EXPLORING THE EFFECTS OF WEB 2.0 TECHNOLOGY ON INDIVIDUAL AND COLLABORATIVE LEARNING PERFORMANCE IN RELATION TO SELF-REGULATION OF LEARNERS

By

ANANTA KUMAR JENA * SATARUPA BHATTACHARJEE ** SOMNATH GUPTA ***

JOY DAS **** RAJIB DEBNATH *****

** Assistant Professor, Department of Education, Assam University, Silchar, India.*
, ** Research Scholar, Department of Education, Assam University, Silchar, India.*
**** M.Phil Scholar, Department of Life Science and Bioinformatics, Assam University, Silchar, India.*
***** Assistant Professor, Department of Teacher Education, Holly Cross College, Agartala, Tripura, India.*

Date Received: 14/03/2018 *Date Revised: 10/05/2018* *Date Accepted: 23/05/2018*

ABSTRACT

Web 2.0 is a revolutionary technology that operates Facebook, WhatsApp, LinkedIn, Twitter, Google+, and other social networks. The study aimed to explore the effects of individual and collaborative web 2.0 technologies on the learning performance and self-regulation of secondary school students over traditional approach of learning. One hundred and ten participants were assigned for non-web 2.0 group (n=40), individual web 2.0 group (n=40), and collaborative web 2.0 (n=30). Nonequivalent pretest posttest quasi-experimental design used to conduct the experiment, where samples were not randomly selected rather the whole class students were the participants of the study. Individual web 2.0 used Slideshare, Wiki, Whatsapp, and Youtube and Collaborative web 2.0 used the similar tools, such as Slideshare, Wiki, Whatsapp, Youtube counted as the experimental class I and II, and conventional lecture was used in non-web 2.0 group or comparative group. Before and after instruction, self-regulatory learning test (Bhattacharjee and Jena, 2017a) and achievement test in tissue (Bhattacharjee and Jena, 2017b) were used to collect the data. It resulted that collaborative and individual web 2.0 technology have significant effects on learning performance and self-regulation of learning over traditional approach of secondary school students in Silchar, India.

Keywords: Collaborative Learning, Individual Learning, Performance, Self-regulation of Learning, Web 2.0 Technology.

INTRODUCTION

Web 2.0 is a revolutionary technology works for the dissemination and sharing of content via World Wide Web. Web 2.0 is a presentation tool that helps in the uploading and sharing of information anytime at any place. Several web 2.0 mobile tools are efficiently used for sharing media information through various mobile apps through smartphones. Now-a-days, various web 2.0 community tools are used in the social networking websites to enable the learners as well as teachers to collaborate, share, and communicate various activities. There are different elements of web 2.0 technology like Wikis, that are the websites, which enable the users to contribute, edit, and to collaborate the content. Software as a Service (SaaS), Web Application, and cloud computing are most prevalent services provided by the third party as the host. Mobile computing is the recent trend in which the user can connect from anywhere. It enables the devices like Smartphones, Tablets, etc., with quick accessible internet and Wi-Fi networks. Mash-ups are web pages or applications, which integrate the complementary elements from two or more sources. Social networking is an online platform used by people for building social networking and relations with people. The important social networking sites, include Facebook, LinkedIn, Twitter, and Google+, where Crowdsourcing, crowdsource testing,

and crowdfunding work for reaching and connecting large numbers of participants. User Generated Content, which includes writing materials, images, audio, and video that are freely available in online uses web 2.0 technology. Similarly, Unified Communication tool helps in the integration and sharing of audio/video call and multimedia message. Not only that, but also social curation sites which include Reddit, Digg, Pinterest, and Instagram are now-a-days active in collaborative sharing of contents. Most of the Web 2.0 tools are advanced and supported to Adobe Flash, Microsoft Silverlight, and JavaScript along with RSS, Ajax, and Eclipse. Web 2.0 applications are often based on the decentralized download methodology and out of these, BitTorrent is a successful tool that helps each downloader to access heavily demanded contents, with more accessible to all (Ebner and Nagler, 2010). Recently, Web 2.0 technology is used in the knowledge building in higher education through Podcasts, Wikis, and Blogs, which were highly explored for innovations and other purposes for digital literacy. Web 2.0 is used in evaluation, assessment, and content preparation, with individual and group experiences. Now-a-days, the implementation of Web 2.0 implemented in the university websites tries to produce fruitful and ideal environment for teachers and students by sharing and uploading lectures and information (Khalid, 2010). Web 2.0 users usually involved themselves in the virtual learning environment, which focuses on social media skills. Using this tool, students communicate their views, ideas, researches, and findings with their peers and teachers. The researchers tried to explore the effects of the web 2.0 technology, specially the uses of Wikis, Slideshares, YouTube, and WhatsApp on the individual learning as well as collaborative learning process.

1. Web 2.0 and Learning Performance

Performance or achievement is the attainment of the total teaching learning process. The main goal of the teacher is also to enhance all the levels of capabilities of the students and prepare them for facing the world. The teacher would be successful when he/she can determine the students' achievement/ performance related to the progress of the learners. It can be said that students' performance or achievement is the outcome of the education. The academic achievement or performance of the students are generally measured by different examinations or regular continuous assessments. Web 2.0 has a significant effect on the communication, interaction, collaboration, creating knowledge, and reading writing skills (An et al., 2009). Cochrane and Bateman (2008) have carried out a study about engaging students with Mobile 2.0 and found that mobile based web 2.0 has a positive and significant impact on the achievement. A study on the use of web 2.0 in higher education has found that blogs, wikis, and KSS provide powerful information, and encourage collaboration and sharing of information, and those have influenced learner's performance (Grosseck, 2009).

2. Self-regulated Learning and Web 2.0

Self-regulated learning has the autonomy and control to run the learning process with individual monitoring for directing, and regulating actions toward goals of knowledge acquisition, for expanding expertise, and self-improvement (Paris and Paris, 2001). Self-regulated learners are cognizant of their academic strengths and weaknesses, and they have a repertoire of strategies, which they appropriately apply to tackle the day-to-day challenges of academic tasks. These learners hold incremental beliefs about intelligence (as opposed to entity, or fixed views of intelligence) and attribute their successes or failures to factors (e.g., effort expended on a task, effective use of strategies) within their control (Dweck and Leggett, 1988; Dweck, 2002). Students who are self-regulated learners believe that opportunities to take on challenging tasks, practice their learning, develop a deep understanding of subject matter, and exert effort will give rise to academic success (Perry et al., 2006).

3. Significance of the Study

Web 2.0 technology contains a set of internet services for both the individual and collaborative group users. The web 2.0 technologies promote the technology users to involve themselves in constructing knowledge and sharing it worldwide. It offers a universal spot of engagement with the web. Web 2.0 is a multimedia environment for sharing and constructing knowledge. It is a recent trend in the instructional process. It is very important for the teachers and the students to know about how to teach, learn,

communicate, and create knowledge using this technology. Web 2.0 also makes the learning participatory (Albion, 2008; McLoughlin and Lee, 2007). Again, it is found that mobile-based web 2.0 as a source of creation and sharing of content enhancing the constructivist-teaching environment (Cochrane and Bateman, 2008). Thus, the pedagogy using web 2.0 should be promoted. It is a fruitful platform for sharing and collaborating learning materials. A study by Malhiwsky in 2010 found positive effects of web 2.0 in enhancement of student's knowledge, achievement, and communication abilities. It also enhanced student's research skills. The applicability of the research work finds its scope in replacing the traditional classroom instruction with the innovation using web 2.0 technology. The teacher can effectively provide online instructions and other web resources, which will have an effect on the learning performance, retention, and executive function of learners. The innovative Web 2.0 technology is the independent variable and is feasible to see its impact on the dependant variable for the learners along with its learning performance, retention, and the executive function.

4. Research Questions

Do web 2.0 technologies affect the individual and collaborative web 2.0 technology on the learning performance? In addition to this, a question has raised, whether the individual or collaborative web 2.0 technology affects the self-regulation of learning or behaviour?

5. Objective

The following objective is framed after reviewing the literatures:

- To study the effects of individual and collaborative web 2.0 technologies on the learning performance and self-regulation of secondary school students over traditional approach of learning.

6. Hypotheses

The following hypotheses are used, and tested to draw the inferences:

- There is significant difference between individual and collaborative web 2.0 technology based learning performance of secondary school students over traditional approach.
- There is significant difference between individual and collaborative web 2.0 technology on the self-regulatory learning of secondary school students over traditional approach.

7. Methodology

7.1 Participants

One hundred and ten participants were assigned for traditional group (N=40), experimental group 1 (N=40), and experimental group 2 (N=30). In the traditional group, the participants were 14.5-15.5 age range, their mean age was 15 years, and SD was 0.41. Similarly, for experimental group 1, the sample age range was 14.5 to 15.3, their mean age range was 14.9, and SD was 0.42. In case of experimental group 2, the sample age range was 14.3-15.4, their mean age range was 14.7, and SD was 0.44. The whole class IX students of three schools were the participants of the study. Here, non-randomization and selective manipulation principle are used to conduct the experiment.

7.2 Design of the Study

Nonequivalent pretest posttest quasi-experimental design is used to conduct the experiment, where samples were not randomly selected rather the whole class students were the participants of the study. As per the need of the study, three schools and their respective class IX students were selected for intervention. Class IX students (n=40) of school 1 are assigned for traditional treatment while class IX student of school 2 (n=40) and school 3 (n=30) were assigned for individual web 2.0 and collaborative web 2.0 learning. Individual and collaborative web 2.0 technology assisted Slideshare, Wiki, YouTube, and WhatsApp applications are used for experimental group 1 and experimental group 2 for the intervention while traditional group was treated with traditional approach. During the intervention extraneous variables like history, maturation, regression, instrumentation, and Hawthorne effect was minimized with ANCOVA techniques. The result of the study has generalized on the whole population and is open for greater discussion in connection to web 2.0 technologies and its recent use in teaching learning process.

7.3 Instrumentation

7.3.1 Self-Regulation Learning Test

Self-regulatory learning test (Bhattacharjee and Jena,

2017b) was constructed, validated, corroborated, and verified. There were six subareas like engage with social interaction, conceptual understanding, construct collaborative knowledge, construct individual knowledge, self-pacing, and self-evaluation. Each subarea has five items and a total of 30 rating type items range from 1 to 10. Items were statements related to these subareas. Thus 1, 7, 13, 19, and 25 belong to scale 1 Engage with social interaction; 2, 8, 14, 20, and 26 items belong to scale 2 Conceptual understanding; 3, 9, 15, 21, and 27 items belong to scale 3 Construct collaborative knowledge; 4, 10, 16, 22, and 28 items belong to scale 4 Construct individual knowledge; 5, 11, 17, 23, and 29 items belong to scale 5 Self pacing; and 6, 12, 18, 24, and 30 items belong to scale 6 Self evaluation. The content validity ratio (CVR = .85) and Cronbach Alpha reliability coefficient 0.81. (Before study = 0.78, during study = 0.77, after study = 0.87) was found. Participants took maximum 10 minutes to response the whole items.

7.3.2 Achievement Test on Tissue

Tissue test (Bhattacharjee and Jena, 2017a) for class IX has 25 multiple choice items having three strong distractors and one correct response for each item. Preliminary try out was conducted with six experts to find out the content validity ratio. The content validity ratio, test retest reliability, and Cronbach alpha reliability was found to be 0.83, 0.85, and 0.89, respectively. Maximum 10-15 minutes are needed to response the whole items. An equivalent set of posttest on the tissues has 25 multiple-choice items with three strong distractors and one correct response was constructed for each item. Preliminary try out was also conducted with six experts to find out the content validity ratio. The content validity ratio, test retest reliability, and Cronbach alpha reliability was found to be 0.83, 0.85, and 0.89, respectively. Maximum 10-15 minutes needed to response whole items.

8. Procedure of Experiment

8.1 Activity 1: Individual Web 2.0 (Slideshare, Wiki, Whatsapp, Youtube)

Fourty class IX student of school 2 was assigned with Web 2.0 technology assisted Slideshare, Wiki, Youtube, and Whatsapp based learning. All these applications are online learning tools, where the researcher took the initiation on how to train the class IX students to learn through online mode via web 2.0 technology (see Figure 1).

A special training program was organized on how to operate the laptop, desktop, smartphone, and how to browse materials for learning purpose. The researchers have installed a hundred rupees data package to continue the internet facility. During the training, they have faced difficulties because 25% students have no laptop or desktop in their home. That is why the researchers have requested the school headmaster to provide computer lab. It was another interesting fact that parents were requested to take their laptops and desktops to the school for their children's better training for online education.

Accordingly, parents took initiation and installed in their laptops and desktops in the school for training. The researchers identified the web 2.0 applications, and learned on how to teach through these. In day 1, Wiki and WhatsApp applications and their functions in teaching learning program was clarified and taught with demonstration. The researcher installed the WhatsApp applications in their parents' smartphones, desktops, and laptops. In day 2, the software like YouTube application and Slideshare was installed followed by demonstration on how to learn online through YouTube and Slideshare. No frequent feedback was given to the students. The course material announced with teaching points and special guidelines also provided information regarding the timetable of using internet. In this way, the formal instruction of web 2.0 learning continued, which in detail is given in Figure 1.

8.2 Activity 2: Collaborative Web 2.0 (Slideshare, Wiki, Whatsapp, Youtube)

Thirty class IX students of school 3 was assigned with collaborative web 2.0 technology assisted online learning, where Slideshare, Wiki, WhatsApp, and YouTube were not used in individual mode rather a collaborative mode. Similar to individual web 2.0 technology based training, collaborative participants' parents were requested to install their smartphones, laptops, and desktops in their classroom. Next day the training was organized regarding the installation of software applications and training on how

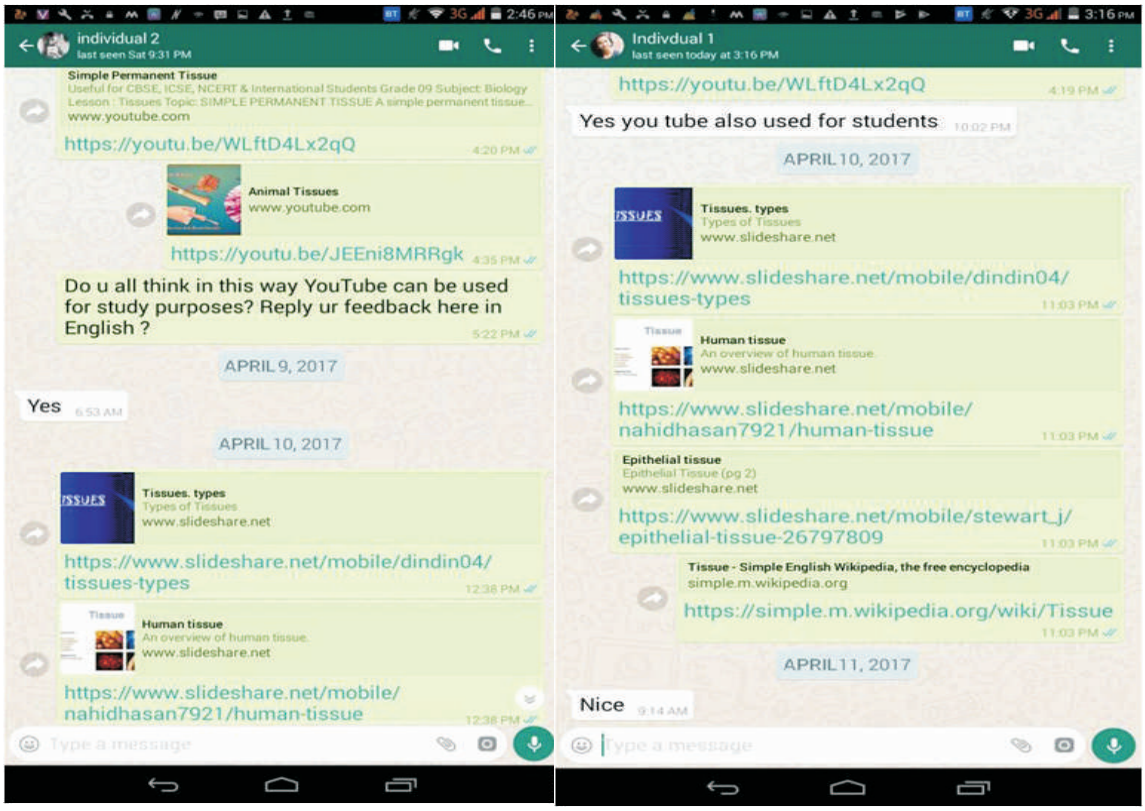

Figure 1. Individual Web2.0 (Slideshare, Wiki, Whatsapp, Youtube)

to learn through these applications. No frequent feedback was given to the students. The course material was announced with teaching points and special guidelines were also provided regarding timetable of using internet. In this way, the formal instruction of web 2.0 learning continued which is given below in detail.

8.2.1 Phase I: Installing Software

During the training session, WhatsApp and YouTube applications were installed and the knowledge of YouTube, learning through Wiki, YouTube, WhatsApp, and Slideshare was provided to the learner. A demonstration class was taken by the researcher to equip the learners for learning in online mode.

8.2.2 Phase II: Collaborative Learning Activity

During the training session, a group was created in the WhatsApp along with the researcher. The researcher posted the learning material in the WhatsApp and sent to the group.

Simultaneously, all the participants got the same information/ reading material and accordingly they shared their valuable understanding, clarification, misconceptions, and eagerness to know the relationship between the concepts, the differentiation among the factors, reasons, causes, and factors effecting different issues on tissues. In this time, the researcher also posted her opinion on content knowledge to the participants for better clarification. In WhatsApp, the researcher provided study materials and hyperlinks of YouTube to the group and advised the students to click in the hyperlinks to see the video lectures based on tissue. In this way, the two directional online learning processes continued and completed the concept on tissues (See Figure 2).

8.2.3 Phase III: Feedback

The researcher solved the learning difficulties during the instruction, but a special feedback was provided to the participants who were unable to reach or faced difficulty in the material.

8.2.4 Phase IV: Enrich Instruction

The WhatsApp group continuously showed their difficulties

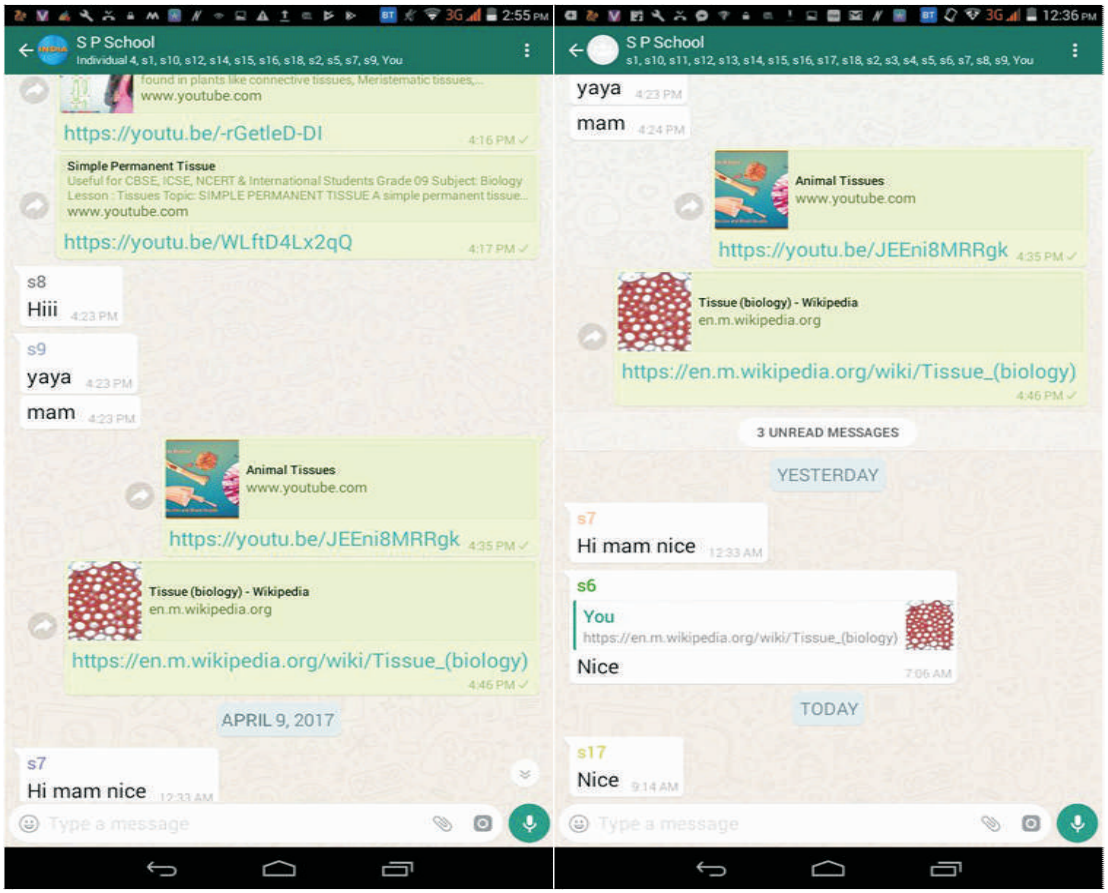

Figure 2. Collaborative Web 2.0 (Slideshare, Wiki, WhatsApp, Youtube)

and wanted to clarify their doubts, misunderstandings, and to get the enriched material. After knowing the learners' eagerness and desire of study, the researcher posted enriched content in the form of Wiki, YouTube, WhatsApp, and Slideshare about the tissues.

8.2.5 Phase V: Feedback

The researchers did not neglect the participants' interest and desire of learning with the new tool, sending many materials, and directly interacting with their learning difficulties and their permanent understanding of the concept. Class IX students of school 1 were treated with traditional intervention. Tissue concept was discussed with question-answering methods with book reading. No frequent feedback was given to the students. Thus, during the intervention, the parents of the participants took the pain for installing the desktop, laptop, smartphones, and waited for hours that are respectable and there is no language to express my gratitude to them. The extraneous variable like history, testing, maturation, regression, attrition, and Hawthorne effect was minimized with different techniques. After collecting the data, some extent intervening variables are minimized through statistical technique like ANCOVA.

8.3 Activity 3: Traditional Treatment

No special treatment was provided to any of the participants of the non-web 2.0 group or the comparative group. However, the researchers used lecture cum discussion method to complete the contents of tissue. Pretest and posttest was administered among the participants like individual and collaborative web 2.0 group participants.

9. Procedure of Data Collection

The present study is quasi-experimental research, where three groups were assigned for treatment 1, treatment 2, and traditional approach to learn tissue contents.

Experimental group 1 was treated with web 2.0 technology assisted Slideshare, Wiki, YouTube, and WhatsApp through individual modes of learning. Experimental group 2 was treated through web 2.0 technology assisted Slideshare, Wiki, YouTube, and WhatsApp through collaborative modes of learning, but traditional group was treated with lecture cum discussion method. According to the purpose of the study, the researcher administered pretest to all the three groups and after instruction; posttest was assigned to assess their learning performance. After one month of posttest, a delay test was administered to assess the retention level and the effectiveness of web 2.0 technology based learning over traditional approach. Not only that a self-regulatory questionnaire was administered to all the three groups to know their self-learning interest, attitude, and how much they are satisfied with their approaches. Here pretest posttest delayed test and self-regulatory question response sheet of 30 collaborative participants, 40 individual participants, and 40 traditional students were collected for data tabulation, analysis, and interpretation to draw the inferences.

10. Analysis and Result

SPSS version 21 was used to analyze the data about the effect of individual and collaborative web 2.0 technology on the learning performance, and self-regulation; ANCOVA and ANOVA statistics were used. ANCOVA predicts the outcome of the continuous variable (achievement), assesses the effect of experimental manipulations, and minimizes the bias of covariates. ANCOVA reduces within group error variance if any unexpected reason or internal validity influences the effectiveness of intervention on the posttest. To some extent, it reduces the error variance and accurately assesses the effect of the experimental manipulation. Pretest was used as a covariate to eliminate the confounding variable. In the present study, specially ANCOVA was used for assessing the effectiveness of intervention of learning performance and retention. ANOVA was used to eliminate the mean differences among the different groups with regard to their self-regulation in web 2.0 based learning.

10.1 Testing of Hypothesis 1

- There is a significant difference between individual and collaborative web 2.0 technology based learning performance of secondary school students over traditional approach.

Table 1 reveals the means and Standard Deviation (SD) of learning performance of traditional, individual web 2.0, and collaborative web 2.0 assisted learning performance. The traditional group post test score (m =19.70, SD = 3.220) was smaller than the individual web 2.0 posttest score (m=35.00, SD= 2.265) and collaborative web 2.0 posttest (m=40.27, SD=1.721). Here, the collaborative web 2.0 technology assisted learning performance was better over both traditional and individual web 2.0 learning performance.

Table 2 interprets the univariate analysis for the posttest scores of traditional, individual web 2.0, and collaborative web 2.0 learning performance, where pretest score is used as the covariate. The F value at the df=2/106, is 137.697, and $p<.05$ was significant and there was statistical significant difference among the posttest score of traditional, individual web 2.0, and collaborative web 2.0 learning performance.

Table 3 depicts the effects of covariate on the posttest mean estimated in this model. The covariates appearing in

Group	N	Mean	SD
Traditional	40	19.70	3.220
Individual Web 2.0	40	35.00	2.265
Collaborative Web 2.0	30	40.27	1.721
Total	110	30.87	9.093

Table 1. Mean and SD of Learning Performance of Individual web2.0 and Collaborative Web 2.0 Learning over Traditional Approach

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8328.209[a]	3	2776.070	430.204	.000
Intercept	392.993	1	392.993	60.902	.000
Posttest	6.257	1	6.257	.970	.327
Group	1777.097	2	888.548	137.697	.000
Error	684.009	106	6.453		
Total	113856.000	110			
Corrected Total	9012.218	109			

[a]R Squared = .924 (Adjusted R Squared = .922)

Table 2. ANCOVA for Groups (Traditional, Individual web 2.0, and Collaborative web 2.0)

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Traditional	20.248[a]	.686	18.887	21.609
Individual Web2.0	34.810[a]	.446	33.927	35.693
Collaborative Web2.0	39.789[a]	.671	38.459	41.119

[a]Covariates appearing in the model are evaluated at the following values: posttest = 39.60.

Table 3. Estimated Marginal Mean of Traditional, Individual Web 2.0, and Collaborative Web 2.0 Learning

the model was evaluated, which was pretest=13.48, while the pretest mean of traditional group (18.887), individual web 2.0 group mean (33.927), and collaborative web 2.0 group mean was 38.459.

Table 4 reveals the Bonferroni multiple comparisons, which showed the adjusted and estimated marginal mean difference between traditional and individual web 2.0 (m= -14.562, p<.05), traditional, and collaborative web 2.0 (m= -19.541, p<.05) was significant. Similarly, mean difference between individual web 2.0 and traditional group in the retention test (m= 14.562, p<.05), the individual web 2.0, and collaborative web 2.0 (m=-4.979, p<.05) was significant. So far collaborative web 2.0 is concerned, traditional group mean difference (m=19.541, p<.05) and the mean difference between collaborative web 2.0 and individual web 2.0 was (m= 4.979, p<.05) significant. It showed that the mean difference between traditional and experimental group was found significant. Not only was that but also there was significant difference between individual and collaborative web 2.0 in the posttest learning performance of students.

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Traditional	Individual Web 2.0	-14.562	.940	.000
	Collaborative Web 2.0	-19.541	1.208	.000
Individual Web 2.0	Traditional	14.562	.940	.000
	Collaborative Web 2.0	-4.979	.679	.000
Collaborative Web 2.0	Traditional	19.541	1.208	.000
	Individual Web 2.0	4.979	.679	.000

Table 4. Bonferroni Multiple Comparisons among of Traditional, Individual Web 2.0, and Collaborative Web 2.0 Approaches

10.2 Hypothesis 2

- There is significant difference between individual and collaborative web 2.0 technology on the self-regulatory learning of secondary school students over traditional approach.

Table 5 reveals self-regulation of learning during the intervention of traditional experience, individual web 2.0, and collaborative web 2.0. In engagement with social interaction subscale, the traditional group (N=40) mean ± SD (24.63 ± 1.234) was lowest than collaborative web 2.0 (N=30) mean ± SD (47.50 ± 1.167) and individual web 2.0 (N=40), Mean ± SD (43.14 ± 1.583). In this subscale, the self-regulatory experience after the intervention of collaborative web 2.0 was better than individual web 2.0 and traditional intervention. ANOVA of engage with social interaction subscale among the three groups was found (F = df 2/107, 2970.93 p<.05 see Table 6). In the conceptual understanding, the traditional group (N=40) mean ± SD (25.08 ± 1.542) was lowest than collaborative web 2.0 (N=30) Mean ± SD (47.37 ± 1.326) and individual web 2.0 (N=40) Mean ± SD (41.20 ± 1.556). In this subscale, the self-regulatory experience after the intervention of collaborative web 2.0 was better than individual web2.0 and traditional intervention. ANOVA of conceptual understanding subscale among the three groups was found (F = df 2/107, 2160.703 p<.05, see Table 6). Again in construct collaborative knowledge, the traditional group (N=40) Mean ± SD (26.75 ± 1.958) was lowest than collaborative web 2.0 (N=30) Mean ± SD (47.20 ±1.400) and individual web 2.0 (N=40) Mean ± SD (39.15±1.528). In this subscale, the self regulatory experience after the intervention of collaborative web 2.0 was better than individual web 2.0 and traditional intervention. ANOVA construct collaborative knowledge subscale among the three groups was found (F = df 2/107, 1350.210 p<.05, see Table 6). In construct individual knowledge subscale, the traditional group (N=40) Mean ± SD (25.43 ± 2.099) was lowest than collaborative web 2.0 (N=30) Mean ± SD (47.03 ± 1.326) and individual web 2.0 (N=40) Mean ± SD (39.33 ± 1.900). In this subscale, the self-regulatory experience after the intervention of collaborative web 2.0 was better than individual web 2.0 and traditional

Self Regulation		N	Mean	SD
Engage With Social Interaction	Traditional	40	24.63	1.234
	Individual Web 2.0	40	43.18	1.583
	Collaborative Web 2.0	30	47.50	1.167
	Total	110	37.61	10.098
Conceptual Understanding	Traditional	40	25.08	1.542
	Individual Web 2.0	40	41.20	1.556
	Collaborative Web 2.0	30	47.37	1.326
	Total	110	37.02	9.509
Construct Collaborative Knowledge	Traditional	40	26.75	1.958
	Individual Web 2.0	40	39.15	1.528
	Collaborative Web 2.0	30	47.20	1.400
	Total	110	36.84	8.461
Construct Individual Knowledge	Traditional	40	25.43	2.099
	Individual Web 2.0	40	39.33	1.900
	Collaborative Web 2.0	30	47.03	1.326
	Total	110	36.37	9.044
Self Pacing	Traditional	40	26.08	1.655
	Individual Web 2.0	40	39.48	2.063
	Collaborative Web 2.0	30	46.80	1.297
	Total	110	36.60	8.676
Self Evaluation	Traditional	40	33.00	1.769
	Individual Web 2.0	40	41.40	1.150
	Collaborative Web 2.0	30	47.13	.973
	Total	110	39.91	5.877

Table 5. Individual and Collaborative Web 2.0 Technology on the Self-regulatory Learning of Secondary School Students over Traditional Approach

intervention. ANOVA of construct individual knowledge subscale among the three groups was found (F = df 2/107 1258.657, p<.05). Similarly, in self-pacing subscale, the traditional group (N=40) mean, ± SD (26.08 ± 1.655) was lowest than collaborative web 2.0 (N=30) Mean ± SD (46.80 ± 1.297) and individual web 2.0 (N=40) mean ± SD (39.48 ± 2.063). In this subscale, the self-regulatory experience after the intervention of collaborative web 2.0 was better than individual web 2.0 and traditional intervention. ANOVA of self-pacing subscale among the three groups was found (f = df 2/107 1311.561, p<.05). Lastly, in self evaluation subscale, the traditional group (N=40) Mean ± SD (33.00 ± 1.769) was lowest than collaborative web 2.0 (N=30) Mean± SD (47.13 ± 0.973) and individual web 2.0 (N=40) Mean ± SD (41.40 ± 1.150). In this subscale, the self-regulatory experience after the intervention of collaborative web 2.0 was better than individual web 2.0 and traditional intervention. ANOVA of self evaluation subscale among the three groups was found (F = df 2/107, 948.319, p<.05) (see Table 6).

Table 7 depicts Scheffe multiple comparison among traditional, individual web 2.0, and collaborative web 2.0 with reference to engaged social interaction of self-regulation experience after intervention. In engage with social interaction subscale, the mean difference between traditional and individual web 2.0 (m= 18.550, p<.05) and collaborative web 2.0 (m = -22.875, p<.05). Similarly, in

		Sum of Squares	df	Mean Square	F	Sig.
Engage With Social Interaction	Between Groups	10917.541	2	5458.770	2970.193	.000
	Within Groups	196.650	107	1.838		
	Total	11114.191	109			
Conceptual Understanding	Between Groups	9617.822	2	4808.911	2160.703	.000
	Within Groups	238.142	107	2.226		
	Total	9855.964	109			
Construct Collaborative knowledge	Between Groups	7505.655	2	3752.827	1350.210	.000
	Within Groups	297.400	107	2.779		
	Total	7803.055	109			
Construct Individual Knowledge	Between Groups	8552.202	2	4276.101	1258.657	.000
	Within Groups	363.517	107	3.397		
	Total	8915.718	109			
Self Pacing	Between Groups	7882.850	2	3941.425	1311.561	.000
	Within Groups	321.550	107	3.005		
	Total	8204.400	109			
Self Evaluation	Between Groups	3564.024	2	1782.012	948.319	.000
	Within Groups	201.067	107	1.879		
	Total	3765.091	109			

Table 6. ANOVA Individual and Collaborative Web 2.0 Technology on the Self-regulatory Learning of Secondary School Students over Traditional Approach

case of individual web 2.0, the mean difference from traditional intervention (m=18.550, p<.05) and collaborative web 2.0 (m=-4.325, p<.05) was found. The mean difference between collaborative web 2.0 and traditional group (m=23.875, p<.05) and individual web 2.0 (m=4.325, p<.05) was also determined. In conceptual understanding subscale, the mean difference between traditional and individual web 2.0 (m= -16.125, p<.05) and collaborative web 2.0 (m = -22.292, p<.05) was found. Similarly in case of individual web 2.0, the mean difference from traditional intervention (m=16.125, p<.05) and collaborative web 2.0 (m= -6.167, p<.05) was found. The mean difference between collaborative web 2.0 and traditional group (m=22.292, p<.05) and individual web 2.0 (m=6.167, p<.05) was determined. In construct collaborative knowledge subscale, the mean difference between traditional and individual web 2.0 (m= -16.125, p<.05) and collaborative web 2.0 (m = -22.292, p<.05) is found. Similarly in case of individual web 2.0, the mean difference from traditional intervention (m=16.125, p<.05) and collaborative web 2.0 (m= -6.167, p<.05) was found. The mean difference between collaborative web 2.0 and traditional group (m= 22.292, p<.05) and individual web 2.0 (m= 6.167, p<.05) was also found. In construct individual knowledge subscale, the mean difference between traditional and individual web 2.0 (m= -13.900, p<.05) and collaborative web 2.0 (m = -21.608, p<.05) is determined. Similarly in case of individual web 2.0, the mean difference from traditional intervention (m=13.900, p<.05) and collaborative web 2.0 (m= -7.708, p<.05) is also found. The mean difference between collaborative web 2.0 and traditional group (m=21.608, p<.05) and individual web 2.0 (m=7.708, p<.05) is analysed. In Self Pacing subscale, the mean difference between traditional and individual web 2.0 (m= -13.400, p<.05) and collaborative web 2.0 (m = -20.725, p<.05) was found. Similarly, in case of individual web 2.0, the mean difference from traditional intervention (m=13.400, p<.05) and collaborative web 2.0 (m= -7.325, p<.05) is determined. The mean difference between collaborative web 2.0 and traditional group (m= 20.725, p<.05) and individual web 2.0 (m= 7.325, p<.05) is found. In self-evaluation subscale,

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
Engage With Social Interaction	Traditional	Individual Web 2.0	-18.550*	.303	.000
		Collaborative Web 2.0	-22.875*	.327	.000
	Individual Web 2.0	Traditional	18.550*	.303	.000
		Collaborative Web 2.0	-4.325*	.327	.000
	Collaborative Web 2.0	Traditional	22.875*	.327	.000
		Individual Web 2.0	4.325*	.327	.000
Conceptual Understanding	Traditional	Individual Web 2.0	-16.125*	.334	.000
		Collaborative Web 2.0	-22.292*	.360	.000
	Individual Web 2.0	Traditional	16.125*	.334	.000
		Collaborative Web 2.0	-6.167*	.360	.000
	Collaborative Web 2.0	Traditional	22.292*	.360	.000
		Individual Web 2.0	6.167*	.360	.000
Construct Collaborative knowledge	Traditional	Individual Web 2.0	-12.400*	.373	.000
		Collaborative Web 2.0	-20.450*	.403	.000
	Individual Web 2.0	Traditional	12.400*	.373	.000
		Collaborative Web 2.0	-8.050*	.403	.000
	Collaborative Web 2.0	Traditional	20.450*	.403	.000
		Individual Web 2.0	8.050*	.403	.000
Construct Individual Knowledge	Traditional	Individual Web 2.0	-13.900*	.412	.000
		Collaborative Web 2.0	-21.608*	.445	.000
	Individual Web 2.0	Traditional	13.900*	.412	.000
		Collaborative Web 2.0	-7.708*	.445	.000
	Collaborative Web 2.0	Traditional	21.608*	.445	.000
		Individual Web 2.0	7.708*	.445	.000
Self Pacing	Traditional	Individual Web 2.0	-13.400*	.388	.000
		Collaborative Web 2.0	-20.725*	.419	.000
	Individual Web 2.0	Traditional	13.400*	.388	.000
		Collaborative Web 2.0	-7.325*	.419	.000
	Collaborative Web 2.0	Traditional	20.725*	.419	.000
		Individual Web 2.0	7.325*	.419	.000
Self Evaluation	Traditional	Individual Web 2.0	-8.400*	.307	.000
		Collaborative Web 2.0	-14.133*	.331	.000
	Individual Web 2.0	Traditional	8.400*	.307	.000
		Collaborative Web 2.0	-5.733*	.331	.000
	Collaborative Web 2.0	Traditional	14.133*	.331	.000
		Individual Web 2.0	5.733*	.331	.000

Table 7. Scheffe Multiple Comparisons Individual and Collaborative Web 2.0 Technology on the Self-regulatory Learning of Secondary School Students over Traditional Approach

the mean difference between traditional and individual web 2.0 (m= 8.400, p<.05) and collaborative web 2.0 (m = -14.133, p<.05) is determined. Similarly, in case of individual web 2.0, the mean difference from traditional intervention (m= 8.400, p<.05) and collaborative web 2.0 (m= -5.733, p<.05) was found. The mean difference between collaborative web 2.0 and traditional group (m= 14.133, p<.05) and individual web 2.0 (m= 5.733, p<.05)

was found.

11. Discussion

The study claimed that individual and collaborative web 2.0 technology has significant effect on learning performance of secondary school students over traditional approach. Here, web 2.0 technology based intervention has significant effect on learning performance as compared to individual web 2.0 technology; the collaborative web 2.0 technology has statistically more significant effect on learning performance over traditional and individual web 2.0 based learning. This was because of sharing of information, gathering of collaborative knowledge, dissemination of knowledge, skills, and technological transformation of competencies over traditional approach. The result of the study was equivalent to earlier studies (Dabbagh and Kitsantas, 2012; Exter et al., 2012; Madar and Abdikadir, 2015; Rahimi et al., 2013).

It was found that the effect of individual and collaborative web 2.0 technology based intervention has significant effect on self-regulatory learning of secondary school students over traditional approach. In the engage with social interaction subscale, the collaborative web 2.0 technology learners' self-regulatory learning assumption was better than individual web 2.0 technology and traditional group of learners' assumptions. Similarly in conceptual understanding, constructing collaborative knowledge, constructing individual knowledge, self-pacing, and self evaluation subscales collaborative web 2.0 technology based learners' perceptions towards self regulatory learning through web 2.0 technology was better than both individual web 2.0 technology and traditional group of students' learning perception. The study also claimed that the impact of collaborative and individual web 2.0 technology based learning on the performance of secondary school students in Silchar town was statistically significant. This was the first study in India where both collaborative and individual web 2.0 technology used in learning biology, especially in the learning of tissues to secondary school students who have no laptop or desktop for personal use. This result was corroborated with the earlier studies (eg. Beldarrain, 2006; Huffaker, 2004; Parker and Chao, 2007). The learning environment in the secondary school of Silchar, Assam, India was not fully technology assisted or the learners have no laptop, desktop, etc. However, the researcher undertook the study and applied web 2.0 technology in two schools by collecting and requesting the parents to install their laptop, desktop in the concerned classroom. After all, the instruction was provided through individual and collaborative modes, as a result the learning performance was found better than traditional approach. The retention was assessed after one month of intervention, where maturation, motility, etc, were the main extraneous variables minimized during statistical analysis. In this study, no participants drop out up to the retention test. In Assam, mostly in area of Silchar town learner has so many opportunities to continue their higher course at the end of their course. However, the participants responded the retention test and found collaborative web 2.0 technology has the significant effect over the individual web 2.0 and traditional approach. The effect of individual and collaborative web 2.0 technology on the self-regulatory learning was assessed and found statistically significant effect over traditional approach. This result of the current study was supported by Hsu et al., 2009; Kitsantas, 2013; Li and Liu, 2007; Rahimi et al., 2013; Yen et al., 2013 and not corroborated by Benishek, 2014; Tutty, 2013. In all subscale of self-regulation scale, collaborative web 2.0 technology group of learners' perception towards web 2.0 technology as the instructional tool was found better over traditional approach. This is because the traditional approach of learning is teacher centric and so learners have few hours every day for their self-regulatory learning. Nevertheless web 2.0 technology is an online platform operated by Wiki, Blog, Facebook, Podcasts, Slideshares, WhatsApp, Twitter, Journals, Linkedin, Power point presentations, YouTube, Skype, videoconferencing, and all such tools. Recently providing, sharing, collecting, disseminating, knowledge competency, skill got better gaining of information. That is why, web 2.0 group perceived it as a suitable media for self-regulatory learning over traditional approach.

Conclusion

Web 2.0 technology is an internet-assisted software of World Wide Web based tool. It includes Wiki, Blog,

Facebook, Podcasts, Slideshares, WhatsApp, Twitter, Journals, Linkedin, PowerPoint presentations, YouTube, Skype, Videoconferencing, and the link. Nevertheless, in the recent study Wiki, YouTube, WhatsApp, and Slideshare were used both in individual and collaborative mode. It was concluded that collaborative web 2.0 technology was better over individual web 2.0 technology based learning. In India, still technology based learning, smart classrooms, internet assisted online platform inside institutional boundary or at least a well-equipped library could not be found in secondary level. The researcher has put an effort, provided online instruction through web 2.0 technology assisted software, and the learners perceived self-regulatory efficiency of web 2.0 technology. The retention level also found satisfactory which was not possible in traditional mode of learning. Recently researchers, scholars, educators are emphasizing on self learning, self pacing, and self-evaluation of learning performance before going to sit for summative evaluation. However, traditional mode of instruction is still going on with rote learning and it is encouraging students to learn through note, traditional exercise, and vocabulary practice. The literatures argued and the recent studies corroborated that web 2.0 technology would be provided through individual smartphone, Ipad, tab, laptop, and desktop. Out of these IT accessories mobile is cost effective and available with learners' family member. Therefore, the family members should provide the learner to access the smartphone for one to two hours. Teacher should encourage self-learning and should provide opportunity to use web 2.0 technology based learning platform.

Educational Implications

The stakeholders should take the initiations to develop the curriculum, syllabus, and the mode of instruction by integrating web 2.0 technology in them. Parents should provide at least one to two hours for using their smartphone for web 2.0 technology based learning to their children. The policymakers should take the precautions regarding the allocation of fund for the construction of online platform in each elementary and secondary school with trained instructors. Frequently the teachers and the teacher educators should be oriented and reoriented with ICT and web 2.0 based learning. The study recommended conducting to conduct investigation on the effect of individual and collaborative web 2.0 technology on participants' gender, socioeconomic status, home environmental status, and IQ like in relation to learning performances. Parental attitude, socio economic status and their perception towards mobile learning and web 2.0 technology based learning needs further investigation. Teachers' perception, attitude and their efficiency to provide web 2.0 technology based instruction and creating online learning environment needs further investigation. Inclusive education, main streaming education, special education how equipped with web 2.0 technology for better performance and learning efficiency of the students need further investigation, assessment, and inquiry.

References

[1]. Albion, P. R. (2008). Web2.0 in teacher education: Two imperatives of action. *Interdisciplinary Journal of Practice, Theory, and Applied Research,* 25(3-4), 181-198.

[2]. An, Y., Aworuwa, B., Ballard, G., & Williams, K. (2009). Teaching with Web 2.0 technologies: Benefits, barriers, and best practices. *AECT Annual Proceedings* (pp. 1-6). Nova Southeastern University, North Miami Beach, Florida.

[3]. Beldarrain, Y. (2006). Distance Education Trends: Integrating new technologies to foster student interaction and collaboration. *Journal of Distance Education,* 27(2), 139-153.

[4]. Benishek, L. (2014). *Exploring the Hows and the Whos: the Effects of Self-regulation Prompting and Goal Orientation on the E-learning Process* (Electronic Theses and Dissertations, University of Central Florida Orlando: Florida).

[5]. Bhattacharjee, S., & Jena, A. K. (2017a). *Achievement Test in Tissue.* Assam University, Silchar.

[6]. Bhattacharjee, S., & Jena, A. K. (2017b). *Self-regulatory Learning Test.* Assam University, Silchar.

[7]. Cochrane, T., & Bateman, R. (2008). *Engaging Students with Mobile Web 2.0.* Paper presented at the Teaching & Learning Conference, Eastern Institute of Technology, Hawkes Bay.

[8]. Dabbagh, N., & Kitsantas, A. (2012). Personal Learning Environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education,* 15(1), 3-8.

[9]. Dweck, C. S. (2002). Beliefs that make smart people dumb. In R. J. Sternberg (Ed.), *Why Smart People do Stupid Things* (pp. 24-31). New Haven: Yale University Press.

[10]. Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review,* 95(2), 256-273.

[11]. Ebner, M., & Nagler, W. (2010). Has Web 2.0 reached the educated top? *Journal of Applied Computing,* 6(2), 27-37.

[12]. Exter, K. D., Rowe, S., Boyd, W., & Lloyd, D. (2012). Using Web 2.0 Technologies for Collaborative Learning in Distance Education: Case Studies from an Australian University. *Future Internet,* 4(1), 216-237.

[13]. Grosseck, G. (2009). To use or not to use web 2.0 in higher education. *Procedia Social and Behavioral Sciences,* 1(1), 478 -482.

[14]. Hsu, Y., Ching, Y., & Grabowski, B. (2009). Web 2.0 technologies as cognitive tools of the new media age. In Hin Tan , L.W. (Ed). *Handbook on Research on New Media Literacy Issues and Challenges* (pp. 353-371). IGI Global: Information Science Reference Publication.

[15]. Huffaker, D. (2004). The educated blogger: Using Weblogs to promote literacy in the classroom. *Peer Reviewed Journal on the Internet,* 9(6-7),1-10.

[16]. Khalid, I. (2010). *Role of Web 2.0 Technology for Knowledge Building in Higher Education* (Masters Degree Project published. Linnaeius University; School of Computer Science, Physics and Maths).

[17]. Kitsantas, A. (2013). Fostering college students' selfregulated learning with learning technologies. *Hellenic Journal of Psychology,* 10(3), 235-252.

[18]. Li, M., & Liu, L. (2007). The brief analysis of the training of long-distance learners' self-regulated learning ability under the Web 2.0 environment. *Journal of Jilin Teachers Institute of Engineering and Technology,* 3(1), 34-37.

[19]. Madar, M., & Abdikadir, M. H. (2015). An integrated framework of web 2.0 technology and a collaborative learning. *International Journal of Scientific & Technology Research,* 4(5), 253-256.

[20]. Malhiwsky, D. R. (2010). *Student Achievement using Web 2.0 Technologies: A Mixed Method Study* (Public Access Theses and Dissertations from the College of Education and Human Sciences, University of Nebraska-Lincoln).

[21]. McLoughlin, C., & Lee, M. J. W. (2007). Social software and participatory language: Pedagogical Choices with technology affordances in the Web2.0 era. Proceedings Ascilite Singapore.

[22]. Paris, S. G., & Paris, A. H. (2001). Classroom Applications of Research on Self-Regulated Learning. *Educational Psychologist,* 36(2), 89-101.

[23]. Parker, K. R., & Chao, J. T. (2007). Wiki as a teaching tool. *Interdisciplinary Journal of Knowledge and Learning Objects,* 3(1), 58-79.

[24]. Perry, N. E., Phillips, L., & Hutchinson, L. (2006). Preparing student teachers to support for self-regulated learning. *The Elementary School Journal,* 106(3), 237-254.

[25]. Rahimi, E., Van den Berg, J., & Veen, W. (2013). A framework for designing enhanced learning activities in web2.0-based Personal Learning Environments. In *Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications* (pp. 2222-2231). *Association for the Advancement of Computing in Education (AACE).*

[26]. Tutty, J. I. (2013). *Effects of Self-regulatory Status and Practice Type on Student Performance in the Mobile Learning Environment* (Doctor of Education Dissertation Published. Liberty University: Lynchburg).

[27]. Yen, C., Tu, C., Laura, E. S., Armfield, S. W. J., & Chan, J. (2013). Learner self-regulation and web 2.0 tools management in personal learning environment. *International Journal of Web-Based Learning and Teaching Technologies,* 8(1), 46-65.

ABOUT THE AUTHORS

Dr. Ananta Kumar Jena is working as an Assistant Professor in the Department of Education at Assam University, Silchar, India. He has received his M.Sc. Degree in Botany from the North Orissa University, and M.Ed. with Ph.D. from Utkal University, Odisha, India. His research interest, includes Cognitive Science and E-Learning, and Science Education.

Satarupa Bhattacharjee is pursuing her Ph.D. in the Department of Education at Assam University, Silchar, India. She has received her M.Sc. Degree in Life Sciences, and M.Ed. Degree from the Assam University, Silchar, Assam, India. Her area of research interest, includes Cognitive Science, Web 2.0, and Science Education.

Somnath Gupta is a M.Phil Scholar in the Department of Life Science & Bioinformatics at Assam University, Silchar, India. He has received his M.Sc. in Life Sciences, and M.Ed. Degree from the Assam University, Silchar, Assam, India. His research interest, includes Cognitive Science, E-Learning, Genetics, Toxicology, and Science Education.

Joy Das is working as an Assistant Professor in the Department of Teacher Education, Holly Cross College, Agartala,Tripura, India. He has received his M.Sc. Degree in Zoology from the Vidyasagar University, and M.A.(Education) Degree from Netaji Subhash Open University, West Begal, and M.Ed. Degree from the Assam University, Silchar, India. His research interest, includes Cognitive Science, E-Learning, and Science Education.

Rajib Debnath is a Research Scholar in the Department of Education at Assam University, Silchar, India. He has received his M.A. Degree in Bengali and M.Ed. Degree from the Assam University, Silchar, India. His research interest, includes Cognitive Science, E-Learning, Social Networking, and Environmental Education.