Creating Constructivist Learning Environment: Role of “Web 2.0” Technology

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[Abstract] Contemporary educational practices encourage teaching practices grounded in the principles of constructivism. In a constructivist learning situation learners bring unique prior experiences and beliefs, and knowledge is constructed uniquely and individually, in multiple ways, using a variety of tools, resources, and contexts. New developments in the area of Information and communication Technology (ICT) in general and “Web 2.0” in particular have provided variety of tools and resources for designing and delivering instruction based on the constructivist principles. The terms “Web 2.0” refer to Web-based utilities and technology tools that focus on social, collaborative, user-driven content and applications. These among other things include blogs, wikis, multimedia sharing services, content syndication, podcasting and content tagging services. This emerging technology which is characterized by greater functionality, interoperability and connectivity helps in knowledge creation through open communication and collaboration. The adoption level of these emerging web technologies is on the rise in academic settings. There are also multiple instructional design models based on constructivist pedagogy having the scope to integrate most of the “Web 2.0” technologies. This paper elaborates upon various “Web 2.0” tools and its integration in the designing process to create a constructivist learning environment. A sample “Web 2.0” integrated constructivist learning plan based on the 5E approach is also provided.

[Keywords] constructivism; multimedia; web technology; constructivist learning environment

Constructivist Learning Environment

Constructivist theory has its roots in a number of disciplines, including philosophy, anthropology, psychology, sociology, and education. Enranch in learning theories advanced by Dewey, Piaget, Vygotsky, Bruner, and Glasersfeld, the essential element of constructivism is active construction of new knowledge by the learner based on their experiences. In a constructivist learning situation learners bring unique prior knowledge and beliefs, and knowledge is constructed uniquely and individually, in multiple ways, using a variety of tools, resources, and contexts. Learning is both an active and reflective process. The learners’ knowledge structure is expanded through the process of assimilation and accommodation facilitated by multiple perspectives from more knowledgeable others. Though the meaning making takes place through social interaction and collaboration, learning is internally controlled and mediated by the learner.


These characteristics are as follows:
1. Multiple perspectives and representations of concepts and content are presented and encouraged.
2. Goals and objectives are derived by the student or in negotiation with the teacher or system.
3. Teachers serve in the role of guides, monitors, coaches, tutors and facilitators.
4. Activities, opportunities, tools and environments are provided to encourage meta-cognition, self-analysis -regulation, -reflection & -awareness.
5. The student plays a central role in mediating and controlling learning.
6. Learning situations, environments, skills, content and tasks are relevant, realistic, authentic and represent the natural complexities of the ‘real world’. 
7. Primary sources of data are used in order to ensure authenticity and real-world complexity.
8. Knowledge construction and not reproduction is emphasized.
9. This construction takes place in individual contexts and through social negotiation, collaboration and experience.
10. The learner's previous knowledge constructions, beliefs and attitudes are considered in the knowledge construction process.
11. Problem-solving, higher-order thinking skills and deep understanding are emphasized.
12. Errors provide the opportunity for insight into students’ previous knowledge constructions.
13. Exploration is a favored approach in order to encourage students to seek knowledge independently and to manage the pursuit of their goals.
14. Learners are provided with the opportunity for apprenticeship learning in which there is an increasing complexity of tasks, skills and knowledge acquisition.
15. Knowledge complexity is reflected in an emphasis on conceptual interrelatedness and interdisciplinary Learning.
16. Collaborative and cooperative learning are favored in order to expose the learner to alternative viewpoints.
17. Scaffolding is facilitated to help students perform just beyond the limits of their ability.
18. Assessment is authentic and interwoven with teaching.

In a constructivist learning environment the role of the teacher is to facilitate and guide the knowledge construction process by engaging students in meaningful learning. Teacher should design and provide of learning activities and experiences characterized by collaboration, cooperation, multiple perspectives, real world examples, scaffolding, self-reflection, multiple representations of ideas, and social negotiation.

Wilson (1995) defines a constructivist learning environment as “a place where learners may work together and support each other as they use a variety of tools and information resources in their pursuit of learning goals and problem-solving activities.” The same is evident from the views expressed by (Jonassen et al., 1995) “constructivist learning environments engage learners in knowledge construction through collaborative activities that embed learning in a meaningful context and through reflection on what has been learned through conversation with other learners.

Cunningham, Duffy and Knuth (1993, in the section of “The Age of constructivism”) outlined seven pedagogical goals which emerge from the constructivist perspective. These goals are to:
• Provide experience with the knowledge construction process;
• Provide experience in and appreciation for multiple perspectives;
• Embed learning in realistic and relevant contexts;
• Encourage ownership and voice in the learning process;
• Embed learning in social experience;
• Encourage the use of multiple modes of representation; and
• Encourage self-awareness in the knowledge construction process.

Information and Communication Technology

Technology in its formative years catered well to behaviorist instructional strategies, which rely on the development of a set of instructional sequences with predetermined outcomes. There are many such models available including the designs based on the programmed instructional approach developed by Skinner. Then the primary use of technology in education has been to deliver computer-assisted instruction (CAI), including drill and practice programs, computer-based tutorials. These models, whilst applicable in a behaviourist environment, are not serving instructional designers well when the theoretical foundation for the subject outcomes is based on a constructivist approach to learning. The constructivist group of theories places less emphasis on the sequence of instruction and more emphasis on the design of the learning environment (Jonassen, 1994, p. 35).

Now the development of Information and communication Technology (ICT) has provided new
opportunities for designing and delivering instruction based on the constructivist principles. Combining the developments in information technology and the trend of constructivism can transform the learning process. ICT provides access to rich sources of authentic information; encourages meaningful interactions with content; and brings people together to challenge, support, or respond to each other with the help of multiple collaborative tools. Today ICT has many tools to create constructivist learning environment where authenticity and social collaboration is valued. The role of ICT is very clear when Jonassen (1999) proposed the following components to be incorporated when designing a constructivist learning environment:

- **Conception of the problem.** A problem must first be conceived in order for the students to begin their learning development.
- **Interpretation.** Students interpret and develop solutions to their problems.
- **Information sources to support the understanding of the problem.** The learning environment provides the information that learners need to understand and solve problems. Appropriate information (text documents, graphics, sound, video and animation resources) can be accessed through the World Wide Web.
- **Cognitive tools.** Learners interpret and manipulate aspects of the problem through the World Wide Web as a cognitive tool.
- **Conversation and collaboration tools.** Learners form communities to negotiate and co-construct meaning for the problem through these tools. Students require a platform to share and exchange their ideas and create a community to solve their problem collaboratively and to facilitate and foster communities of learners. Examples are of collaborative tools are: e-mail, chat, forum, wiki, blog etc.

**“Web 2.0”**
The term “Web 2.0” is commonly associated with web applications that facilitate interactive information sharing, interoperability, user-centered design, and collaboration on the World Wide Web. A “Web 2.0” site allows its users to interact with other users or to change website content, in contrast to non-interactive websites where users are limited to the passive viewing of information that is provided to them. “Web 2.0” technologies created around the idea that the people who access and consume the web content shouldn't passively absorb what's available; rather, they should be active contributors. These are Web-based utilities and technology tools that focus on social, collaborative, user-driven content and applications which facilitate a more socially connected Web. “The Web is where constructivist learning can take place The web provides access to rich sources of information; encourages meaningful interactions with content; and brings people together to challenge, support, or respond to each other” (Khine, 2003, pp. 22-23). The new and promising “Web 2.0” technologies, the second generation of internet, contribute not only to the development of the individual expression but also to the creation of Communities of Practice. This emerging technology which is characterized by greater functionality, interoperability and connectivity helps in knowledge creation through open communication and collaboration. Following are various characteristics of “Web 2.0” tools:

**Characteristics of “Web 2.0” Tools**

- **Collaboration:** “Web 2.0” is driven by participation and collaboration. Social tools like blog, wiki encourage people to create, collaborate, edit, categorize, exchange, and promote information.
- **Standards:** there are certain standards by which various “Web 2.0” tools are developed so that there is a fixed data structures and communication protocols which enables interoperability between applications.
- **Openness:** The world of “Web 2.0” has only become possible through a spirit of openness whereby developers and companies provide open, transparent access to their applications and content. Openness, freedom and collective intelligence are essential attributes of “Web 2.0”
- **Modularity:** “Web 2.0” emerges from many, many smaller technologies that are designed to link and integrate with others.
User Control: “Web 2.0” is user driven- users have the control over the content they create. They are the one who decides with whom they share the content and request for collaboration.

Identity: We can increasingly choose to represent our identities however we please, across interactions, virtual worlds, and social networks.

Evolving content: As more and more people get networked through the use of “Web 2.0” tools more content is generated and also the existing content gets revised as in the case of Wikipedia

Overview of Major “Web 2.0” Tools
There are a number of Web-based services and applications that demonstrate the foundations of the “Web 2.0” concept, and they are already being used to a certain extent in education. These are not really technologies as such, but services (or user processes) built using the building blocks of the technologies and open standards that underpin the Internet and the Web. These include blogs, wikis, multimedia sharing services, content syndication, podcasting and content tagging services. A detailed list of “Web 2.0” technologies along with its description and examples are given in the Table 1.

Table 1
List of “Web 2.0” Tools with Explanation and Examples

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Name of the Tool</th>
<th>Purpose of the Tool/ Major Features of the Tool</th>
<th>Examples with URL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Wiki</td>
<td>Wiki is a piece of server software that allows users to freely create and edit Web page content using any Web browser and are often used to create collaborative websites</td>
<td>Wikispaces <a href="http://www.wikispaces.com">www.wikispaces.com</a>, Twiki <a href="http://twiki.org/">http://twiki.org/</a>, Wetpaint <a href="http://www.wetpaint.com/">http://www.wetpaint.com/</a></td>
</tr>
<tr>
<td>9.</td>
<td>Web</td>
<td>Gather information from diverse sources</td>
<td>iGoogle <a href="http://www.google.com/ig">http://www.google.com/ig</a></td>
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<tr>
<td><strong>syndication</strong></td>
<td>across the Web and publish in one place. Includes news and RSS feed aggregators and tools that create a single webpage with all your feeds and email in one place.</td>
<td>bloglines <a href="http://www.bloglines.com/">http://www.bloglines.com/</a> google reader <a href="http://www.google.com/reader">http://www.google.com/reader</a></td>
<td></td>
</tr>
<tr>
<td>10. <strong>Virtual Learning Environment</strong></td>
<td>A virtual learning environment (VLE) is a software system designed to support teaching and learning in an educational setting. A VLE will normally work over the Internet and provide a collection of tools such as those for assessment, communication, uploading of content, return of students' work, peer assessment, administration of student groups, collecting and organizing student grades, questionnaires, tracking tools, wikis, blogs, RSS and 3D virtual learning spaces.</td>
<td>Moodle <a href="http://www.moodle.org">http://www.moodle.org</a> Atutor <a href="http://www.atutor.ca/">http://www.atutor.ca/</a> Sakai <a href="http://sakaiproject.org/">http://sakaiproject.org/</a></td>
<td></td>
</tr>
<tr>
<td>13. <strong>Forum</strong></td>
<td>An Internet forum is a discussion area on a website. A place where people have the ability to start communication (in the form of threads) and reply to other people's threads.</td>
<td>Nicenet <a href="http://www.nicenet.org/">http://www.nicenet.org/</a></td>
<td></td>
</tr>
<tr>
<td>14. <strong>Social search</strong></td>
<td>Social search or a social search engine is a type of web search method that determines the relevance of search results by considering the interactions or contributions of users.</td>
<td>Google social search <a href="http://www.google.com">http://www.google.com</a> Technorati <a href="http://technorati.com">http://technorati.com</a></td>
<td></td>
</tr>
<tr>
<td>16. <strong>Word clouds/tag clouds</strong></td>
<td>A visual depiction of tags that have been used to describe a piece of content, with higher frequency tags emphasized to assist content comprehension and navigation.</td>
<td>Wordle <a href="http://www.wordle.net">http://www.wordle.net</a> Tagcrowd <a href="http://tagcrowd.com">http://tagcrowd.com</a> Tocloud <a href="http://www.tocloud.com">http://www.tocloud.com</a></td>
<td></td>
</tr>
<tr>
<td>17. <strong>Collaborative graphic aids</strong></td>
<td>Online brainstorming, mind/concept mapping, graphic organizers, timelines software which allows people to create various graphic organizer collaboratively.</td>
<td>Mindmap <a href="http://www.bubbls.us">bubbls.us</a> Mindmeister <a href="http://www.mindmeister.com">http://www.mindmeister.com</a> Timeline <a href="http://www.xtimeline.com">http://www.xtimeline.com</a></td>
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"Web 2.0" Technologies

Some technologies are key for the development of “Web 2.0” sites, such as Ajax, mash-ups etc. These are explained below:

- **Aggregation** is the method of gathering multiple content sources/information together from different web sites into one interface or application.

- **AJAX** (Asynchronous JavaScript and XML) is a way of programming for the Web. A combination of technologies that allows web pages to be updated asynchronously by exchanging small amounts of data with the server behind the scenes.

- **API** (Application Programming Interface) is a particular set of rules and specifications that software programs can follow to communicate with the operating system or other program such as a database management system.

- **Embedding** is the method of Integrating content or an application into a web page, while the original format is maintained.

- **Mashups** is a web service or application that combines two or more tools or functionality from two or more external sources to create a whole new service.

- **RSS** (Really Simple Syndication) is a group of formats to publish (syndicate) content on the internet so that users automatically receive content "feeds" from a variety of sources on the internet which can be read by an aggregator.

- **Atom** is a different approach to syndicate feeds of online content, atom functions as a newer alternative to RSS.

- **Ruby on Rails** is an open source web application framework that is frequently used by programmers for sustainable productivity in Web 2.0 website development.

- **Tags** are user-generated keywords used to describe online content.

- **Tagging** is the process of assigning personal keywords (“tags”) to resources by users.

- **Widget** is small, portable web application that can be installed and executed within a web page by an end user.

- **XML** (eXtensible Markup Language) is an open standard which is used to describe and carry data to enables easy exchange of information between applications.

"Web 2.0" Technologies and Constructivism

Through this new technology we are in a position to create learning environment where learners are able to collaborate electronically or otherwise to form a self-regulated and self-governed learning community. The “Web 2.0” supports social interaction and experience in education. The emphasis here is the construction of knowledge with the others and for the others. The focus is on the community itself and not on the individual user. “These new technologies foster cooperation and construct human networks that promotes sociability through knowledge and mutual participation in new forms of activities” (Mark, 2001).
Emerging Web technologies mentioned above have the potential to create engaging learning environments. People and organizations in academic settings have already started drawing the benefits of these technologies. For example, blogs facilitate the publication of knowledge, opportunities for subsequent reflection. They can be used for reflection as part of a course, or as an ongoing tool for reflecting on experience and sharing ideas. Students and teachers enjoy blogging and use it for community building, resource consolidation, sharing ideas or as a personal journal. The ability to comment on one’s blogs means that this learning can be further enhanced by allowing others to comment on the content of posts, ask questions, and suggest resources.

Wiki is an important tool of the constructivist educators. Wiki is a piece of server software that allows users to freely create and edit Web page content using any Web browser and are often used to create collaborative websites. Wikis facilitate the creation of shared knowledge, dissemination of information, and group interaction (Augar, et al., 2004). Wiki caters to many of the principles of constructivism including multiple modes of representation, Collaboration opportunities, Experience with multiple perspectives, Learner centered, Learner relevant, and Social negotiation.

Social bookmarks allow quick and easy access to online resources. With social bookmarking tools like Delicious, individuals can categorize and organize useful information they find online. Through tagging, students can then share these bookmarks with other students and teachers with other teachers and students. Making students to create social book mark of sites related to a particular theme will enhance their ability to acquire and process information. Podcasts and vodcasts provide an innovative and exciting way for people to improve communication, collaboration and social networking (Ractham & Zhang, 2006). They can also be used for dissemination of knowledge, broadcasting news to staff and students, supplementing class materials, guest lecture presentations and as a marketing tool for attracting prospective students (Harris & Park, 2008).

Social networking software such as Ning focuses on building online communities of people who are able to share interests, build on-line profiles, share information, pictures, blog entries, music clips, etc. These networks allow learners engage in “active dialog” with their peers and their teachers, and establish and participate in interactive learning communities where teachers and students alike collaborate to solve real world problems. These are only the description of a few “Web 2.0” tools. However most of the “Web 2.0” tools described above are appropriate for creating and providing constructivist learning environment for the learners.

**Approaches to Constructivist Learning Designs**

There are many constructivist design models developed by different educationists and many of these are being used and researched up on. Three of such models are discussed in the following sections.

**Constructivist Learning Design**

A constructivist learning design was developed by George W. Gagnon, Jr., and Michelle Collay. This design offers teachers a six-step framework for lesson planning and assessment:

- **Situation:** develop goals, tasks, and curriculum standards
- **Grouping:** group students and materials, and use cooperative learning
- **Bridge:** recall prior knowledge using students’ cognitive maps, skills, values, motivation, and expectations
- **Task:** use higher-level thinking skills and problem-based learning
- **Exhibit:** arrange student portfolios and work samples
- **Reflection:** synthesize critical thinking and knowledge

**The Information Construction (ICON) Model**

- Robert O. McClintock and John B. Black of Columbia University Teachers College derived yet another design model from several computer technology-supported learning environments at the Dalton School in New York.
The Information Construction (ICON) model contains seven stages:

- **Observation**: Students make observations of authentic artifacts anchored in authentic situations
- **Interpretation Construction**: Students construct interpretations of observations and construct arguments for the validity of their interpretations
- **Contextualization**: Students access background and contextual materials of various sorts to aid interpretation and argumentation
- **Cognitive Apprenticeship**: Students serve as apprentices to teachers to master observation, interpretation and contextualization.
- **Collaboration**: Students collaborate in observation, interpretation and contextualization
- **Multiple Interpretations**: Students gain cognitive flexibility by being exposed to multiple interpretations
- **Multiple Manifestations**: Students gain transferability by seeing multiple manifestations of the same interpretations

### The 5E Approach to Constructivist Learning

The Biological Science Curriculum Study (BSCS), a team whose Principal Investigator is Roger Bybee developed an instructional model for constructivism, called the "Five Es". The 5Es represent five stages of a sequence for teaching and learning: Engage, Explore, Explain, Extend (or Elaborate), and Evaluate. The details are given below:

#### Engage

This stage should stimulate curiosity and activate prior knowledge of student. The activity should be a problem or an event that raises questions and motivates students to discover more about the concept. Specifically this stage helps in: 1) Make connections between past and present learning experiences 2) Anticipate activities and focus students' thinking on the learning outcomes of current activities. Students should become mentally engaged in the concept, process, or skill to be learned. 3) Gives an opportunity for teacher to understand misconception of students

#### Explore

Students need the opportunity to actively explore the concept in a hands-on activity. This establishes a commonly shared classroom experience and allows students to share ideas about the concept. This phase of the 5 E's provides students with a common base of experiences. They identify and develop concepts, processes, and skills. During this phase, students actively explore their environment or manipulate materials.

#### Explain

This phase of the 5 E's helps students explain the concepts they have been exploring. They have opportunities to verbalize their conceptual understanding or to demonstrate new skills or behaviors. Teachers use questioning strategies to lead students’ discussion of information discovered during the Explore stage. This phase also provides opportunities for teachers to introduce formal terms, definitions, and explanations for concepts, processes, skills, or behaviors.

#### Elaborate

This phase of the 5 E's extends students’ conceptual understanding and allows them to practice skills and behaviors. Through new experiences, the learners develop deeper and broader understanding of major concepts, obtain more information about areas of interest, and refine their skills. Students are encouraged to apply, extend, and enhance the new concept and related terms during interaction with the teacher and other students.
Evaluate
This phase of the 5 E's encourages learners to assess their understanding and abilities and lets teachers evaluate students' understanding of key concepts and skill development. The teacher must create a quality assessment to gauge the learner's understanding of the topic. The students must also be able to reflect on their own understanding and progress.

A Sample “Web 2.0” Integrated Constructivist Learning Plan
Based on the discussions above, a sample constructivist learning plan is designed using the 5E model and is given below. The unit is based on the content of NCERT science text book for class IX. The topic is poultry farming under the larger unit of animal husbandry and is suitable for any secondary school class level. There are many technology integrated activities suggested under each phase of the model and the facilitator can choose and direct the learning based on the available time and resources.

The main purpose of learning this topic is to make the learner aware of the poultry farming practices and its importance. The learner is also encouraged to explore the poultry farming practices in different regions of the world and the current status of poultry farming in the country. This unit is also expected to give them many answers to the problem of bird flu which is very common in today’s context. The learning environment created through various phases of this model encourages the learner to use varieties of “Web 2.0” tools. The learning environment provides the information that learners need to understand poultry farming and related concepts through text documents, graphics, sound, video and animation resources which can be accessed through the World Wide Web. The learners are also provided with various collaborative tools such as e-mail, chat, forum, wiki, blog etc. to form learning communities to negotiate and co-construct meaning about the concepts through these tools.

“Web 2.0” Mediated Constructivist Learning Design
Area: Animal Husbandry- Poultry Farming
5E Approach
Class IX

Engage
Engaging Activities for the Topic (can conduct one or more activities)
- View the online streaming video on poultry farming from http://www.youtube.com/watch?v=aJ7rrHYmFiQ
- Collaborative digital concept map on egg/poultry farming– mind map- use freemind (offline), bubbl(online) http://www.bubbl.us/index
- Questions that you want to ask about egg and poultry farm- online forum (questions like the following will emerge) http://www.allexperts.com/
- Take a online webquest on Bird flu from http://www.mofb.org/WebQuest.aspx/BirdFlu.aspx

Explore
Exploration Activities for the topic (can conduct one or more activities)
- Take the following virtual fieldtrip
  1. Online visit to an organic egg farm / virtual trip http://www.exploratorium.com/cooking/eggs/farm/index.html
  2. Poultry virtual farm http://sites.ext.vt.edu/virtualfarm/poultry/poultry.html
- Visit a Poultry Farm. Visit a nearby poultry farm. Take along all types of digital recording equipment. Audiotape farm sounds. Videotape farm activities. Photograph farm people, equipment, crops and animals. Show the world a unique farm in your area by adding your own farm website to the Internet.
- Different poultry birds and stages/process of poultry farming – creating digital album – flicker/picasa
Understanding poultry farming and poultry birds in different country through:

1. **Online collaboration** through e-pal
2. viewing and discussion of various **streaming videos** from Youtube http://www.youtube.com/watch?v=kOk8lcn_TQ
3. through **Google image** search

Ask an expert. Have your class e-mail (or live chat if available) an expert about question they have about the poultry farm http://www.allexperts.com/, specifically http://www.allexperts.com/el/Poultry-Farming/, http://en.allexperts.com/q/Poultry-Farming-3481/index_11.htm

Ask question on the following **forum sites**
1. http://apps.exploratorium.edu/cgi-bin/yabb2-cooking/YaBB.pl
2. http://www.the-coop.org/cgi-bin/UBB/ultimatebb.cgi

View the **webcast** on egg http://www.exploratorium.edu/cooking/webcasts/index.html

**Explain**

**Explain Activities for the Topic** (can conduct one or more activities)

- Students collaborate and develop a **wiki** on poultry farming using wiki space
- **E-News letter** on poultry farming – publisher or equivalent open source software
- Plan and design a **digital poultry farm** of your own in groups and share the design
- Discuss the difference in poultry farming in different countries using **discussion board/forum/groups**
- After the visit to the local poultry farm Show the world a unique farm in your area by adding your own farm **website to the Internet**.
- Compare traditional poultry farming with modern poultry farming using **discussion board/forum/groups**
- Collaborative **digital concept map** on poultry farming–mind map- use freemind (offline), bubbl(online) http://www.bubbl.us/index

**Elaborate**

**Elaborate Activities for the Topic** (can conduct one or more activities)

- Making art work using egg shell
- They analyze and develop a **social bookmarking** of websites related poultry farming/animal husbandry
- Take a **webquest** on the following
  2. From egg to chick http://www.mofb.org/webquest/wq23a.htm
  3. adventures on aviculture http://www.besd61.k12.il.us/webquests/8th%20Grade/sharp/birds2/studentspage.htm
- Write a review of a poultry farming website in your **blog**
- Develop a collaborative **podcasts** on importance of poultry farms and host it in Gcast
- Conduct a survey of poultry industry in india- **internet search and online survey**
- Explore the poultry(duck) farming in kerala through **internet and e-mail**
- searching the net and making a **database** of poultry related websites

The Coop is dedicated to all the folks around the world that raise, breed or show poultry, waterfowl, gamebirds and related species. http://www.the-coop.org/index.html
Evaluate

**Evaluation Activities for the Topic** (can conduct one or more activities)

- Create a digital portfolio on poultry farming – develop the portfolio using mahara
  - Portfolio artifacts
    - News letter
    - Project report
    - Blog posts
- Online reflective journal
- Peer Assessment
- Create digital rubrics along with students for assessing the portfolio and other activities using rubistar [http://rubistar.4teachers.org/](http://rubistar.4teachers.org/)
- Develop digital checklist for all other activities and products they are involved in
- Conduct a traditional multiple choice online test

**Conclusion**

ICT integration is a comprehensive process of applying the emerging technologies to the educational processes to improve all aspects of education. Its success in teaching learning depends not only on the availability of technology, but also heavily on the pedagogical design. The sample ICT integrated constructivist learning plan based on the 5E approach introduced here has explored the tremendous possibilities of information technology and “Web 2.0” technology in particular to create learning environment based on constructivist pedagogy. This plan is expected to provide insight to those techno savvy teachers and learners the possibilities of technology integration in their day to day teaching learning practices.

**References**


