

## A Study of Web 3.0 Technologies for Collaborative Learning

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*Abstract: Learning is a process that accompanies us during our whole life, starting with school being followed by higher education at colleges or universities up to extra-occupational further training. Earlier, students gathered information by listening to face-to-face lectures, searching the stacks of libraries and reading books. But, today technology has changed the way we learn and work. The easy availability of web technologies has given the power to the students to construct their own learning paths. Of all the learning types, collaborative learning has earned a lot of popularity. This paper begins by identifying the aims and benefits of online collaborative learning. It further provides an overview of the evolution of the web from Web 1.0 to Web 3.0. This paper also provides insights into the new Web 3.0 tools and technologies that allow learners to collaborate with each other and learn and teach at the same time. Finally, a review of "Wiki-Learnia- a Web 3.0 platform for collaborative learning" is presented.*

**Keywords:** collaborative learning, semantic web, Web 1.0, Web 2.0, Web 3.0

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### I. INTRODUCTION

Education sector is experiencing a major innovation and the instrument in this development is the web technologies. The omnipresent web technologies offer enhanced environment for scholarly interaction and intellectual pursuit. Today, learners decide when and where they want to learn as learning is accessible 24/7. Learners can choose how and what to learn according to their personal learning style and development goals. The current web technologies are immensely valuable as they serve the larger educational goals: to create active learners who have the opportunity to engage in self-directed learning activities that promote critical thought, co-operative learning and interaction not only with their immediate environment but with the outside world as well.

The easy availability of web technologies has given rise to a new form of learning called online collaborative learning. Collaborative learning is a type of learning in which students learn in teams. It centers on the students' discovery, study and use of information in a collaborative manner, rather than an instructor simply lecturing and the students individually and passively taking notes. It also gives the students the opportunity to analyze, create, and evaluate ideas together which further helps in the development of communication skills such as discussion skills.

Online collaboration platforms refer to a range of web based tools that allow people who may not be geographically co-located to do things together online. This may include online conversations in forums, real time video communication, co-creation of documents on wikis, file sharing and storing etc. This paper identifies most popular online collaborative learning tools that can help educators and learners in effectively meeting their teaching and learning goals.

The web has transformed from Static Web 1.0 to Semantic Web 3.0. This gradual transition of Web 1.0 to Web 3.0 over the last three decades has had a tremendous impact on education [1]. Web 3.0 shifts the focus entirely on the learner as learning through semantic web technologies is self directed and self regulated. Web 3.0 tools for online learning use artificial intelligence techniques for providing automatic feedback to the learner and also allows learners to customize learning based on their preferences. Semantic web provides opportunities to learners in different age groups to collaborate with each other to accomplish their learning goals.

One such platform for online collaborative learning is *Wiki-Learnia*. Wiki-Learnia is a learning system for digital natives developed by University of Rostock, Germany. It is wiki software, which allows you to create and edit collaborative learning content within the community (crowd-sourcing). It offers various tools of communication such as chat, messaging system and forum. Different types of learning content e.g. MOOC (Massive Online Open Course) portals, news services, Internet encyclopedias, social networks and various other Web 2.0 platforms can be integrated by using automated methods[2]. This paper investigates the key features of this Web 3.0 learning platform.

## II. COLLABORATIVE LEARNING

Collaborative Learning is an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a product.

In the collaborative learning environment, the learners are challenged both socially and emotionally as they listen to different perspectives, and are required to articulate and defend their ideas. In so doing, the learners begin to create their own unique conceptual frameworks and not rely solely on an expert's or a text's framework.

In a collaborative learning setting, learners have the opportunity to converse with peers, present and defend ideas, exchange diverse beliefs, question other conceptual frameworks, and are actively engaged[3].

When collaborative learning occurs in a virtual learning space by using web technologies then it is called *Online Collaborative Learning*.

Collaborative learning offers numerous benefits and improves the efficiency of teaching-learning process.

- Uses a team approach to problem solving while maintaining individual accountability [4].
- Collaborative learning often allows for “peer coaching,” when the higher achieving students can help their less achieving team members understand a problem and its possible solutions.
- Greater ability of students to view situations from others' perspective.
- Develops higher level thinking skills which helps in effectively solving real world problems.
- Students explore alternate problem solutions thus obtaining optimal solutions to complex problems.

## III. POPULAR WEB-BASED COLLABORATIVE LEARNING TOOLS

Building a collaborative learning environment is a complex process. Web-based collaborative learning tools enable smooth collaboration among learners as well as their instructors in a group. These tools allow digital learners to collaborate with each other, create content, share their work and get feedback from readers globally. This section examines the features and capabilities of a variety of online tools that help in facilitating collaboration.

### A. *Collaboration Suites*

Several companies have developed families of applications that meet a range of collaborative needs. These systems usually include traditional desktop applications for word processing, spreadsheets, communication, or calendaring. *For example- Google Docs*[5]

- This online collaboration tool allows documents to be written, edited, collaborated upon and accessed from any remote location at any time and from various devices.
- Changes get automatically saved in documents as being typed upon.
- By referring revision history of a document, its old versions can be seen and can be sorted by date. It can be known who made a specific change.
- It also offers chat and commenting options.

### B. *Real time communication tools*

These tools are especially useful for project teams as well as students that are not co-located. *For example- Skype*[6]

- Skype's reliability and ease of use makes it a preferred choice for remote collaboration.
- It boosts online group learning. Instructors can conduct video meetings with groups.
- However, its limitation is that it is not suited for asynchronous communication.

### C. *Collaborative Concept Mapping tools*

These tools allow students to understand the relationships between ideas by creating a visual map of the connections. *For example- Mind Meister* [7]

- This collaborative web based tool enables groups to do planning or brainstorming on one mind map document during the early phases of group work.
- Groups can also use the document for collaborating during the course of a project as per the nature of their assignment.

- It has got the live chat feature for direct and fast communication. At the same time, Mind Meister can also be asynchronously used.

*D. Webinars*

Webinars are the seminars conducted over the web. *For example- Big Marker [8]*

- This web conferencing service facilitates communication among learning group members through webinars.
- Members can be invited to participate in a webinar through automatic email invitations.
- Webinars can be tracked through calendar.
- Presentations, audio and chat can be effectively recorded for later viewing and sharing. So members missing the live events can view their recorded version and gain from them.
- Participation and attendance of group members in events can be effectively tracked through member's page.

*E. Presentation and Slide Sharing*

Presentation and Slide Sharing tools enable you to easily upload and share presentations online. *For example- SlideRocket [9]*

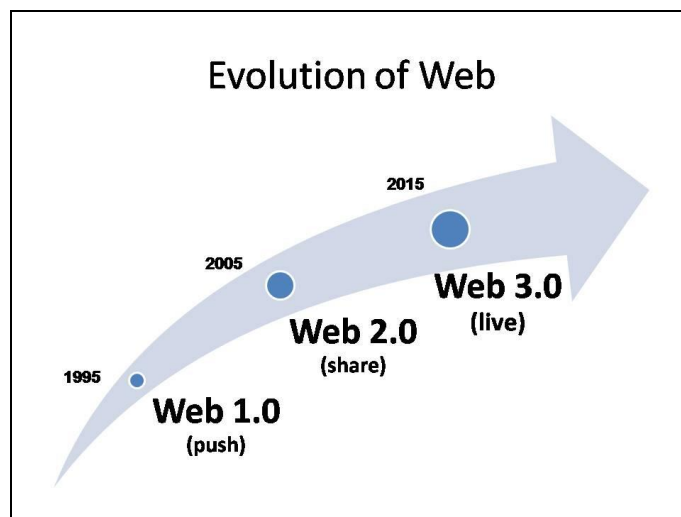
- Members in a learning group can collaboratively work on one presentation document.
- Each document gets a specific URL which can be submitted to an instructor for easy viewing.
- Data can be pulled in real time from Google Spreadsheets and Twitter live feeds.
- SlideRocket analytics helps to measure a presentation's effectiveness by giving information about who viewed it and what was their response.

*F. Wikis*

Wikis are most effective for collaborative writing or collaborative creation of text-based documents. *For example- Wikipedia[10]*

- It is basically a page or collection of web pages that allows anyone with proper privileges to modify, add, or delete content.

IV. EVOLUTION OF WEB



*Fig. 1: Evolution of Web*

Since the 1990s when the World Wide Web was established, it has evolved from the earlier versions, Web 1.0 to the latest version Web 3.0. It is essential to understand how this transformation happened.

*A. Web 1.0*

Web 1.0, or web, refers to the first stage of the World Wide Web linking WebPages with hyperlinks. Here static pages were used to explain the data. According to Tim Berners-Lee, Web 1.0 could be considered as a read-only web. Web 1.0 began as an information place for businesses to broadcast their information to people. The early web provided a limited user interaction and only allowed to search the information and read it. Hence, the main goal of the websites was to publish the information and establish an online presence [11].

B. *Web 2.0*

Web 2.0 describes World Wide Web sites that use technology beyond the static pages of earlier Web sites. The term is claimed to have been coined in 1999 by Darcy DiNucci [12]. Web 2.0 is also known the participative web and read-write web. A Web 2.0 site may allow users to interact and collaborate with each other in a social media dialogue as creators of user-generated content in a virtual community, in contrast to Web sites where people are limited to the passive viewing of content. Examples of Web 2.0 include social networking sites, blogs, wikis, video sharing sites and mash-ups.

C. *Web 3.0*

John Markoff of the New York Times suggested Web 3.0 as third generation of the web in 2006[13]. Web 3.0, the newest phase of Internet use, is known as the *Semantic Web*. It includes the features of previous web versions and adds the awareness of location and preferences.

Google's CEO, Eric Schmidt [14] stated:

“Web3.0 is a series of combined applications. The core software technology of Web3.0 is artificial intelligence, which can intelligently learn and understand semantics. Therefore, the application of Web 3.0 technology enables the Internet to be more personalized, accurate and intelligent.”

AI and machine learning are the main driving force behind the Web 3.0. For example in Web 2.0, searching the word “collaborative learning” on Google will give a number of unrelated hits, however the Web 3.0 will solve this problem by providing context to searching for online information.

## V. WEB 3.0- THE SEMANTIC WEB

The semantic web is a place where machines are able to read web pages very much like humans. This technology facilitates intelligent search and behavioral advertising among other things [15].

When we want to search for particular information, we get the answers after multiple searches. However, with the 3.0 version, this task is carried out in one search itself. Suppose you want to go out for a movie of a specific genre and also want to eat out after the movie. You would just need to type in a complex sentence and the search engine will fetch the answer for you. Your query string will be analyzed by the browser, looked up the Internet and all the possible alternatives would be fetched and the results would be organized for you. This is possible through the use of Artificial Intelligence and Software agent technologies.

The most distinguishing characteristics of Web 3.0 are-

- *Intelligent Web*- Web 3.0 is the web with intelligence. By using artificial intelligence techniques, Web 3.0 applications can do intelligent analysis and provide optimal results without human intervention. In Web 3.0, documents in different languages can easily be translated to other languages [16].
- *Personalization*- Personal or individual preferences would be considered during different activities such as information processing, search, formation of personalized portal on the web.
- *Interoperability and Pervasive Web*- An application based on Web 3.0 is able to run on many types of Computers, Hand-held devices, Mobiles, TVs, Automobiles and many others. Pervasive Web is the term used to describe this phenomenon where web is operable from a wide range of electronic devices.
- *Virtualization*- A new trend that has gained popularity as a result of Web 3.0 is creation of virtual 3-dimensional environments.
- *Multimedia*- In Web 3.0, the search engines can take input as a multi-media object and are able to search out related media objects based on its features. The same thing is being done by Google's search by image feature and Microsoft's Bing Image match feature.

## VI. WEB 3.0 TOOLS FOR COLLABORATIVE LEARNING

Learning in Web 2.0 emphasizes the active participation of internet users and interaction among social communities, through social networking tools such as Blogs and wikis. At the same time, Web 3.0 offers tremendous potential for learning. In the Semantic Web, content will find you, rather than you actively seeking it. Your activities and interests will determine what information is delivered to you and in which form. The following table lists some popular Web 3.0 tools and services for learning:



<i>Tool</i>	<i>Use</i>
<i>Intelligent Search Engines [17]</i>	Search and process web contents based on their meanings and find relationships between them.
<i>Intelligent Tutoring Systems</i>	An Intelligent Tutoring System (ITS) is a computer based program that presents educational materials in a flexible and personalized way.
<i>Online 3D Virtual world</i>	3D rich GUI act as a powerful platform for the users to participate and perform collaborative activities.
<i>Semantic Forums</i>	Support collaborative learning, allowing learners to communicate at large to ask questions, articulate their thoughts, explain and justify their opinions, share ideas and resources.

Table 1: Web 3.0 Tools for Collaborative Learning

## VII. WIKI-LEARNIA: A WEB 3.0 PLATFORM FOR COLLABORATIVE LEARNING [2]

Wiki- Learnia is Web 3.0 platform being used by University of Rostock, Germany for both formal and informal learning. WikiLearnia is a collaborative platform for collaborative knowledge acquisition. Some of the key features of this project are-

- Wiki Learnia uses a WYSIWYG editor called *MediaWiki*. The users can create content without learning a special syntax. For example, texts can be marked as bold or colorized by the touch of a button and images can be added by drag and drop from the local hard disk. The MediaWiki software in the background merges the changes of all users, while providing a versioning mechanism in order to undo changes and look at older versions.
- Basically, all users in Wiki-Learnia can create and edit content. This approach is used for quality assurance because the community continuously corrects, adds and updates the learning modules. Unlike Wikipedia there is also the attribute "approved content", which indicates that this version is classified as factually correct by technical experts.
- To distinguish users, each member of Wiki-Learnia has a unique name embedded in a social profile after registering. Additionally to photos and personal information, each user can set a personal learning target which will offer many new opportunities within Wiki-Learnia. For example, users can search other members not only by their name but also by their learning targets and connect with each other to build up learning communities.
- An integrated bulletin board- Wiki-Learnia wall in the social profile page provides the exchange of public or private messages. A further possibility for taking private conversations is the built-in messenger. The user can respond immediately by taking advantage of the live chat feature.
- In addition to a textual chat, the Wiki-Learnia service "DiaLook" offers audiovisual communication.
- Wiki-Learnia offers a blogging feature. Each user can write individual blogs on any topic, which can be commented and rated by other participants.
- In addition to public editing of learning modules a personal editing of the content exists. In analogy to annotate a printed script, users can select and annotate (add footnotes/ explanations) text.
- Another way of individualization of the learning content is the tool "Summarizer". Using this function, users can create summaries of the learning materials.
- Each user action is awarded by a certain amount of points. The total score and corresponding to this value, rank (e.g. "beginner", "advanced" or "expert") will also be presented on the profile page of the user for the community. By this, users can be motivated in an easy way to work actively with the system.
- Wiki Learnia also allows integration with other social networks like Facebook, Twitter and Youtube. For this purpose, the user must first connect the required accounts with their own Wiki-Learnia account to exchange data between the platforms. This supports the formation of learning groups that extend beyond the boundaries of Wiki-Learnia.



## VIII. CONCLUSION

In the era of digital learning, web based collaborative learning is a new and the most promising learning model. The emergence of Web 3.0 technologies have provided new ways for effectively building learning groups where learners discuss, share and give feedback to others in the online environment. Web 3.0 uses artificial intelligence, software agent and machine learning techniques to provide learners with a personalized learning experience. Along with this, Web 3.0 tools allow learners to enhance their problem-solving and critical thinking skills and learn to collaborate and work in teams. One such Web 3.0 platform for collaborative learning developed by University of Rostock, Germany is Wiki-Learnia. This paper gives an overview of the features of Wiki-Learnia project as it can act as basis for similar collaborative learning projects in India.

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