

E-Learning in Web 3.0

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Abstract—Web 2.0 is about social networking and collaboration between the creator and the user. Web 3.0 is termed as intelligent web or semantic web with technologies like big data, linked data, cloud computing, 3D visualization, augmented reality and more to make passive learner into active learner in the learning process. This paper identifies the characteristics of the different generations of web and its effect on the different generations of e-learning and also identifies the various issues related with web 3.0. Finally a study is made on the user preferences and recorded in this paper.

Index Terms—Learning Styles, e-Learning 3.0, Web 3.0, Web 4.0, Collaborative learning.

I. INTRODUCTION

A. Learning

Learning is a two phase process that involves reception and processing of the information received. Reception engages the various senses to gather information from external sources, whereas the internal activities of memorization, induction, deduction, introspection, reflection are primarily necessary in the processing activity. [1]. Every learner has a preferred way of reception and process the information. This activity is known as a learning style. According to Felder-Silverman [2] there are 32 different styles of learning.

Once a teacher becomes aware of these learning styles he will become more sensitive in designing classroom activities that enhances the teaching-learning process. Numerous learning styles theories are proposed by various theorists and have classified them based on characteristics of learning. Synthesis of learning style theories are tabulated in Table 1. Felder-Silverman classified the learning characteristics as the following.

B. Active

Active learners always learn by action, through physical activity or by discussion to try, test, analyze and

prefer to work in a group/team.

C. Reflective

Reflective learners are deep thinkers. Basically they think over their observation by introspection and prefer to work individually or in pairs.

D. Visual

Visual aids such as pictures, diagrams, graphs, flowcharts, videos, demonstrations enhance the visual learning. Most of the learners feel that visual learning is the best way to learn easily and effectively.

E. Verbal

Auditory learners often talk to themselves. They also move their lips and read out loud. They often do better talking to a colleague.

F. Sensing

The other physical sensations [4] like touch, smell, taste primarily involve in the act of sensing. This method is the prime method in the field of physical and chemical sciences and catering.

G. Intuitive

Intuitive learners tend to focus more on the world of possibility. They are basically Theoretical, intellectual, and knowledge oriented. Intuitive thinkers prefer to be challenged intellectually and to think things through for themselves. They are curious about ideas. Unlike the sensing learners, the intuitive learners [4] use indirect perception such as speculation and imagination to unravel the mystery behind the truth.

H. Sequences

Sequence learning is a step by step learning. This method provides information in an incremental way to the learner, encouraging him to take a step forward in linear way. Such kind of learners will be strong in convergent thinking and analysis.

I. Global

Global learner [5] learn in large jumps, leap. They may find it difficult to explain how they reached the solution. It is just the opposite of sequence learners they are good in divergent thinking and synthesis.

This paper is structured as follows. Section II describes about e-learning and lists some of the popular learning styles. Section III identifies the web characteristics from web1.0 to web 4.0. Section IV shows the analysis of the attributes that determines the factors for application development in web 3.0. Finally a brief conclusion is described in section V.

II. E-LEARNING

Education is defined as a conscious attempt to promote learning to others to acquire knowledge, skills and character. To achieve this mission, different pedagogies were used. Later, the advent of new information and communication technologies and internet make the teaching and learning process simple and extend to the birth of e-learning. The e-learning enables the learner to set up his own phase of learning. Breaking the limitation of geographical barriers, it promotes individual learning [5]. The e-learning is nothing but, the extensive use of internet, electronic devices and network to disseminate knowledge. The key factors of e-learning are reusing, sharing resources and interoperability. At present, various organizations provide e-learning tools with multiple

functionalities. MOODLE (Modular Object Oriented Dynamic Learning Environment) is one among them which would support the e- learners. This in turn created difficulty in sharing the learning objects between heterogeneous sites, and standards such as SCORM & SCORM LOM [6], IMS & IMS DRI [7], AICC [8] and likewise were proposed by different organizations to overcome this difficulty.

III. EVOLUTION OF WEB AND E-LEARNING

A. Web 1.0, e-Learning 1.0 (Link to anything)

The internet was invented by Tim Berners-Lee in 1989, with the vision of communicating or sharing information in a common information space, called web. [9]. By the exponential growth, it became a platform to store and access various versions of learning contents such as text, pictures, audio and video. The main drawback of web 1.0 is the creation of the content and sharing with others. The users are unable to curate knowledge. As a result the web 1.0 is vividly recognized as read only web with its general attributes like static information and minimal interaction between web sites. Beside this, e-learning 1.0 evolved along with web 1.0 with many Learning management systems (LMS) like copying the various aspects of traditional learning with databases, communication tools and task solutions. Finally, the Web 1.0 allows to incorporate the learning theories of instructivism, behaviorism and cognitivist.

Table 1. LEARNING STYLES [3]

	Characteristic's				
1	Accommodating	Diverging	Converging	Assimilating	
2	Activists	Reflectors	Theorists	Pragmatists	
3	Environmental	Emotional	Sociological	Physiological	Psychological
4	Active / Reflective	Visual / Verbal	Sensing / Intuitive	Sequential / Global	
5	Visual	Auditory	Kinesthetic		

1- David Kolb's LMS, 2-Peter Honey and Alan Mumford's LMS, 3-Dunn and Dunn LMS, 4-Felder-Silverman LMS, 5-Felder-Silverman LMS

B. Web 2.0, e-Learning 2.0 (User Participation)

As stated in Wikipedia, web 2.0 is a transition from web sites. Added to that, it is a full computing platform, replacing desktop applications with web applications, with attributes like network as platform, continuous updated software, consuming and remixing data from various sources [11]. “Digital Natives” were able to curate content and it demands the learner to participate actively in the learning process. Web 2.0 is entirely learner centric reality; therefore, teaching and learning process became less separated. It allows to use the other learning theories like constructivism and Social Constructionism. Figure 1 depicts the evolution of the web and Table 2 tabulates the characteristics of different generations of web.

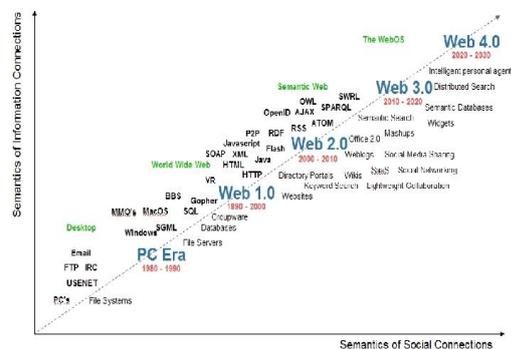


Fig 1. EVOLUTION OF WEB [10]

Web 3.0, e-Learning 3.0 (Existing Data Reconnected)

The predictions of web 3.0 vary due to the difference in the technologies which will make up web 3.0. Web 3.0 is still in its formative years but the early indicators indicate that it will include the technologies depicted in Figure 2. E-Learning has been evolving along the side of world wide web. E-learning 1.0 was all about providing information to users, e-learning 2.0 was about providing information, authoring the contents and interaction capabilities. E-learning 3.0 had the capabilities of e-learning 1.0, 2.0 and rich 3D virtual learning environment. The table 3 illustrates the relationships between the generations of e-learning. It remains as a hypothesis how these technologies may be utilized in e-learning 3.0.

Table 2 CHARACTERISTICS OF WEB 1.0, WEB 2.0 AND WEB 3.0

Web 1.0	Web 2.0	Web 3.0
Read	Read and Write	Read, Write and Execute
Client Server	Peer to Peer	Portable Personal Web
HTML, Portals	XML, RSS	RDF
Companies Own	Communities Share	Individuals
Web Pages	Web Applications	Semantic Applications

Artificial Intelligence

Most of the success of AI are mainly in the closed domains, where rules and objectives are well defined but limited in open domains like education where there is large set of data and require significant computing power. But, now the invention of cloud solved the problem of storing huge amount of data, establish links between datasets by linked data and to perform computation.

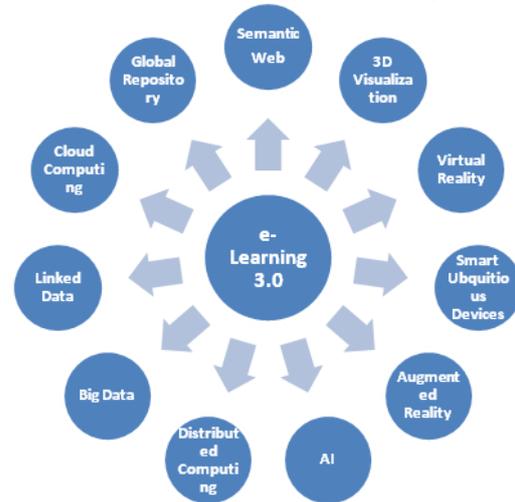


Fig 2. TECHNOLOGIES IN E-LEARNING 3.0

C. Big Data

The web 2.0 technologies like wikis, blog, tweets generate vast amount of data, yet, they are all underutilized. Therefore, AI became a perfect tool to extract the patterns in the vast amount of data and its utilization.

D. Linked Data

The data generated by web2.0 is in free-form and with different characteristics. Hence, they could not be linked, processed and utilized. Linked data framed by Berners-Lee is a set of practices for publishing and connecting datasets on web. The linked data principles are listed in [12].

E. Cloud Computing

Significant amount of infrastructure is necessarily required to process and analyze large set of data produced by web. To perform this process cloud computing services can be utilized without much burdening the exchequer.

F. 3D Visualization

3D visualization and interaction enrich the learning, by making a whole range of tasks easier including fine motor skill interaction, exploration of virtual spaces and manipulation of virtual objects.

G. Augmented Reality and Virtual Reality

Augment reality is a live, direct or indirect view of a real world which is been augmented by computer [13]. Augmented reality technologies recognize what the user is doing and tries to enhance it. This technology

enhances ones perception on reality whereas the virtual reality substitutes the real world with a simulated one.

H. Semantic Web

Semantic web was introduced as an extension to the WWW to allow machines to search and process web contents, based on their meanings and find relationships between them using inference rules and organizational tools. Hitzler et al. identifies that semantic web can be used to

1. Describe knowledge – Semantic web adds machine understandable form of data about the documents and how they are related. It is done using Resource Description Framework (RDF), RDF Schema (RDFS), Web Ontology Language (OWL), query language for RDF (SPARQL), SKOS (Simple Knowledge Organization System).
2. Reason out meaningful conclusions.
3. Exchanging information is done with TCP/IP protocols and file formats like RSS.

I. Distributed Computing

In distributed computing, a task can be tackled by various computers. In it each computer performs its own

assigned task. Scientists believe that the web will become a giant brain, able to think by distributing, analyzing and extrapolating [15].

J. Hand held and Wearable Devices

E-learning was revolutionized by performing teaching learning process of anywhere, anytime, anything by means of hand held and wearable devices. Some of the devices can be PDA, smart phones, tablets, hand held, hand/leg worn, head worn etc. These devices are miniature electronic devices worn by the learner which are connectable, accessible, flexible, wireless performing ubiquitous computing [16]. Wearable devices are also applied in sensory integration, behavioral modeling, health care, service management, electronic textiles [17].

K. Challenges in Web 3.0, e-learning 3.0

The first major challenge is due to the nature of web 3.0 its vastness, interoperability, lack of server side checks, less privileges control and increased privacy and security risk [18]. The second major issue is whether the current education scenario is ready to utilize the benefits of web 3.0 when they are still struggling with the previous generations [19].

Table 3. RELATIONSHIP BETWEEN GENERATIONS OF E-LEARNING

Version	Concept	Technologies
1	Content Management Read or Write Only	CBT, Learning Management Systems, eBooks, Virtual Learning Environment
2	Read and Write Blended Learning, Content Authoring, Collaborate, Multimedia Content	LCMS, Social Networks, Audio/ Video Conference Social, Mashups
3	Learner-Centeric, U-learning, Knowledge representation	PLEs, Mashups Social, Semantic Web, Personal Agents, Big Data, Linked Data, 3D, Global Database

L. Web 4.0 (Read/Write/Execute/Concurrency)

It is still in its infancy, there is no concrete definition on its appearance and its operations. It is named as symbiotic web in which human mind can interact with the machine in symbiosis. Even though there is no idea on technologies in web 4.0 it is sure that AI would play a greater role in making the web, which would interact with the humans in a high intelligent way [20, 21].

IV. ANALYSIS OF THE ATTRIBUTES IN WEB 3.0

Attributes identify the way an application in web 3.0 will be. The attributes considered are the preferences of

the learner and they are 3D, augmented reality or virtual reality, ubiquitous and wearable devices, audio/video/text, related files/sites intelligently filtered. Data was collected on these attributes using a questionnaire with closed type of questions from 100 graduate and post graduate students in our campus. The analysis of these attributes determines the factors for application development in web 3.0. The sample questionnaire is tabulated in Table IV. The frequency statistics for questions in the questionnaire are tabulated in Table V, Table VI, Table VII, Table VIII, Table IX, Table X and Table XI. The Correlation between the different variables in the questionnaire is tabulated in Table XI.

Table 4. SAMPLE QUESTIONNAIRE

S.No	Question Type	Response Type
1	Do you prefer a 3D Tutor?	Yes/No
2	Are you sensitive to the gender of the 3D Tutor?	Yes/No
	Do you prefer the learning objects to incorporate a) 3D Visuals b) Virtual Reality c) Augmented Reality d) Text e) All of the Above	a/b/c/d
3	Preferred way to communicate with the Tutor a) Lap Top b) Ubiquitous Devices c) Wearable Devices	a/b/c
4	Your preferred way of communicating with the Tutor a) Text b) Voice	a/b
5	Aggregation of the Web Resources can be done by I. Tutor II. Yourself	a/b
6	Do you Prefer a) Sequential Learning Path b) Personalized Learning Path	a/b
7	You preferred way of communicating with the Tutor a) Any point of time (Random) b) Only at the end	a/b

Table 5. PREFERENCE FOR A 3D TUTOR

	Frequency	Percent
Yes	86	86.0
No	14	14.0
Total	100	100.0

Table 6. GENDER SENSITIVITY TO THE 3D TUTOR

	Frequency	Percent
Yes	55	55.0
No	45	45.0
Total	100	100.0

Table 7. PREFERRED LEARNING OBJECTS

	Frequency	Percent
3D Visuals	28	28.0
Virtual Reality	30	30.0
Augmented Reality	18	18.0
Text	24	24.0
Total	100	100.0

Table 8. COMMUNICATION DEVICES

	Frequency	Percent
Lap Top	42	42.0
Ubiquitous Devices	9	9.0
Wearable Devices	10	10.0
All of the Above	39	39.0
Total	100	100.0

Table 9. MEANS OF COMMUNICATING WITH THE TUTOR

	Frequency	Percent
Text	16	16.0
Voice	31	31.0
All of the Above	53	53.0
Total	100	100.0

Table 10. POINT OF COMMUNICATION WITH THE TUTOR

	Frequency	Percent
Any point of time (Random)	60	60.0
Only at the end	40	40.0
Total	100	100.0

Table 11. AGGREGATION OF THE WEB RESOURCES

	Frequency	Percent
Tutor	19	19.0
Yourself	34	34.0
All of the Above	47	47.0
Total	100	100.0

Table 12. PREFERRED LEARNING PATH

	Frequency	Percent
Sequential Learning Path	55	55.0
Personalized Learning Path	45	45.0
Total	100	100.0

Table 13. CORRELATIONS

	1	2	3	4	5	6	7	8
1	1							
2	-.017	1						
3	-.085	.087	1					
4	-.178	.254 (*)	.444 (**)	1				
5	-.239 (*)	.280 (**)	.225 (*)	.433 (**)	1			
6	.041	.221 (*)	.085	.289 (**)	.188	1		
7	-.017	.192	.069	.063	.091	-.69	1	
8	.141	.041	.141	.009	-.077	.128	.000	1

1 – Preference for a 3D Tutor

2 – Gender Sensitivity of the 3D Tutor

3 – Preferred Learning objects

4 – Preferred Communication Devices

5 – Means of Communicating with the tutor

6 – Aggregation of the Web Resources

7 – Preferred Learning Path

8 – Communicating with the Tutor

* – Correlation is significant at the 0.05 level (2-tailed)

** – Correlation is significant at the 0.01 level (2-tailed).

Table 14. LEARNING PATH PREFERENCE

Degree	Preference towards Sequential and Personalized Learning Path		Total
	Sequential Learning Path	Personalized Learning Path	
Under Graduate	22 (44.0) (40.0)	28 (56.0) (62.2)	50 (100.0) (50.0)
Post Graduate	33 (66.0) (60.0)	17 (34.0) (37.8)	50 (100.0) (50.0)
Total	55 (55.0) (100.0)	45 (45.0) (100.0)	100 (100.0) (100.0)

Table XIII describes that majority (66.0) of the post graduate students preferred sequential path learning, because they are very fashioned in the chronological learning path and more than half (56.0%) of the

undergraduate students preferred to have a personalized path learning.

Association (Chi Square Test)

Chi Square Value: 4.889

Degree Of Freedom: 1

Significance Value: 0.04

H0: There is no association between Degree of Study and their Preference towards Sequential or Personalized Learning Path.

H1: There is an association between Degree of Study and their Preference towards Sequential or Personalized Learning Path.

V. CONCLUSION

This paper provides an overview of the evolution of web and e-learning from web 1.0 to web 4.0. The attributes of each generation were introduced and discussed. Finally, it concludes that the web space develops rapidly and makes its progress into the future by including artificial intelligence to enable web to interact with human in highly intelligent manner.

From the analysis on the dataset collected, H0 can be rejected since the level of significance value is less than the 0.05, and it could be concluded that there is an association between of the degree of study and preference of a learning path. So these attributes should be given preferences while designing / developing of e-learning 3.0 applications.

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