as the dynamic web. The users can read, write and collaborate to a certain extent. The latest technologies used on client side or server side in Web 2.0 are Ajax (Asynchronous Javascript), XML (Extensible markup language), Adobe Flash, PHP, Per, Python, Flash and so on.

The technologies and concepts related to the Web 3.0, though still in the infancy stage, are advancing quite rapidly. The Web 2.0 has given rise to silos of data being generated by social networking and there will be a need to enable the utilization of this data. An astounding statistics by the Forrester Research (2006) shows that 97% of the users never look beyond the top three search results when they are searching on the internet. The main features of the Web 3.0 technologies which differentiate it from its earlier generation, Web 2.0 are given as follows (Cho, 2008; Wheeler 2009a; Berners-Lee, 2001; Morville, 2005; Semweb, 2011):

- Intelligent/semantic Web: The term semantic web refers to the W3C's vision on the Web of linked data enabling people to create data and build vocabularies. .Simply put, semantic web is all about describing things in a form that is understood by computers
- Openness and interoperability: This refers to openness in terms of application programming interfaces, data formats, protocol and interoperability between devices and platforms.
- Global repository of data: This is the ability of information to be accessed across programs and across the web.
- 3D Virtualization: Extensive use of 3D modeling and 3D spaces using services like second life and personalized avatars connected to your devices.
- Distributed and Cloud Computing: The delivery of computing as a service rather a product.

AI and machine learning are the main driving force behind the Web 3.0. For example, in Web 2.0, searching the word e-Learning on Google will give a plethora of unrelated hits, but the Web 3.0 will solve this problem by providing context to searching for online information. As the Web 3.0 is also referred to as the Semantic Web of Data (Berners-Lee Video), there will be huge datasets created, so the need of the time is management of 'Big Data' and 'Linked data' (Fischetti, 2010). The Web 3.0 will make use of technologies such as RDF (Resource Description Framework, SPARQL (Query Language for RDF), OWL (Ontology Web Language and SKOS (Simple Knowledge Organization System) (W3CSW, 2009); these will help structure information such that programs like web spiders and web-crawlers can search, discover, collect and analyze information from the web (RDF, 2004). "If HTML and the Web made all the online documents look

like one huge book, RDF, schema and interface languages will make all the data in the world look like one huge database", (Berners-Lee, 1999).

2.2 Evolution of e-Learning

E-learning is usually understood as instruction delivered via a computer in teaching and learning. A number of other terms are synonymously used with e-Learning for example, computer based training, online learning, virtual learning, web-based learning and so on. The central idea is that all these refer to use of information and communication technology that pertain to all educational activities either performed individually or in groups, working online or offline, synchronously or asynchronously, via networked or standalone computers or other electronic devices. (Romiszowski, 2004; Garrison and Anderson, 2003) The learner of the future is totally digitalized. The often so-called digital natives, digital immigrants, net-generation, Generation @ are some of the names given by researchers to the students of today. (Prensky, 2001; Tapscott, 1997; Pelevin & Bromfield, 2002)

2.2.1 E-Learning 1.0

With the advent of the Web, the major change was to have content available online. The concept of "learning objects" came into being which were used to create what is known as the learning (content) management systems (LMS or LCMS) developed to support study management and course organization for learners. This is considered more of a traditional, rather than a hierarchical way of learning where communication is mono-directional. In this direct-transfer model, the instructor is the distributor of learning material in a media-rich way and addresses learners through various communication channels. This era is usually referred to as e-Learning 1.0.

2.2.2 E-Learning 2.0

Stephen Downes described the use of Web 2.0 technologies for teaching and learning as 'e-Learning 2.0' (2005). Web 2.0 for example has transformed the class room in terms of how it is not only socially but collaboratively constructed by using wikis, blogs, podcasts, and other social web tools. Such tools demand dynamic content generation which may comprise of reflections and conversation, hence requiring a collaboration and interaction. (Richardson, 2009) This is a collaborative way of learning where communication is multi-directional where knowledge may be socially constructed.

2.2.3 E-Learning 3.0

Education researchers are now quite freely using the term e-Learning 3.0 in various blogs and discussion forums. (Walters, 2010; Moore, 2010, Wheeler, 2009a) Emergence of cloud computing and availability of new technologies such as collaborative intelligent filtering, increased and reliable data storage capacity, higher screen resolutions, multi gesture devices and 3D touch user interface is leading us into the next generation of e-Learning. One of the big things of third generation of e-Learning will be the ubiquitous access to learning resources with the use of mobile devices to virtually access anything, anytime and anywhere. (Baird 2007; Wheeler 2009a) Technology people also suggest the use of AI and data mining for building the e-Learning 3.0 systems which have the capability to sift and sort big data, in turn provide to the learner a deeper and better understanding of the learning process itself. (Rubens et al., 2011) Further, education researchers believe that the underlying concept of 'anytime, anywhere and anybody' will be supported by 'anyhow' which will be provided by virtual 3D worlds such as use of Second Life and personal avatars. (Baird 2007; Rego 2010) With well-established Web 2.0 technologies and moving ahead to Web 3.0, research communities are talking about the personal learning environments (PLEs also referred to as mash-ups). "Personalization is seen as the key approach to handle the plethora of information in today's knowledge-based society." (Ebner et al., 2011, p. 22)

Though e-Learning 3.0 systems are not prevalent commercially, however researchers are proposing such solutions as proof-of-concepts or working prototypes. One of the first online services to use semantic web automatically and intelligently organizing information about users' specific interests is Twine. (Spivack's, 2010) Another example of a true e-learning 3.0 system is AHKME (Adaptive Hypermedia Knowledge Management E-Learning Platform) an e-Learning Information System having learning requirements compliant with a Web 3.0 philosophy (Rego, 2011).

2.3 Relationship between Web Evolution and E-Learning Evolution

Relating the generations of the Web with generations of e-Learning, if Web 1.0 is the read only web and Web 2.0 is the read/write web, then Web 3.0 is the read/write/collaborate web. E-Learning 1.0 is about providing to the learner information access, whereas e-Learning 2.0 in addition to all e-Learning 1.0 capabilities provides authoring and interacting capabilities to the learner. Furthermore, e-Learning 3.0, enabled and enriched with Web 3.0 technologies will promote intelligently collaborative, rich 3D virtual learning environments which will bring learners together for anytime, anywhere, anyhow learning experience, utilizing the semantic capabilities to parse the global databases of knowledge. Hence it can be deduced that e-Learning 3.0 will provide all earlier generations capabilities enhanced with the Web 3.0 technologies. The relationship between the generations of the Web and e-Learning are summarized in Table 1.

Ebner (2007) while attempting to answer whether e-Learning 2.0 is just a sum of e-Learning 1.0 and Web 2.0 technologies posited that the human factor is also important, that is the readiness and acceptability of users towards a new technology. Therefore, Ebner (ibid) revised his equation to be e-Learning 2.0 = f (e-Learning 1.0, Web 2.0, human factor). In the context of this paper, when accepting Web 3.0 technologies for e-Learning 3.0, the human factor will also play some role but possibly not a significant one because the transition for the aforementioned 'digital natives' will be much quicker as compared to the earlier generations, the 'digital immigrants'.

Table 1. Relationship between generations of Web and e-Learning (adapted from Rego, 2011).

| Version | Web | | E-Learning | |
	Concept	Technologies	Concept	Technologies
1	Read-only or write only, security, web of documents	HTML, HTTP,URL	Content management, Unidirectional activities	CBT, LMS, eBooks VLEs,
2	Read/write Social web	Dynamic web technologies. ASP, AJAX, podcasts, SNS	Blended learning, content authoring, Bidirectional activities, Multimedia content	LCMS, social networks, video conf ,VLEs, Mashups
3	Read/write/request/collaborate big data, linked data	RDF, XML, OWL, 3D, second life	Learner-centered, U-learning, knowledge representation	PLEs, Social semantic web, second life, personal avatars

3. DO WE NEED A LEARNING THEORY FOR THE WEB 3.0?

Information on the fly and on the go has become a norm for the digital natives. (Oblinger & Oblinger, 2005; Oblinger, 2005) One relevant question to ask here is, does all the advancement in technology signal a change in the learning behavior, or do we need a new learning theory for the digital natives? Recently, education researchers are also discussing whether connectionism is adequate as a theory in terms of its coverage of the need for the digital age; Connectionism is *so* Web 2.0 (Miechel, 2009; Wheeler, 2009b). George Siemens' Connectivist approach to learning in a digital age might actually be superseded by our need to re-conceptualize the whole idea of what learning will mean - especially when we are immersed in a world of ambient mobile pervasive communication where intelligent agents and filtering tools do our bidding for us. Based on review of the literature of learning theories, this paper makes a preliminary attempt to answer this question.

Learning theory refers to a framework that helps us think about how and why change (in learning) occurs (Smith, 1999). A review of the literature shows that there are different orientations and approaches to explaining how this process of learning takes place, for example, behaviorist, cognitivist, humanistic, social/situational and the connectivist approaches to learning. Broadly speaking, in the education literature, there is reference to four theories of learning namely Behaviorism, Cognitivism, Constructivism and Connectivism. In Behaviorism knowledge is perceived as facts that can be transferred from teacher to student (can be related to e-Learning 1.0) Cognitivism opens up the black box of the mind, considering the learner as an information processor whereas Constructivism suggests that learners create knowledge as they try to make

meaning of their experiences. Connectivism, considered to be the learning theory of the digital age, according to Siemens (2004) is, "a successor to behaviorism, cognitivism, and constructivism." These theories of learning are briefly described in Table 2, in terms of the view of the learning process, locus of learning and purpose of education; Table 2 is adapted from Ashworth et al., (2004) adding a column to relate with the connectivist approach (Siemens, 2004).

Table 2. Summary of learning theories (adapted from Ashworth et al., 2004; Seimens, 2004).

Theories of Learning				
Aspect	**Behaviorist**	**Cognitivist**	**Constructivist**	**Connectivist**
Learning theorists	Skinner, Pavlov,	Bruner, Kohler, Piaget	Bandura, Vgotsky	Siemens, Downes
View of the learning process	Change in behavior	Internal mental processes	Construction of meaning from experience	Connecting specialized information sets
Locus of learning	Stimuli in external environment	Internal cognitive structuring	Internal construction of reality by individual	Draw information outside of our primary knowledge
Purpose of education	Produce behavioral change in desired direction	Develop capacity and skills to learn better	Construct knowledge	Ability to synthesize and recognize connections

Connectivism applies ideas from biological models of the brain to neural networks in machine learning; stating its basic principles as follows (Siemens, 2004):

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialized nodes or information sources.
- Learning may reside in non-human appliances.
- Capacity to know more is more critical than what is currently known
- Nurturing and maintaining connections is needed to facilitate continual learning.
- Ability to see connections between fields, ideas, and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.

This paper does not indulge in the debate of whether connectionism is a theory or a phenomenon or for that matter does not attempt to counter some of the criticisms about it. The simple approach taken in this paper is to examine the important principles of the connectivist theory of learning as stated by Siemens (2004) and then look at the new technologies which will be introduced as a result of the advancements in the web technologies, thus compare and relate which technological shift may be supported by the principles of the connectionist learning theory; this is demonstrated in Table 3. Based on the relationship illustrated in Table 3, the paper posits that the cutting edge technologies to be a part of e-Learning 3.0 are adequately supported by the principles of the learning theory of connectivism. Hence a call for a new learning theory for e-Learning 3.0 is probably not justified.

Table 3. Web 3.0 technologies supported by basic principles of connectivism.

Web 3.0 technologies used in e-Learning 3.0	Basic principles of connectivism
Social semantic networks, openness and interoperability	Learning and knowledge rests in diversity of opinions.
Big data or global data repository, linked data, cloud computing, extended smart mobile technology	Learning is a process of connecting specialized nodes or information sources. Currency of knowledge is important.
Machine learning, artificial intelligence, personal avatars, 3D visualization and interaction	Learning may reside in non-human appliances.
Semantic web, control of information	Capacity to know more is more critical than what is currently known
Semantic web, collaborative intelligent filtering	Ability to see connections between fields, ideas, and concepts is a core skill.
Semantic web, collaborative intelligent filtering	Nurturing and maintaining connections is needed to facilitate continual learning

4. CHALLENGES AND ISSUES RELATED TO E-LEARNING 3.0

A review of the secondary literature shows that various challenges and issues may arise due to prevalence and adoption of e-Learning 3.0 technologies. In the MashUps of the interconnected world in the hyperspace, there will be an increased risk of privacy of data due to difference in privacy laws from country to country. Also, added security risks may be faced due to lack of server-side checks and excessive privileges. (Weippl, and Ebner, 2008) Researchers are concerned that the ethical dilemmas will also be enhanced as due to the nature of the semantic web, vastness, vagueness, uncertainty and inconsistency may add to privacy and loss of control. (Alves, et al., 2011; Alkhateeb et al., 2010) Similar to other web-based applications, there is going to be more of a challenge to provide accessibility with web content to people with special needs. There have been some initiatives from the World Wide Web consortium on this (WAI, 2009) but much more work will be required in this direction. There are researchers who are apprehensive about the use of such advanced technologies. "There are teachers who are still struggling with Web 1.0 let aside the students. So the questions or apprehensions on the other side are: are our students truly ready to be autonomous learners? Are our teachers willing to give into technology? (Wheeler, 2009a)" As suggested earlier in section 2.3, the human factor is definitely a variable in the equation; the impact should reduce as the users become more and more comfortable with technology. Lack of standards is another concern.This is in relation to exchange of data and content between systems. Standard that do exist will have to be enhanced for the future generation of the web for example, sharable course object reference model (SCORM), IEEE learning technology standards committee (LTSC), Instructional Management Systems project (IMS) and so on. Educational technology standardization movement has become an important force, for example IMS Global Learning Consortium (IMS, 2011), IEEE (IEEELOM, 202), Dublin Core (DC, 2010) which are basically working towards standardization of educational technologies for e-Learning applications such as metadata, digital repositories, and many more.

5. CONCLUSION

Keeping pace with the unprecedented innovations in technology, the education domain has also evolved. Use of technology in education has had a significant impact on teaching and learning. E-Learning systems have also evolved with the evolution of the Web and the new technologies will continuously enable the application of learning and teaching theories into e-Learning practice. This paper explores how Web 3.0 technologies will entail e-Learning 3.0; whether the need for a new learning theory is called for with the use of the Web 3.0 in educational technologies and what are the potential challenges and issues related to the advent of e-Learning 3.0. The evolution of e-Learning (e-Learning 1.0, e-Learning 2.0 and e-Learning 3.0) is related to

the three generations of the Web (Web 1.0, Web 2.0 and Web 3.0). Web 2.0 and the associated technologies are well established and accepted by the user and the prevalence of these in e-Learning is common. This paper posits that, just like its predecessor, Web 3.0 technologies, once stable and well developed will further transform the e-Learning discipline. However, it does not seem that there is a need to call for a new learning theory as the theory of connectivism should be adequate. However, with the advent of any technology and its adoption, use of Web 3.0 and e-Learning will come with a plethora of technological, social, legal and ethical challenges. So the equation in the title can be modified to E-learning 3.0 = f (E-learning 2.0, Web 2.0, other factors and challenges), (here f means a *function of*) . Advanced technologies will continue to play a central role in the development and evolution of e-Learning; however it will do so more in the background providing connections between knowledge; so technology is not merely an enabling tool in education, rather a driver of change.

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