

**Effects of Online Technology Based Scaffolding on Asynchronous Learning  
Performance of Students**

**Ananta Kumar Jena**

Assistant Professor

Department of Education

Assam University Silchar 788011

Email: akjenaus@gmail.com

**Somnath Gupta**

Research scholar

Department of Education Assam University Silchar 788011

Email: somnathgupta43@gmail.com

**Abstract**

Instructional Scaffolding is a learning process designed to promote a deeper level of learning and asynchronous learning involves learning via e-mails, blogs etc. The study was conducted in the urban area of Assam, India aimed to find out the effects of Online Technology Based Scaffolding (OTBS) on the asynchronous learning performance in relations to self-efficacy and persistence of school students. Non Equivalent Quasi Experimental Design used to conduct the experiment where pre test and post test used to assess the learning performance over traditional approach. Class VIII students(N = 40) of 'School 1' was counted as the non scaffolding group and 35 students of class VIII of 'School 2' was assigned for the Scaffolding group. It was resulted that 1) the effects of online technology based scaffolding was statistically significant over traditional approach, 2) misinformed factor of self-efficacy was comparatively lower in scaffolding group than the traditional group, and 3) the mean score of current purpose perusing factor of persistence found higher among the participants of the scaffolding group than the participants of the traditional group because of the influence of scaffolding learning.

Key words: asynchronous Learning Performance; online Technology Based Scaffolding persistence of Students; self-Efficacy

**Introduction**

Recently, Online Technology used in the classroom to improve the performance of the students. The terminology scaffolding (Bruner, 1976; Vygotsky, 1978) recently using in the online technology to provide new knowledge based on old knowledge. McLoughlin (1999) felt the importance of redefining scaffolding in terms of online environment where teacher is not present. Instructional scaffolding is a learning process designed to promote a deeper level of learning (Jena, Bhattacharjee, Gupta, Das,& Debnath,2018). Scaffolding is the support given during the learning process relating to the needs of the students with the intention of helping the student in achieving his/her learning goal (Sawyer, 2006). Scaffolding provides a social support, collaboration through World Wide Web (www), computer supported learning environment, intelligent tutoring system and design support environment (McLoughlin, 1999). Literature found a majority of student constructing their knowledge in asynchronous

learning and collaborative learning environment (Bieber, Hitz and Dezhi, 2008). It is also found that there is no difference between synchronous and asynchronous online learning on students' satisfaction (Somenarain, Akkaraju and Gharbaran, 2010). Asynchronous learning involves learning via e-mails, blogs etc. In the present research problem, the researcher uses e-mail as the medium of asynchronous learning (Jena & Pokhrel, 2017; Mayadas, 1997). Research works also found that Instructor Made Videos (IMVs) in asynchronous learning had appositive impact on students' learning (Pan, Sen, Starrett, Bonk, Rodgers, Tikoo and Powell, 2012). The effect of scaffolding of learning autonomy engages high learners' involvement and the scaffolding of the learners helps to create effective learning environment (Bezanilla and Ribbe, 2013). Literature found students' benefit from both synchronous and asynchronous learning environment (Coogle and Floyd, 2015). Students got maximum satisfaction in an asynchronous online learning environment (Choi, 2016). Literature also found that online technology based scaffolding enhances learner's asynchronous learning performance. The technology-based scaffolding in a problem based online asynchronous learning improved students' task orientation and related learning activities (Serife, 2016). Zhu (2012) found online collaborative learning increases students learning achievement. Literature found asynchronous and synchronous e- learner determiner test predict the asynchronous and synchronous learning performance (Shahabadi and Uplane, 2015). However, Picciano (2002) found that there was no significant difference in performance between traditional and online learning group. Online technology based scaffolding has significant role on learning and self-efficacy of students (Girasoli and Hannafin, 2008). Similarly, students overall self-efficacy was low whereas online learning self-efficacy was high (Yantraprakorn, Darasawang and Wiriyakarun, 2013). But Kuo (2010) found that there was no significant relationship between students' asynchronous learning performance and self-efficacy. Rovai (2002) used Tinto's model, Bean and Metzner's model to describe students' persistence in online distance education. Similarly, Croxton (2014) used Bandura's social cognitive theory, Anderson's Interaction-Equivalency theorem and Tinto's Social Integration theory to describe students' persistence. The findings suggest that interactivity is an important component of satisfaction and persistence for online learners. Performance in the field of education or academic performance or academic achievement is the outcome or result of education, provided by the teachers and the academic institutions that measures how far the educational goal has been achieved (Annie, Howard and Mildred, 1996). Self-efficacy referred as personal efficacy is the extent or strength of one's belief in one's own ability to complete tasks and reach goals (Ormrod, 2006). Rovai (2003) defined persistence as a behaviour showing continuity in action or repeating an action despite observing or facing obstacles.

*From the above literatures, it clarified that many of the researchers found online scaffolding has significant role on learners' asynchronous performance, self-efficacy and persistence, and few did not agree. Therefore, it was difficult to predict whether online scaffolding has significant role on asynchronous learning performance, self-efficacy and persistence of the learners. Whether online technology based scaffolding has the significant effect on students' asynchronous learning performance or not? Does the Online Technology Based Scaffolding*

*on students' asynchronous learning performance have the relations with self-efficacy and persistence at primary level?*

The term scaffolding means a structure of planks and metal poles, used while working on a building, which gives a temporary support to the building under construction and this support could be removed after the completion of the building. In education, Jerome Bruner first used the term scaffolding in 1960s means considering the essential elements of effective teaching to help the students in providing stronger understanding and, ultimately, greater independence in the learning process. Here, teachers provide successive levels of temporary supports that help students in reaching higher levels of comprehension and skills that they would not be able to achieve without assistance (Jena, 2013). In his socio-cultural theory, Vygotsky introduced a term ZPD (Zone of Proximal Development) where scaffolding is closely related to ZPD. The zone of proximal development (ZPD) has been defined as: "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers" (Vygotsky, 1978, p. 86; Jena, 2018)). Thus in simple words, the difference between Level of Actual Development or LAD and Level of Potential Development or LPD are the ZPD. Thus, ZPD works as bridging the learning gaps. Lev Vygotsky views interaction with peers as an effective way of developing skills and strategies.

Now, Online Technology based Scaffolding (OTBS) is the process of scaffolding or assisting the students through Online and technologies like Computer, Internet, e-mail etc for better learning by the teacher or the more experienced peer (Jena, 2019). There are various kinds of OTBS materials like Online Quizzes, Play-lists, Weblinks, Multimedia tutorials, PowerPoint presentations, e-books etc. In the present, work the researcher uses e-mail as the technology or medium of OTBS for providing OTBS materials like Multimedia tutorial, Power Point presentation and e-books.

Bandura (1997) defines Self-Efficacy as "beliefs in one's capabilities to organise and execute the courses of action required to produce given attainments." (p3). Self-efficacy determines how people feel, think, motivate themselves and behave. A strong sense of self-efficacy helps in accomplishment of desired work, production of designated level of performance and personal well-being. People generally misinterpret Self-Efficacy with Self-Esteem. They assume the two concepts are the same (Jena, 2014). Nevertheless, self-efficacy and self-esteem are two different concepts. According to Baumeister, self-esteem is how favourably a person regards him or herself. High self-esteem can mean confidence but it can also mean conceited, arrogant, narcissistic behaviour (Briggs, 2014). Briggs (2014). Instead of self-esteem, confidence can be regarded as a stronger predictor of success in case of academic performance (Briggs, 2014). Shoemaker considered self-esteem as an interrelated construct of confidence. Research shows self-efficacy influences academic motivation, learning and achievement whereas according to Baumeister, the effects of self-esteem are small, limited and not all good (Briggs, 2014). Thus, teachers should work on developing self-efficacy of the students by boosting their confidence. Similarly, learning should also be based on increasing confidence and development of self-efficacy. In this context, Dr. Bruno's research

work in Confidence Based Learning may help in developing self-efficacy of students. Confidence Based Learning (CBL), measures the correctness of a learner’s knowledge and confidence in that particular knowledge. In his CBL model or Learning Behaviour Model, Dr. Bruno prepared knowledge quadrants to identify learner’s behaviour (Jena, 2015a; Jena,2015b).

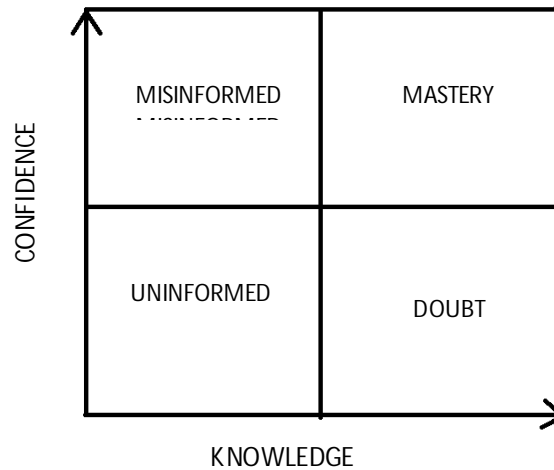


Figure 2: Confidence Based Learning (CBL) Model of Bruno

Source of Figure 2.: taken from <http://resources.axonify.com/blog/the-importance-of-confidence-based-learning> and Cash, Mitchner and Ravyn, 2011

Persistence is the behaviour showing continuing action despite the presence of obstacles (Rovai, 2003). An interrelated and synonymous term of persistence is retention. Bean from his psychological model of persistence showed that factors like entry characteristics, environmental interactions, psychological processes, psychological outcomes, intermediate outcomes attitudes and intention have direct effects on students’ persistence (Bean, Bogdan, 2002). Similarly Pascarella and Terenzini also concluded that multiple forces in multiple setting like student precollege characteristics, organizational context, peer environment, individual student experiences influence students learning and persistence (Reason, 2009). According to Bean and Metzner’s Student Attrition Model, along with the previously mentioned factors like Environmental Variables or environmental factors, Psychological Outcomes etc. students’ academic performance in terms of GPA also effects students’ persistence (Rovai, 2003). In case of online learning, consisting of both synchronous and asynchronous learning, the persistence of the students can be visualised from three theoretical backgrounds viz. Bandura’s Social Cognitive theory, Anderson’s Interaction Equivalency theorem and Tinto’s Social Integration theory (Croxtton, 2014). Social cognitive theory is used to determine the relationship among student, behaviour and environment which in turn helps in determining the persistence of online students. Social learning theory also gives importance to providing active learning environment via students’ interaction(Jena, & Barman,2018). Interaction equivalency theorem is used to examine different types of online interactions occurring online i.e. student-student, student-instructor, student-content (Jena, Gogoi & Deka,2016). Finally, Tinto’s Social integration theory is used to examine how the

student integration plays the role in an online students' choice to whether persist or to drop out an academic environment. For proper persistence, proper interaction or interactivity is necessary. The role of the three theories in developing persistence of students in an asynchronous online course can be described diagrammatically as follows: Social cognitive theory is used to determine the relationship among student, behaviour and environment, which in turn helps in determining the persistence of online students (Jena, Deka & Barman, 2017). Social learning theory also gives importance to providing active learning environment via students' interaction. Interaction equivalency theorem is used to examine different types of online interactions occurring online i.e. student-student, student-instructor, student-content. Thus from the above discussion we can say that when individuals (here online asynchronous learning students) start to believe they are competent via various interactions, they gain self-confidence or self-efficacy and thereby develop higher levels of persistence. After going through the literatures, the researchers assumed that *there is a significant effect of Online Technology Based Scaffolding (OTBS) in Cell on students' asynchronous learning performance, self-efficacy and persistence at primary level.*

### **Methodology**

#### ***Participants***

A total of 175 Class IX students of two schools were the participants whom were randomly assigned for control group, and for an experimental groups. Class VIII students (n=40) of school I having the age range, mean age and SD of their age (14.2-14.9, 13.6 & 0.61 respectively) assigned for traditional treatment, and Class VIII students (n=35) of school II having, age range, mean age & SD of their age (14.3-14.8, 14.5 & 0.71 respectively) assigned for experimental group 1 counted as scaffolding learning group.

#### ***Design of the Study***

Non-equivalent pre test-post test quasi-experimental design is used where sample units are not randomly selected, but the groups (two schools and their respective two class VIII) are randomly selected. The study was a pre test-post test design where Group 2 assigned for Online Technology based Scaffolding Learning to assess the asynchronous learning performance while Group 1 was treated as Traditional Intervention. The purpose of the study was to assess the effect of Online Technology based Scaffolding on the asynchronous learning performance in relation to self-efficacy and persistence of students. That is why the researcher used pre test-post test achievement test on 'Cell', Self-Efficacy Questionnaire and Learning Persistence Scale. During the intervention of Online Technology based Scaffolding Learning, extraneous variables were minimised through ANCOVA and Regression Analysis.

### **Instrumentation**

Three tools were used to collect data from the participants during the experiment.

**i) *Achievement Test on Cell***

Cell Test contains 25 multiple choice type items with 4 options. Both Plant Cell and Animal Cell contents are included during the preparation of the test. The Content Validity Ratio was 0.74, test-retest reliability was 0.89 and Cornbach's Alpha 0.88 and maximum 10 minutes need to response the whole items.

**ii) *Self-Efficacy Questionnaire***

Self-Efficacy Questionnaire constructed to assess the learners' confidence and self-efficacy in learning after attending a class. There were four categories of self-efficacy items such as: a. Misinformed, b. Uninformed, c. Doubt and d. Mastery. Item No. 1, 5,9,13 and 17 counted as Misinformed Items. Item No. 2, 6, 10, 14 and 18 counted as Uninformed Items. Item No. 3, 7, 11, 15 and 19 were categorised in Doubt Subscale and in Mastery Subscale Item No. 4, 8, 12, 16 and 20 are included. All the items were in statement forms having 0 to 10 rating type options. Individual has to rate the items freely without any barrier. There is the freedom to change the option in any time but within the duration of response. The researcher has followed all the standardised guidelines to construct the items and the Construct Validity found to be 0.78 and Test-Retest Reliability to be 0.84 and Cornbach's Alpha 0.83. It requires maximum 10 minutes to response the whole items of the Questionnaire.

**iii) *Persistence Scale***

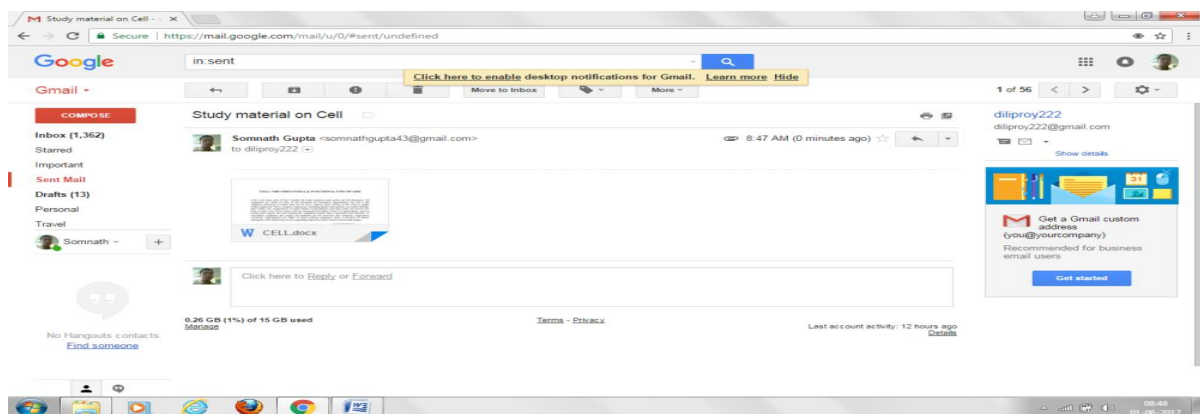
Persistence Scale or Persistence Scale Questionnaire was constructed to assess the learners' persistence in learning after attending a class. Accordingly three categories of persistence items were developed. These are: - a. Current Purpose Pursuing, b. Long Term Purpose Pursuing and c. Recurrence of Unattained Pursuits. Item No. 1, 4, 7, 9, 12, 15 and 18 are counted as 'Current Purpose Pursuing Items'. Item No. 2, 5, 10, 13, 16, 19 and 20 are categorised in 'Long Term Purpose Pursuing Subscale' and in 'Recurrence of Unattained Pursuits Subscale', Item No. 3, 6, 8, 11, 14 and 17 are included. All the items were in statement forms having 0 to 10 rating type options. Individual has to rate the items freely without any barrier. There was the freedom to change the option in any time but within the duration of response. The Construct Validity 0.75, Test-Retest Reliability 0.82 and Cornbach's Alpha was 0.85. It requires maximum 10 minutes to response the whole items of the Questionnaire.

**Procedure of the Experiment**

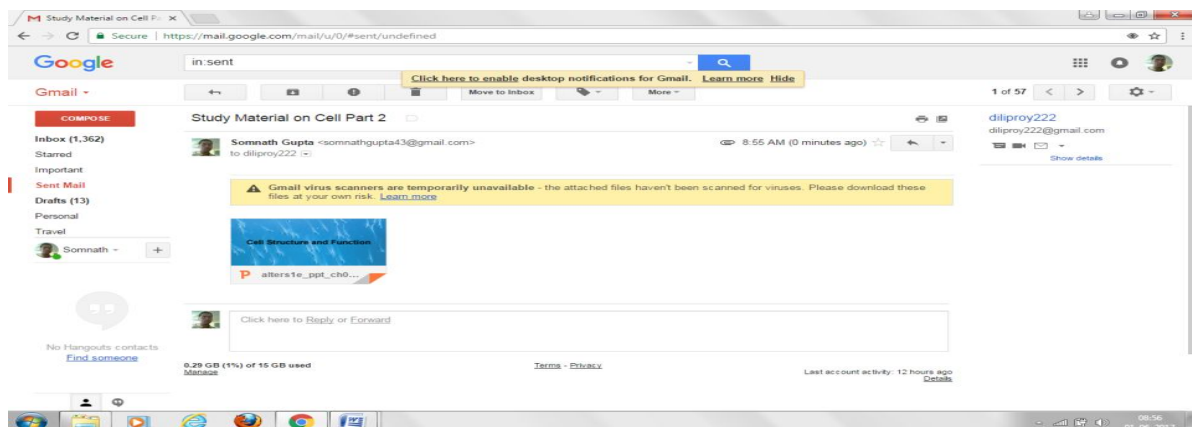
Non Equivalent Quasi Experimental Design used to conduct the experiment where pre test and post test used to assess the learning performance before and after intervention. Here, experimental group students exposed to Online Technology based scaffolding on cell while control group with traditional approach counted as non-scaffolding group. 35 students of Class VIII of School 2 assigned for Online Technology based Scaffolding learning where subjects were exposed to preliminary training on operating the Laptop or Desktop and opening of Gmail, Yahoo mail, Rediff mail and Hotmail. Before that, the whole cell chapter

was analyzed into discovery of cell, general construction of cell, general functioning of cell, concept of animal cell, concept of plant cell, difference between plant and animal cell, microscopy and staining and biochemistry of cell. In these contents huge materials were downloaded including videos, animation and few Wikipedia materials, and screened these materials, and uploaded to the e-mail ID of the participants, and advised them to read these materials in their own pace, and if they feel difficulties they could mail the researcher about their queries at any time. Frequently the researcher uploaded the material according to the need of the participants. This process continued up to two weeks (*see* screenshot 1 & 2). After getting the learning material, participants tried to learn by using their previous knowledge and continuously they proceeded up to their unknown region where the researcher provided guidance, feedback and the knowledge to clarify the misconception or doubt. Participants used the learning material in addition to their previous knowledge, applied their pace of learning and constructed their scaffolding. No such intervention was provided to the traditional group. Before providing online scaffolding learning instructional training to the experimental group, participants were advised to response the pre test on Cell. After collecting the Cell test, Online Scaffolding learning assigned to students with the fix programme and curriculum. Accordingly, the researcher installed Rs. 100/- for internet data packages to all scaffolded group of participants to run the internet and to browse the e-mails, and this process was continued up to one month to complete the cell chapter of biology. A posttest, just the equivalent set of the pre test on Cell was administered among the experimental and control group students to assess their post learning performance. After taking the posttest, Self-Efficacy Questionnaire and Learning Persistence scale was administered to scaffold as well as traditional group of students.

Screenshot 1: 1<sup>st</sup> Study Material on Cell Provided Asynchronously to a Student of the Scaffolding or Experimental Group via e-mail



Screenshot 2: 2<sup>nd</sup> Study Material on Cell Provided Asynchronously to a Student of the Scaffolding or Experimental Group via e-mail



**Analysis and results**

SPSS used to analyze the data of Online Technology Based Scaffolding on Asynchronous Learning Performance, Self Efficacy and Persistence of both scaffolded and non-scaffolded group of participants. In the present study, ANCOVA used to know the effect of intervention on the outcomes and for objective 2 and 3, ANOVA used to know the mean difference between scaffold group and traditional group with regards to self-efficacy and persistence of the secondary school students. ANCOVA is an extended form of ANOVA predicts the outcomes of any continuous variables after the experimental manipulation but the influence of extraneous variables like history, testing, maturation; regression, instrumentation, and mortality were minimized by using covariates. Here pretest of the scaffolded group and traditional group was the covariate. To reduce the within group error variance and eliminating the confounds, ANCOVA used with two important additional considerations: i) Independence of the covariates and treatment effects, and ii) Homogeneity of the regression slopes. ANCOVA used to look at the overall relationship between the outcomes and covariates. Here, the regression line to the entire data set ignored to which group a person belonged. In fitting this overall model, it was assumed that the overall relationship is true for all groups of participants.

H1: There is significant effect of Online Technology Based Scaffolding (OTBS) in Cell on students' asynchronous learning performance at primary level

Table 1.1 Mean, Standard Deviation (SD) of Post-Test Score of Traditional and Online Technology Based Scaffolding (OTBS) Group

Group	Mean	Std. Deviation	N
Traditional	25.10	2.560	40
Online Technology based Scaffolding	38.11	3.462	35
Total	31.17	7.189	75

Table 1.2 Univariate Analysis of Group and Test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	3385.204 <sup>a</sup>	2	1692.602	277.259	.000



Intercept	1055.970	1	1055.970	172.975	.000
pretest	223.600	1	223.600	36.627	.000
Group	3195.021	1	3195.021	523.366	.000
Error	439.543	72	6.105		
Total	76708.000	75			
Corrected Total	3824.747	74			

a. R Squared = .885 (Adjusted R Squared = .882)

Table 1.3 Marginal Adjusted Mean of Traditional and Online Technology Based Scaffolding (OTBS) Group

Group	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Traditional	25.067 <sup>a</sup>	.391	24.288	25.846
Online Technology based Scaffolding	38.152 <sup>a</sup>	.418	37.320	38.985

a. Covariates appearing in the model are evaluated at the following values: pretest = 14.80.

Table 1.4 Bonferroni Multiple Comparison of Post Test between Traditional and Online Technology Based Scaffolding

(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig. <sup>0</sup>
Traditional	Online Technology based Scaffolding	-13.086*	.572	.000
Online Technology based Scaffolding	Traditional	13.086*	.572	.000

Table 1.1 reveals the mean and standard deviation of posttest of learning performance of Traditional, and OTBS Group. It showed that Mean and SD of Traditional Group (M = 25.10, SD = 2.560) was smaller than that of OTBS Group (M = 38.11, SD = 3.462). Univariate Analysis used to estimate the impact of independent variable on dependent variable. Pre-test used as covariate. The post test mean difference between traditional group and online scaffolding group was significant (df = 1/72 , F = 523.366, R<sup>2</sup> = .885 and adjusted R<sup>2</sup> = .882 p < .05). Hence, the intervention was effective over the pre test (see table 1.2). The pre test used as the covariate in the model are evaluated at the value of (m=14.80) and the mean of the traditional group converted to 25.067 which was smaller than the adjusted online technology based scaffolded mean 38.152 (see table 1.3). Bonferroni Multiple Comparison showed the mean difference between the posttest of Traditional and Online Technology Based Scaffolding Group. It showed M = 13.086, p<.05 was significant.

H2: There is significant effect of Online Technology Based Scaffolding (OTBS) in Cell on students' asynchronous learning performance in relation to self-efficacy at higher secondary level

Table 2.1 Self-Efficacy Score, Mean and SD of Traditional and OTBS Intervention

	N	Mean	Std. Deviation
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Self efficacy of Traditional Treatment Group			
Misinformed	40	19.33	5.695
Uninformed	40	42.60	3.657
Doubt	40	44.23	3.408
Mastery	40	10.13	4.496
Self efficacy of Online Technology Based Scaffolding Intervention Group			
Misinformed	35	8.14	4.387
Uninformed	35	6.60	2.862
Doubt	35	7.69	3.350
Mastery	35	42.97	5.079
Total	300	23.13	16.868

Table 2.2 ANOVA for Self-Efficacy of Traditional and OTBS Group

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	79859.742	7	11408.535	638.310	.000
Within Groups	5218.925	292	17.873		
Total	85078.667	299			

Table 2.1 reveals the Self-Efficacy mean and SD of both Traditional and OTBS Group. The Traditional Group Self-Efficacy mean ranged from 10.13 to 44.23 and the SD ranged from 3.408 to 5.695. Doubt factor in Self-Efficacy Mean  $\pm$  SD (44.23 $\pm$ 3.408) was higher than Uninformed (42.60 $\pm$ 3.657), Misinformed (19.33 $\pm$ 5.695) and Mastery in self-efficacy (10.13 $\pm$ 4.496). Nevertheless, the self-efficacy of OTBS Group mean ranged from 6.60 to 42.97, and the SD ranged from 2.862 to 16.868. Mastery factors of self-efficacy of OTBS Group Mean  $\pm$  SD (42.97 $\pm$ 5.079) were higher than Misinformed (8.14 $\pm$ 4.387), Doubt (7.69 $\pm$ 3.350) and Uninformed (6.60 $\pm$ 2.862). ANOVA between the factors of Self-Efficacy and OTBS Group was significant F = (df = 7/292, 638.310, p < .05 see table 4.2.2).

H3: There is significant effect of Online Technology Based Scaffolding (OTBS) in Cell on students' asynchronous learning performance in relation to persistence at primary level.

Table 3.1 Persistence mean, SD of Traditional and OTBS Intervention

	N	Mean	Std. Deviation	Std. Error
Traditional Group				
Current Purpose Pursuing	40	24.00	7.140	1.129
Long-term Purpose Pursuing	40	27.18	6.698	1.059
Recurrent of Unattended Pursuits	40	23.95	6.008	.950
Online Technology Based Scaffolding Group				
Current Purpose Pursuing	35	56.31	7.169	1.212

Long-term Purpose Pursuits	35	58.06	6.620	1.119
Recurrent of Unattended Pursuits	35	55.51	4.990	.844
Total	225	39.78	17.099	1.140

Table 3.2 ANOVA for Persistence of Traditional and OTBS Group

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	56264.482	5	11252.896	267.002	.000
Within Groups	9229.846	219	42.145		
Total	65494.329	224			

Table 3.1 reveals persistence factors, mean and SD of both Traditional and Scaffolded Group. The Traditional Group Persistence mean ranged from 23.95 to 27.18 and the SD ranged from 6.008 to 7.140. It was found from the Table 4.3.1 that long-term purpose pursuing in persistence Mean  $\pm$  SD ( $27.18 \pm 6.698$ ) was higher than current purpose pursuing ( $24.00 \pm 7.140$ ) and recurrent unattended pursuits ( $23.95 \pm 6.008$ ). Nevertheless, the Persistence of OTBS Group's mean ranged from 55.51 to 58.06 and SD ranged from 4.990 to 7.169. In case of OTBS Group the persistence factors in terms of long term purpose pursuing ( $58.06 \pm 6.620$ ) is higher than current purpose pursuing ( $56.31 \pm 7.169$ ) and recurrent unattended pursuits ( $55.51 \pm 4.990$ ). The Mean Difference between the factors of persistence of Traditional and OTBS group was ( $df = 5/219$ ,  $F = 267.002$ ,  $p < .05$ ) and it is significant.

Table 3.3 Scheffe Multiple Comparison for Persistence Factors of Traditional and Scaffolded Group

(I) persistence	(J) persistence	Mean	Std. Error	Sig.
		Difference (I-J)		
Traditional Current Purpose Pursuing	Traditional Recurrent Unattended Pursuits	.050	1.452	1.000
	Traditional Current Purpose Pursuing	3.175	1.452	.445
Traditional Long-term Purpose Pursuing	Traditional Recurrent Unattended Pursuits	3.225	1.452	.426
	Traditional Current Purpose Pursuing	32.314*	1.503	.000
	Traditional Long-term Purpose Pursuing	29.139*	1.503	.000
OTBS Current Purpose Pursuing	Traditional Recurrent Unattended Pursuits	32.364*	1.503	.000

	OTBS Recurrent Unattended Pursuing	.800	1.552	.998
	Traditional Current Purpose Pursuing	34.057*	1.503	.000
	Traditional Long-term Purpose Pursuing	30.882*	1.503	.000
	Traditional Recurrent Unattended Pursuits	34.107*	1.503	.000
	OTBS Current Purpose Pursuing	1.743	1.552	.938
	OTBS Recurrent Unattended Pursuing	2.543	1.552	.748
	Traditional Current Purpose Pursuing	31.514*	1.503	.000
OTBS Recurrent Unattended Pursuing	Traditional Long-term Purpose Pursuing	28.339*	1.503	.000
	Traditional Recurrent Unattended Pursuits	31.564*	1.503	.000

Table 3.3 reveals the mean difference between the factors of persistence between Traditional and OTBS Group. The mean difference between traditional current purpose pursuing and traditional recurrent unattended pursuits (0.05,  $p > .05$ ) was not significant. The mean differences between traditional long term purpose pursuing and traditional current purpose pursuing (3.175,  $p > .05$ ), traditional recurrent unattended pursuits (3.225,  $p > .05$ ) were not significant. The mean differences between OTBS Current Purpose Pursuing and Traditional Current Purpose Pursuing (32.314,  $p < .05$ ), Traditional Long term Purpose Pursuing (29.139,  $p < .05$ ), Traditional Recurrent Unattended Pursuits (32.364,  $p < .05$ ) were significant. But the mean difference between OTBS Current Purpose Pursuing and OTBS Recurrent Unattended Pursuits (.800,  $p > .05$ ) was not significant. The mean differences between OTBS Long term Purpose Pursuing Traditional Current Purpose Pursuing (34.057,  $p < .05$ ), Traditional Long term Purpose Pursuing (30.882,  $p < .05$ ), Traditional Recurrent Unattended Pursuits (34.107,  $p < .05$ ) were significant. Nevertheless, the mean differences between OTBS Long term Purpose Pursuing and OTBS Current Purpose Pursuing (1.743,  $p > .05$ ), OTBS Recurrent Unattended Pursuits (2.543,  $p > .05$ ) were not significant. Similarly, the mean differences between OTBS Recurrent Unattended Pursuits and Traditional Current Purpose Pursuing (3.514,  $p < .05$ ), Traditional Long term Purpose Pursuing (28.339,  $p < .05$ ) and Traditional Recurrent Unattended Pursuits (31.564,  $p < .05$ ) found to be significant.

**Findings**

It claimed that the effect of Online Technology Based Scaffolding was statistically significant over traditional approach. This was because of the impact of Online Technology Based Scaffolding Learning. The mean performance score of scaffolded group was better than traditional group. The ANCOVA in between scaffolded group and traditional group on learning performance found significant where pre test was the covariate and it influenced the mean score of the scaffolded group and traditional group where adjusted  $R^2$  found significant. This result corroborated with Bautista, 2013. Clouse, 2001; Duncan, Kenworthy and McNamara, 2012; Galy, Downey and Johnson, 2011; Loomis, 2000; Wellman, 2005 & Zhu, 2012. Although these studies supported the present study, three studies were also found against the result of the current study and these are: Chu, 2014; Picciano, 2002; Shahabadi and Uplane, 2015. According to Chu, 2014 the performance or learning achievement of the control group or traditional group was better than that of the experimental group in mobile learning. According to Picciano, 2002; Shahabadi and Uplane, 2015 no significant difference in performance was there between traditional learning group and online learning group.

It was found that self-efficacy of Online Technology Based Scaffolding Intervention group was better over the group of students following the traditional approach of learning. Especially the misinformed factor of self-efficacy was comparatively lower in scaffolded group than the traditional group. It is because of the learning and scaffolding through online technology, the misinformed factor of self-efficacy was found lower among the participants following Online Technology Based Scaffolding Intervention. Mean score of Uninformed factor of self-efficacy was found surprisingly higher than mean score of uninformed factor of self-efficacy for scaffolded group. The impact of scaffolding learning minimised uninformed factor of self-efficacy of experimental group but in case of traditional treatment, there was no such influence of self-efficacy resulting high mean value of uninformed factor of self-efficacy. In case of doubt factor of self-efficacy, the mean score was comparatively higher among the participants of the traditional group. Nevertheless, the scaffolded intervention reduced the doubt of the participants and it was statistically significant and better. The mastery factor of self-efficacy was comparatively higher among the participants of the scaffolded group. However, in case of traditional treatment the mastery level of self-efficacy score was significantly lower because of the influence of traditional treatment. This result was supported by Alqurashi, 2016; Angeli and Valanides, 2004; Girasoli and Hannafin, 2008; Gomley, Colella and Shell, 2012; Goulao, 2014; Hodges, 2013; Joo, Lim and Kim, 2013; Lim, 2001; Shea and Bidjerano, 2010; Simmering and Posey, 2009; Solimeno, Mebane, Tomai and Francescato, 2008; Taipjutorus, Hansen and Brown, 2012; Wu, Tennyson and Hsia, 2010; Wu, Yen and Marek, 2011; Yantraprakom, Darasawang and Wiriyakarun, 2013. However, two studies found against the result of the current study ( e.g. Kuo, 2010; Meyer and Sternberger, 2007).

It claimed that the effect of Online Technology Based Scaffolding on persistence of secondary school students was statistically significant over traditional approach of learning. The mean score of current purpose perusing factor of persistence was found to be higher among the

participants of the scaffolded group than the participants of the traditional group because of the influence of scaffolding learning. The mean score of Participants' persistence regarding long-term purpose perusing factor found statistically significant and higher in scaffolded group than traditional group. The recurrence of unattained pursuits factor of persistence of the participants of the scaffolded group found better mean score over traditional approach. So it becomes clear that Online Technology Based Scaffolding has certain influence on the persistence of secondary school students over traditional approach. This result was supported by Aragon and Johnson,2008; Bean and Eaton,2002; Bocchi, Eastman and Swift,2004; Bryant,2004; Bunn,2004; Croxton,2014; Deschacht and Goeman,2015. Harrell and Bower,2011; Holder,2007; Ivankova and Stick,2007; Kemp,2002, Levy,2007; Madhlangobe, Chikasha, Mafa and Kurasha,2014; Morris, Finnegan and Wu,2005; Park and Choi,2009; Rovai,2002; Rovai,2003, but Poellhuber, Chomienne and Karasenti,2008; and Svedberg,2010 resulted against the recent result.

### **Discussion**

The area of the study is limited to Assam, where the secondary schools are affiliated with CBSE. In the beginning of the study, the researchers made up their mind to conduct the experiment among CBSE affiliated secondary school where students of different socio-economic background came to receive education. The researcher randomly assigned Online Technology Based Scaffolding to the experimental group and conventional approach to a secondary school of Silchar. The study claimed that there was significant effect of online technology based scaffolding on Asynchronous Learning Performance over Traditional Approach. The effect of scaffolding intervention motivated the learners and encouraged to learn by self with a low feedback from the teacher. As a result, the experimental group performed better in their asynchronous learning. Here asynchronous learning performance means learners used online materials or materials submitted through e-mail by the researcher for the participants' self-learning. Online scaffolding is a self-learning tool beneficial for the proximal development of the learner. The recent result was corroborated with Loomis,2000; Clouse,2001; Wellman,2005; Galy, Downey and Johnson,2011; Duncan, Kenworthy and McNamara,2012; Zhu,2012 and Bautista,2013. Three studies were also found against the result of the current study and these are: Picciano,2002; Chu,2014 and Shahabadi and Uplane,2015. In Indian context one study was found viz. Shahabadi and Uplane,2015 and it was found to be not significant. In the context of Indian primary level of education, no such study regarding online scaffolding to assess the asynchronous learning performance was found. Not only that but also, the geographical area of this school where the experiment was conducted was a urban area with minimum internet facilities and maximum traditional instructional opportunities provided by the teachers. In this area, the researcher conducted the online instruction and found maximum satisfactory results regarding learners' performance.

There was significant difference in self-efficacy between traditional and online-scaffolded group of students. The factors of self-efficacy such as misinformed, uninformed, doubt aspects found drastically high in traditional approach excluding mastery. But on contrast to mastery aspect of self-efficacy of the traditional group, Online Technology Based Scaffolding

group's mastery aspect of self-efficacy found better. This was because of the efficiency Online Scaffolded Instructions over traditional approach. The result was corroborated with Angeli and Valanides,2004; Girasoli and Hannafin,2008; Gomley, Colella and Shell,2012; Goulao,2014 and Alqurashi,2016. Hodges,2013; Joo, Lim and Kim, 2013; Lim,2001; Shea and Bidjerano,2010; Simmering and Posey,2009; Solimeno, Mebane, Tomai and Francescato,2008; Taipjutorus, Hansen and Brown,2012; Wu, Tennyson and Hsia,2010; Wu, Yen and Marek,2011; Yantraprakom, Darasawang and Wiriyakarun,2013. Three evidences were also found against the result of the current study and these are: Meyer and Sternberger, 2007 and Kuo,2010. It clarified that the study conducted in Silchar, Assam, India where learners' online learning and their motivation, way of thinking and their confidence towards self-learning was poor. In this context, the researchers undertook the study to assess the confidence, self-satisfaction and change of motivation towards self-learning assessed through self-efficacy scale and found significant effect of intervention on the participants of the experimental group over traditional group.

It was found that there was significant effect of online scaffolded intervention on persistence of the participants over traditional approach. The factors of persistence such as current purpose pursuing, long term purpose pursuing and recurrence of unattained pursuits in case of scaffolded intervention found better over traditional approach. The result was corroborated with Aragon and Johnson,2008; Bean and Eaton,2002; Bocchi, Eastman and Swift,2004; Bryant,2004; Bunn,2004; Croxton,2014; Deschacht and Goeman,2015. Harrell and Bower,2011; Holder,2007; Ivankova and Stick,2007; Kemp,2002, Levy,2007; Madhlangobe, Chikasha, Mafa and Kurasha,2014; Morris, Finnegan and Wu,2005; Park and Choi,2009; Rovai,2002; Rovai,2003. The persistence of secondary school students receiving primary education was not assessed in Indian context but this was 1<sup>st</sup> time the researcher tried to assess the persistence of learners in online technology based scaffolding intervention over traditional approach in primary level of education.

## **Conclusion**

Online technology in learning is a recent approach providing intellectual benefit to the learners and the society. In the classroom situation, teachers are using online wiki, youtube and sometimes skype and thereby providing e-learning. But in asynchronous mode of learning, teachers are using mostly e-mail, whatsapp, blog etc. to provide the instructions. But recently online scaffolding model are being used and found effective on achievement, self-efficacy and persistence of the learners over traditional approach. It is concluded that technology assisted scaffolding minimised the learning area over feedback area. In the Zone of Proximal Development (ZPD), the task area having difficulty covered himself/herself by the learner with a small effort of a teacher in providing the material through e-mail. Vygotsky's ZPD and his scaffolding learning is really excellent in providing the persistency, consistency and self-efficacy among the learner. Online materials are the elements of scaffolding to build a conceptual framework for better understanding and learning. Online Technology Based Scaffolding is a platform where learners get freedom to learn and to grow their proximal development in learning. After all the researchers have put in front of the world

of educationists, researchers, scholars and students to think, rethink about its usability following educational implications. Teachers should use online technology based scaffolding platform and should provide scaffolding learning starting from elementary to higher secondary level. Online technology based scaffolding learning promotes asynchronous learning and these should be implemented in the elementary schools by the help of the parents, teachers and administrators. Parents should cooperate in providing the smart phone, laptop and desktop for downloading the online materials for the maximum benefit of students' self-learning. Teacher educators and teacher training educational institutions should provide the online technology based scaffolding training to the in-service and the pre-service trainee whom will apply in their elementary and secondary classes. Curriculum, syllabus, mode of instruction should be prepared with respect to online technology based scaffolding learning. The policy makers, curriculum framer, stakeholders should take initiations for the growth of Online Technology Based Scaffolding learning. The recommendations were put in front of the world of colleagues, researchers, educationists, and policy makers. These were: 1) online technology based scaffolding should use in the primary or elementary classes, but it needs further study to conduct in the secondary, and higher secondary education, 2) it needs further study whether online technology based scaffolding has significant effect on synchronous e-learning and also with respect to gender or not, 3) learners performance, persistence, self-efficacy are studied after providing online scaffolded learning intervention. However, it needs further study to take other variables like retention, skill, habit, maturity and other cognitive development aspect, 4) whether online instructions needs socio-economic status of the parents, if so, it needs further investigation, and 5) It needs an investigation with cross cultural states to know the comparative status among the learners after providing Online Technology Based Scaffolding.

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