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WEB 3.0 AND ITS REFLECTIONS ON THE FUTURE OF E-LEARNING

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There are a multitude of diversity in Web 3.0 technologies available for integration in the educational environment, but considering how to implement these initiatives can be overwhelming to the instructor. The adoption of Web 3.0 technologies is very often simple and it involves more than the Internet and basic word processing skills. A review of Web 3.0 applications, which are inexpensive (often free), easy to implement, and require limited technology skills, is covered. Web 3.0 items that can be easily implemented by learners and/or instructors include weblogs, podcasting, RSS …etc. Web 3.0, which uses the Internet as its transfer mechanism can be an effective method of creating a dynamic learning and teaching experience.

Keywords: Web 3.0 technologies, Semantic Web, e-Learning, educational environment.

Introduction

Web 3.0 and its reflection on e-learning are still evolving and a clear vision of "E-Learning 3.0" is still in the future. Educators have the opportunity to influence emerging Web 3.0 technologies by helping to define that vision (Reynard, 2010). While utilizing many of these newer technologies in the classroom may seem foreign to veteran teachers, the youth entering universities today are accustomed to creating, learning and communicating using technology (Green & Hannon, 2007). It is not just the younger generation who has adapted to using technology on daily basis. According to Entertainment Software Association (2010), the average game player is 34 years old and 26% of the Americans over 50 play video games. According to Facebook's press room statistics (2011), people spend over 700 billion minutes a month of Facebook. Web 3.0 technologies and the advent of the Internet have changed how we gather and share information. In respect of different versions of web, the Wikipedia states: "*Web 1.0 is Read Only, static data with simple markup for reading. Web 2.0 is Read/Write dynamic data through web service customize websites and manage items. Web 3.0 Read/Write/Execute."*

In Web 2.0, user not only reads information from the Internet, but also provides information through internet to share with others. Currently, there are many popular Web 2.0 interactive applications like *Blog Podcast, Mashup, Tag, RSS/Atom, Wiki, P2P,…*etc. Views of different pioneers on the evolution of Web 3.0 vary greatly. Some believe that emerging technologies such as *Semantic Web* will transform the way the Web is used, and lead to new possibilities in artificial intelligence based applications. Other visionaries suggest that increase in Internet connection speeds, modular web applications, or advances in computer graphics will play the key role in the evolution of the new version of World Wide Web (Jinhong Cui, 2008).

Concept of Web 3.0

The term 'Web 3.0' was first coined by John Markoff of the New York Times in 2006 (Han & Niu, 2010), and first appeared significantly in early 2006 in a Blog article in early 2006 in a Blog article "*Critical of Web 2.0 and associated technologies such as Ajax"* written by *Jeffery Zeldman.* Major IT experts and researchers support different approaches to the future Web. There is complete agreement among the experts about how Web 3.0 will evolve. Yu (2007) defines Web 3.0 and/or the Semantic Web as " *the next step in Web evolution. It is about having data as well as documents on the Web so that machines can process, transform, assemble, and even act on the data in useful ways"*. (p.8). Semantic is defined as *"meaning"*; the Semantic Web allows computers to *understand the meaning* of information as opposed to simply displaying information. A common example used to help Semantic Web novice fully understand the capabilities of the Semantic Web is a comparison between a traditional Search engine and semantic search engine (Ohler, 2008; Yu).

Traditional search engines can be frustrating to users. Users enter keywords for the search and then must evaluate typically sizeable results and determine which results are relevant. A semantic search engines utilizes semantics and knowledge coded into vocabulary sets which are interpreted by "smart agents" which then conduct intelligent searches returning pertinent information to the user (Yu, p. 36).

Capabilities of Web 3.0 Technologies

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, 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). As mentioned above, 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 websites and webpages created 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 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 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 of Web 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 a cross programs and across the web;

- 3D Virtualization: Extensive use of 3D modeling and 3D spaces using service like second life and personalized avatars connected to your devices;
- Distributed and Cloud Computing: The delivery of computing as a service rather a product.

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).

E-Learning Trends for Web 3.0

Education researchers are now quite freely using the term eLearning 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 eLearning. Teaching effectively online is not just posting traditional classroom materials to a course management system. The workload for online instructors is often more than expected; technology does not reduce an instructor's workload, it just changes the nature of the workload (Devedzic, 2006). The Semantic Web has the means to assist instructors in course development, learner support, assessment, record keeping and document control task (Koper, 2004; Anderson & Whitelock, 2004).

Brindley, Walti, and Blaschke, (2009) state "Quality learning environments include opportunities for students to engage in interactive and collaborative activities with their peers; such environments have been shown to contribute to better learning outcomes, including development of higher order thinking skills". Ounas, Davis, and Millard (2008) offer a framework for using the Semantic Web to form optimal collaborative learning groups. Student features are modeled using ontologies, such as Friend of Friend (a social ontology), to form reliable dynamic learner profiles. Modeled features include personal details, course details, interests, team roles, preferences, and social connections. Daly (2009) states: "The Semantic Web offers learners the possibility of having a wealth of related content delivered to their desktop without explicitly identifying or requesting it". Content stored within virtual words, such as Second Life, can be used by instructors to enhance learning experiences and provide relevant and interesting learning interactions to learners (Daly, 2009).

Anderson and Whitelock, (2004) define Semantic Web as "real work and study contexts". Clark, Parsia, and Hendler (2004) stat: "the added expressivity of the Semantic Web, coupled with search and query tools already under development, will allow changes in non-scientific fields as well. For example a number of historians could each annotate the same document to express differences of opinion about its comment, creating communities of deconstruction". Data collections (ontologies) from different fields will be linked creating "a network effect in academic knowledge" (Clark, Parsia & Hendler).

Characteristics of Web 3.0

As given below, four characteristics can be summarized:

Personalization

Web 3.0 era is personalization; personal and/or individual preferences would be considered during different activities such as information processing, search, formation of personalized portal on the web.

Semantic Web would be the core technology for personalization in Web 3.0 (Russell, K. 2006; & Zhang, Y. 2009).

Intelligence

Experts believe that one of the most promising features of Web 3.0 will be web with intelligence, i.e., an *intelligent web.* Applications will work intelligently with the use of Human-Computer interaction intelligence. Different Artificial Intelligence (AI) based tools and techniques such as, rough sets, fuzzy sets, neural networks, machine learning …etc. will be incorporated with the applications to work intelligently. This means, an application based on Web 3.0 can directly do intelligent analysis, and then optimal output would be possible, even without much intervention of the user. Documents in different languages can be intelligently translated into other languages in Web 3.0 era. Web 3.0 should enable us to work through natural language. Therefore, users can use their native language for communication with the others round the world (Hang, X. & Niu, L. 2010).

Virtualization

Web 3.0 would be a web with high speed internet bandwidths and High end 3D Graphics, which can better be utilized for virtualization. The trend for the future web refers to the certain of virtual 3D environments. An example of the most popular 3-D web application of Web 3.0 is Second Life (Russell K. 2006).

Interoperability

In the context of Web 3.0, the terms Interoperability collaboration and reusability are basically interrelated (Rajiv, T. & Lai, M. 2011). Interoperability implies reuse, which is again a form of collaboration. Web 3.0 will provide a communicative medium for knowledge and information exchange. When a person or a software program produces information on the web and this information is used by another, then the creation of new form of information or knowledge takes place (Mathieu, d. & Enrico, M. 2008). Web 3.0 applications would be easy to customize and they can independently work on different kinds of devices. An application based on Web 3.0 would be able to run on many types of Computers, Microwave devices, Hand-held devices, Mobiles, TVs, and many others. Pervasive Web is the term used to describe this phenomenon where web is operable to a wide range of electronic devices.

Related Learning Theories and the Web 3.0

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 eLearning 1.0) Cognitivism opens up the 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 1, in terms of the view learning process, locus of learning and purpose of education; Table 1 is adapted from Ashworth et al., (2004) adding a column to relate with the connectivist approach (Siemens, 2004).

Table 1. Summary of learning theories (adapted from Ashworth et al., 2004; Seimens, 2004

Theories of Learning				
Aspect	Behaviorist	Cognitivist	Constructivist	Connectivist
Learning Theories	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 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; starting 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 cover skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.

The simple approach has been taken in this paper 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.

Conclusion

Web 3.0 is more than a set of useful and new technologies and services. Web 3.0 technologies offer an array of services to make a true e-Learning environment. Because of its very nature Web 3.0 services will be having a positive impact on teaching and learning. This research 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 new learning theory as the theory of connectivism should be adequate. However, with the advent of any technology and its adoption, Web 3.0 reflections on the future of e-Learning will come with a plethora of technological, social, legal and ethical challenges. Web 3.0 technologies offer benefits of Intelligent Agent based search engines, Virtual environments like Avatar and Semantic Digital Libraries etc.

On the other hand, there is great potential for the Semantic Web to impact learning processes. Daly (2009) stats, “The prospect of applying sematic concepts to learning administration as well as direct pedagogy could offer benefits to the institution and the learner,” p. 2). Smart agents can only perform their tasks if the information on the Web has semantic meaning (Anderson & Whitelock, 2004). Human motivation for tagging knowledge and security concerns about accessibility of information are obstacles to Web 3.0 that will need to be resolved (Anderson & Whitelock; Daly, 2009).

References

1. Anderson, T., & Whitelock, D. (2004). The Educationl Semantic Web: Visioning and Practicing the Future of Education. *Journal of Interactive Media in Education, 1*, 1-15. Retrieved from http://www-jime.openac.uk/2004/1/editorial-2004-1.pdf
2. Ashworth, F., Brennan, G., Egan, K., Hamilton, R. & Saenz, O (2004). Learning Theories and Higher Education. Level3, Issue2. Retrieved from http://arrow.dit.ie/cgi/ on January 8, 2015.
3. Berners-Lee, T. (1995). Past, Present and Future. *IEEE Computer, 29*(10), 69-77.
4. Berners-Lee, T, Hendler, J., & Lassila, O. (2001). The Semantic Web. *Scientific American, 284*(5), 34-43. Retrieved from Academic Search Premier data-base.
5. Berners-Lee, Video. Berners-Lee, T. (2008). The Semantic Web of Data. Retrieved from http://www.youtube.com/watch?v=HeUrEh-nqtU on February 3, 2015.
6. Brindly, J.E., Walti, C., & Blaschke, L.M. (2009). Creating Effective Collaborative Learning Groups in an Online Environment. *The International Review of Research in Open and Distance Learning, 10*(3). Retrieved from http://www.irrodl.org/index.php
7. Cho, A. (2008). What is Web 3.0? Suite101. Retrieved from http://www.suite101.com/internet On Jan. 2015
8. Clark, K., Parsia, B., & Hendler, J. (2004). Will the Semantic Web Change Education? *Journal of Interactive Media in Education, 3,* 1-16. Retrieved from www.jime.open.ac.uk/2004/3/clark-2004-3.pdf
9. Daly, C. (2009, April 9). The Semantic Web and E-Learning. *eLearn Magazine Education and Technology in Perspective.* Retrieved from http://www.elearning.org/subpage.cfm?section=articles&article=77-1
10. Devedzic, V. (2006). *Semantic Web and Education (Integrated Series Information Systems)* (1st. ed.). New York: Springer.
11. Facebook. (2011). Press room, Statistics. Retrieved http://www.facebook.com/press/info.php?factsheet
12. Fischetti, M. (2010). The web turns 20. Linked data gives people power. *Scientific American.* Retrieved from http://www.scientificamerican.com/article.cfm?id=bernes-lee-data on January 12, 2015.
13. Forrester Research, (2006). Search engine usage report, Retrieved http://www.seowritingjobs.com/organic-search-engine-results-why-they-meam-more-work-for-seo-copywriters/ on January 2015.
14. Green, H. & Hannon, C. (2007). Their space: Education for a digital generation. Retrieved http://www.demos.co.uk/files/Their%20-%20web.pdf.
15. Han, X., & Niu, L. (2010). Subject Information Integration of Higher Education Institutions in the Context of Web 3.0 , *IEEE, 2nd International Conference on Industrial Mechatronics and Automation,* 978-1-4244-7656-5.
16. Jinhong, C. (2008). Capability Sharing Architecture and Implementation in IM or SNS, *IEEE,* 978-1-4244-2013-1.
17. Koper, R. (2004). Use of the Semantic Web to Solve Some Basic Problems in Education: Increase Flexible, Distributed Life long Learning Decrease Teachers' Workload. *Journal of Interactive Media in Education, 6,* 1-23.
18. Mathieu, d., & Enrico, M. (2008). Collaborative Semantic Authoring, *IEEE,* 1541-1672.
19. Moore, D. (2010). Web 2.0. Darcy Moore's Blog. Retrieved http://darcymoore.net/ on January 3, 2015
20. Morville, P. (2005). Ambient Findability: O'Reilly Media.
21. Ohler, J. (2008b). Web 3.0 – The Semantic Web Cometh. *Docstoc.* Retrieved from http://www.docstoc.com/docs/25619755/Web-3.0---The-Semantic-Web-Cometh/
22. O'Reilly, T. (2004). What is Web 2.0: Design patterns and business models for the next generation of software. Retrieved from http://www.oreillynrt.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html in December 2014.
23. Ounnas, A., Davis, H. and Millard, D. (2008). Semantic Web-based Group Formation for E-learning. In *:PhD Symposium in the 5th European Semantic Web Conference 2008.* Retrieved from http://eprints.ecs.soton.ac.uk/15855/
24. Rajiv, T.A. & Manohar, L. (2010). Web 2.0 in Agriculture Education. *International Conference on Agriculture Education & Knowledge Management,* Agartala (Tripura), India.

25. Rajiv, T.A. & Manohar, L. (2011). Web 3.0 in Education & Research. *International Journal of Information Technology,* Vol. 3 No 2, ISSN 0973-5658.
26. RDF, (2004). Resource Framework Description W3c Semantic Web. Retrieved from http://www.w3.org/RDF in December 2014.
27. Rego, H. Moreira, T., Morales, E., and Garcia. F.J. (2010). Metadata and Knowledge Management driven Web-based Learning Information System towards Web/e-Learning 3.0 Int. *Journal of Emerging Technologies in Learning (iJET), 5*(2) 36-44.
28. Reynard, R. (2010, February 3). Web 3.0 and Its Relevance for Instruction. *THE Journal.* Retrieved from http://thejournal.com/articles/2010/02/03/web-3.0-and-its-relevance-for-instruction.apx
29. Rubens, N., Kaplan, D., & Okamoto, T. (2011). E-Learning 3.0: anyone, anywhere, anytime, and AI. In International Workshop on Social and Personal Computing for Web-Supported Learning Communities (SPeL 2011).
30. Russell, K. (2006). Semantic Web. *Computer World (9)*: 32.
31. Semweb. (2011). Semantic Web Tutorial. W3Schools, Retrieved from http://www.w3schools.com/semweb/default.asp in December 2014.
32. Siemens, G. (2004). Connectivism: A learning theory for the digital age. Retrieved from http://www.elearnspace.org/Articles/connectivism.html. On January 2015.
33. Smith, M. K. (1999). Learning theory. *The encyclopedia of informal education.* Retrieved from www.infed.org/biblio/b-learn.htm. In Jan. 2015
34. W3CSW. (2009). Semantic Web Activity W3C. Retrieved from http://www.w3.org/2001/sw/ in Jan. 2015
35. Waters, S. (2010). Sue Waters Blog, Retrieved from http://suewaters.com/ in Jan. 2015
36. Wheeler, S. (2009a). E-Learning 3.0, Learning with e's. Retrieved from http://stevewheeler.blogspot.com/2009/04/learning-30.html#!/2009/04/learning-30.html in Dec. 2014.
37. Yu, L. (2007). *Introduction to Semantic Web and Semantic Web Service.* Boca Raton, FL: Chapman & Hall//Crc.
38. Zhang, Y. (2009). The Development of Web and Library. Reference Service-from Web 1.0 to Web 3.0. *Sci-Tech Information Development & Economy,* Vol. 18.