

TECHNO-PEDAGOGICAL MODELLING THROUGH WEB 2.0 TOOLS IN SCIENCE CLASSROOMS

Vrinda Vijayan

Department of Education
Central University of Kerala
Kasaragod (DT), Kerala-671316 (PIN)
E-mail: vrindav28@gmail.com

V.P. Joshith

Department of Education
Central University of Kerala
Kasaragod (DT), Kerala-671316 (PIN)
E-mail: getjoshith@gmail.com

P.D. Subhash

Planning and Monitoring Division
NCERT, New Delhi
E-mail: subhashpd99@gmail.com

The emergence of many new technologies, has created the nexus between technology and pedagogy espoused in education is sometimes very tenuous. Technological pedagogical content knowledge integrates content, pedagogy, and technology knowledge that strengthens the teaching-learning process and enables teachers to use educational technology in constructive ways to teach content. Web 2.0 is a powerful tool that allows users to interact and collaborate with one another as content creators in a virtual community. It also facilitates a way for students to apply their knowledge by using diversified tools like wikis, blogs, social networking sites such as Facebook and Instagram, RSS reader, video sharing sites, like YouTube. The study focuses on the integration of Web 2.0 technologies into the teaching of science that rejuvenates techno-pedagogical practices. It documents features of various Web 2.0 tools and how they can be utilised in the context of science classrooms to support teaching and learning and also explores the benefits, strategies and approaches to effectively integrate Web 2.0 tools into science classroom instruction regardless of different content areas in science or age of learners. The study concludes that teachers should provide opportunities for students to use Web 2.0 tools in their science learning process.

Key Words: *Web 2.0, Technological Pedagogical Content Knowledge, Techno-pedagogical Modelling*

Introduction

World Wide Web (www) is a platform inter-connected with hypertext documents acknowledged by URL (Uniform Resource Locator) accessed through the internet. The first generation of the Web is denoted by Web 1.0. It is a read-only Web that includes static pages and searching for information. User interaction and content contributions are very low. On the other hand, Web 2.0 is a read-write Web that appeared as a follow-up of the transition from Web 1.0. The concept of

Web 2.0 was flourished by Tim O'Reilly. Web 2.0 stands for the second generation of Web resulted in making a new pattern in the use of the internet and collaboration. Web 2.0 is the term used to describe a variety of Websites and applications that allow anyone to create and share online information or material they have created. A key element of Web 2.0 technology is that it allows people to create, share, collaborate and communicate.

Web 1.0 & Web 2.0 — A Comparison

The following table oversees the differences between Web 1.0 and Web 2.0.

Table 1

Web 1.0	Web 2.0
1990's	2000's
Read-only Web	Read and write Web
Tim Berners-Lee	Tim O'Reilly
Content creators were few	Anyone can be a content creator
Millions of users	Billions of users
Static content	Dynamic content
Information sharing	Interaction

What is Web 2.0?

Web 2.0 is the second generation of the World Wide Web which is a transition from static HTML pages to more interactive and dynamic Web pages. Web 2.0 focuses on the skill for people to collaborate and share information online through blogging, social media, and other Web-based channels.

Web 2.0 tools are internet tools that allow the user to go ahead of a mere gathering of information through the Web. The user has an interface for creating and collaborating content with others. Web tools can be used to boost up teaching and collaboration among teachers and students, as well as, increased professional collaboration between educators. Social media sites such as Facebook, Twitter, Edmodo, Voicethread, and Skype are some examples of Web 2.0 tools.

Features of Web 2.0 tools

Web 2.0 tools facilitate the creation of blogs, uploading of media content, and social network sites. The main features of Web 2.0 are given below:

- **Folksonomy** – Folksonomy is related to tagging Web 2.0 tools that facilitate users to classify and find information together (e.g., tagging enables users to label images, Websites, videos, links).
- **Rich User Experience** – Users can get rich experiences with dynamic content responsive to user input.
- **User Participation** – Information flows two ways between the site owner and site user by means of evaluation, review, and comments. It enables users to organise and find information collectively. Users can add content for others to see and comment on.
- **Software as a service** – Web 2.0 sites developed APIs (Application Programming Interface) to allow automated usages by an app or mashup.
- **Mass Participation** – Many users can participate simultaneously via universal Web access.
- **Like buttons** – Like buttons allow users to indicate their likes or dislikes to the content.
- **Free distribution of information** – Information is disseminated liberally to all.

Types of Web 2.0 Tools

The major Web 2.0 tools focused in the present study are wikis, blogs, podcasts, social networks, social bookmarking, RSS and mashups.

1. **Wikis:** Wiki is a Hawaiian word that means 'fast'. Wiki is a server programme in which modification of its

content and structure is done directly from the Web browser collaboratively. The text is written using a simplified mark-up language in a typical wiki and can be edited with the help of a rich-text editor. Wikipedia is an online encyclopedia that is an example for the wiki which is edited by different persons. (0% plagiarism)

Features of Wiki

- Each page in a wiki Website is known as 'wiki page' and the whole collection of Web pages is known as the 'wiki'.
- Easy Editing
- Multimodal
- Collaborative encyclopaedia
- Allows every member to continuously check the changes done by other members on the wiki.
- Openness
- Evolving —the content is dynamic

2. **Blog:** The term blog originated from Web-log as web+log—weblog—blog, which is a term used to express Websites that keep up an ongoing record of information. A blog features opinion, information, personal diary entries, or links arranged in chronological order.

Features of Blogs

- The content is published in a reverse chronological fashion
- Visitors can add comments
- Other blog authors can interact
- The blogs can be created easily in less time

- Entries usually include the source of information which validates the data
- Free public access to content
- Hyperlinked post structure
- The post is involuntarily achieved

3. **Podcasts:** Podcasts are audio recordings that consist of episodic series of audio files in the form of talks, interview, and lectures viewed and downloaded through the Website or computer or mobile device. Video podcasting is called vodcasting.

4. **Social Networks:** Social network is connectivity among individuals or organisations through social media to share ideas and information. Connections between the members can be voluntarily made. Some of the social networking sites are Facebook, Twitter and MySpace, etc.

Features of Social Networks

- Collaboration
- Connections are made based on interdependency and need.
- Allow live chats
- Sharing of ideas and information
- Provide tagging alerts
- Complete freedom for users

5. **Social Bookmarking:** The concept of shared online bookmarks is a unique service allowing its members to save, review and share Websites, articles, photos and music that they discover on the internet. Collaborative tagging is used to connect people.

6. **RSS:** RSS stands for Really Simple Syndication. It is a type of Web feed that allows users to access updates to online content in a standardised, computer-readable format. These feeds can allow a user to keep track of many different Websites in a single news aggregator.
7. **Mash-ups:** A mash-up is a term used to refer to a Website or Web page that combines data and services from various sources on the Web. Mashups can be divided into seven categories: mapping, search, mobile, messaging, sports, shopping, and movies. Google Maps is an example of mashups.

Techno-pedagogical Modelling

Techno-pedagogical modelling is teaching with technology. They are needed for quality teaching in the 21st century classroom. Web generation had played a prominent role in highlighting techno-pedagogical modelling. Anderson (2007) used Web 2.0 tools, such as, social networking, blogs, wikis, and other dynamic, internet-based applications for the study and that allow an ongoing, collaborative and investigative digital experience for the learners.

In view of Hew and Cheung (2013), instructional modelling should be developed and practiced in conjunction with the use of Web 2.0 tools to support students' achievement. Web 2.0 instructional practices involve the combination of technological, pedagogical, and content knowledge.

Technological Pedagogical Content Knowledge

The Technological Pedagogical Content Knowledge (TPCK or TPACK) framework

highlights the integration of effective technologies for teaching specific content which requires a thorough conceptualisation of the relationships between Technology, Pedagogy and Content. TPCK became very popular in the year 2006 after Mishra and Koehler (2006) introduced their framework. The seven knowledge components of TPCK framework are Content Knowledge (CK), Pedagogical Knowledge (PK), Technological Knowledge (TK), Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK) and Technological Pedagogical Content Knowledge (TPCK).

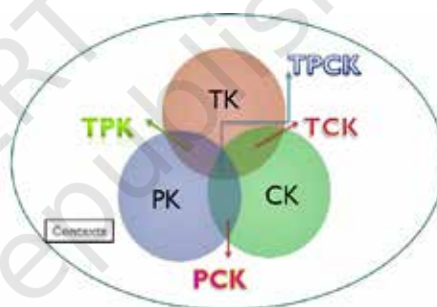


Fig. 1: TPCK Framework by Koehler and Mishra, 2008

Content Knowledge (CK) is the knowledge about the content to teach, Pedagogical Knowledge (PK) is the knowledge about approaches or methods of teaching, and Technological Knowledge (TK) is the knowledge about technology to be used. Pedagogical Content Knowledge (PCK) is knowledge about how to integrate suitable pedagogy to a content, Technological Content Knowledge (TCK) is knowledge about how to integrate appropriate technology to teach content, and Technological Pedagogical Knowledge (TPK) is knowledge about

technology as a facilitator of different teaching methods. Technological Pedagogical Content Knowledge (TPCK) is an integrated form of knowledge about how appropriate technologies and pedagogical methods can be incorporated to facilitate the learning of content.

Science Classrooms and Technological Pedagogical Content Knowledge

Earlier our notions of science were in comprehending scientific concepts and making it applicable in unknown situations. The over-richness of concepts in the form of content was the usual condition of our classrooms. But now comprehending more and more knowledge is not very difficult because the technology has penetrated to odd nooks and corners of our lives which provide all sorts of knowledge at our fingertips. Then it was the research on pedagogical understanding which gave better solutions to the classroom transactions in science. Twenty first century science classrooms are not mainly focussing on pedagogy rather they focus on techno-pedagogy. The concept of techno-pedagogy has been a technological transition of the earlier concept of pedagogical content knowledge proposed by Shulman (1986). Now Kohler and Mishra came up with TPACK, which utilises all the different Web 2.0 tools for its delivery, especially in the science classrooms. Today's learners, motivated with the new technological gadgets and the creativity bestowed on using these technical tools, are more interested in TPACK oriented learning than the conventional activity-based learning. Activity-based learning many a time creates a feeling that activities are artificial and not natural or related to their living conditions.

Web 2.0 Tools as a Tool for Techno-Pedagogical Modelling in Science Classrooms

Web 2.0 tools can be applied in the teaching of science using technology. Web 2.0 tools can be used to produce, publish and update individual or shared writing products. In that way, technology's capacity to link to other information and to display information flexibly and dynamically is well-performed in practice. The applications of different Web 2.0 tools in Techno-pedagogical Modelling in science classrooms are described as follows:

(i) Techno-pedagogical Modelling Using Wikis

In science classrooms, wikis can be used to post assignments and group projects. This allows students to critically analyse a topic. Group discussions on a topic sharing own viewpoints can open a way to enhance science content. Brainstorming can be done by editing a given wiki topic. Writing skills on a science idea and editing in accordance with the suggestions and evaluations put forth are facilitated by using wikis. Techno-pedagogical Modelling using the technology wikis and pedagogical approaches like brainstorming, reflective writing, think-pair-share, interactive lecture and collaborative work can be done for teaching a science topic.

(ii) Techno-pedagogical Modelling Using Blogs

Blogs can be used as a techno-pedagogical tool that allows classroom communication by putting all information in one place for everyone to see. Teachers can publish instructional materials and the students can comment on it. Online reading and writing of articles on a science topic are made more

advanced using blogs. Informal learning by sharing experiences from others on their field visits like a science museum, planetarium, etc., are facilitated. Creating an online e-portfolio of their science experiment on a regular basis, collaborative discussions and works can be done. Assessment of students is done by posting assignments and asking others to give feedback for improvement. Teachers can inform about daily science events to students. Using the technology blogs and pedagogical approach like collaboration on learning more about a scientist can be modelled techno-pedagogically.

(iii) Techno-pedagogical Modelling Using Podcasts

For reviewing a complicated topic in science, recorded lectures and discussions are distributed with the use of podcasts. Podcast or Video podcasts can be used for teaching concepts involving visuals. Students can create their own podcasts on researching the science behind a project assigned by the teacher. Supplementary educational material related to the content to teach can be delivered. Techno-pedagogical Modelling using the technology podcasts or vodcasts and pedagogical approaches like lecture method, discussion and individualised instruction can be done for learning a topic in science.

(iv) Techno-pedagogical Modelling Using Social Networks

Recent information related to science and technology can be updated by linkages in social networks. Discussion and critical analysis of the scientific problem can be fruitful through sharing of information. Creativity on a scientific idea can be nurtured more easily. Option for one's own interest

and disinterest in different science topics can be marked. Additionally, there is a prospect of creating new Web pages specialised in specific fields like astrophysics, pharmacy, organic chemistry, biodiversity, etc., to meet students who are interested in one field of science and give them the opportunity to participate and manage their own page. Moreover, the social network pages involving students' collaboration about science-related topics outside the class may enhance their learning resources. Pedagogical approaches like discussion, collaboration and brainstorming can be integrated into different content areas in science suitably to incorporate social networking.

(v) Techno-pedagogical Modelling Using Social Bookmarking

Social bookmarking enables creating lists of bookmarks or favourites of a particular science Webpage for quick access. Tagging of particular science content and photo tagging are possible. Teachers can highlight important and relevant information on a Web page. Diigo and Delicious are the two most commonly used social bookmarking sites in education. Collaborative group work or research can be assigned to students for particular topics of research and send out bookmarked Websites for their use.

(vi) Techno-pedagogical Modelling Using RSS

Updates on recent developments in science and technology without visiting their sites can be made possible via RSS feeds. RSS feeds for assignment topics and areas of research interest are available. RSS reader marks the read content as read. "Science Buzz" and "Why Files" are RSS feeds on science. Pedagogical approaches like discovery

learning or heuristic method can be employed to research a science topic using RSS and thus techno-pedagogical modelling can be done.

(vii) **Techno-pedagogical Modelling Using Mashups**

Mashups facilitate inquiry-based learning. It assesses and reinforces the student's visual literacy. Mapmaking like 'Sky Map' exploring the sky with YouTube videos, images, and Google maps is facilitated. Inquiry-based learning methods to solve a scientific problem using mashups can be modelled techno-pedagogically.

Impacts of Web 2.0 as Tools for Techno-pedagogical Modelling in Science Classrooms

The major impacts of Web 2.0 as tools for techno-pedagogical modelling in science classrooms are the following.

- Supports twenty first century skills like collaboration, communication and creativity among students and teachers
- Integration of different technologies, pedagogies in accordance with the content to teach
- Better access to science notions
- Disseminates and updates scientific information
- Higher quality of science instruction
- Usability of each and every branch of science subject
- Easy learner reception of scientific concepts

- Effective transmission of reality and simulation
- Motivates learners to know scientific principles more deeply
- Provision for student feedback about their science learning
- Ubiquitous nature of Web 2.0 tools makes learning possible at any time and anywhere
- Learner-focused
- Cost-effective

Suggestions

Teachers

- Need to be trained on how to use Web 2.0 tools in teaching science to realise their learning objectives.
- Should understand how to structure a lesson in science involving techno-pedagogical activities.
- Need up to date Web 2.0 tools to understand how they fit into the science curriculum and locating resources to meet its standards.
- Should use Web 2.0 technologies to improve and support scientific skills and to keep your learners motivated and on-track.
- Should participate in teacher training programmes on courses or workshops on techno-pedagogical aspects for science classrooms.

Conclusion

Web 2.0 tools result in making considerable changes in the use of internet and interactivity which thus opens a new life for science learning by techno-pedagogical Modelling. The rejuvenation of this Techno-pedagogic Modelling should be nurtured by the teachers with updating of new emerging Web 2.0 tools. The study provides information on how to use Web 2.0 tools as learning tools in the science

classroom. The needs of the twenty first century learner are satisfied through the use of Web 2.0 tools like wikis, blogs, podcasts, RSS, social networking, social bookmarking and mashups. The most appropriate Web 2.0 tools for teaching a particular science content using the aptest pedagogy are to be well-designed by the teachers. Hence, Web 2.0 act as a powerful mechanism for science teaching with technology.

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