Compare the Effectiveness of Digital Content Teaching and Traditional Teaching to Academic Achievement: Reference to the Selected Technical School and College in Bangladesh

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ABSTRACT
The purpose of the study was to compare the effectiveness of digital content teaching and traditional teaching to academic achievement: Reference to the selected Technical School and College (TSC) in Bangladesh. Pretest- posttest equivalent group research design was adopted for the study. The population considered the students of TSC of Bangladesh and the sample was taken from one of the TSC of Bangladesh named Gazipur Government TSC, Gazipur. A total of 120 students in class ten. out of that, 32 students' were taken as a research sample. Using matching pair technique and purposive random sampling were used to divide into two groups. In the research, the Experimental group was consisted by 16 students and the control group consisted by 16 students. The treatment applied on Experimental group was "Digital Content Teaching" and on Control group the "Traditional Teaching". The main objectives of the study were: (1) to compare the effectiveness of teaching through experimental test of two groups of students and (2) to assess learning achievement by testing the two groups of students to get the effectiveness of teaching. Two research questions were answered. The data collected through achievement tests were analyzed by using percentages, means, t-test statistics and graphs. It has been found that the Digital Content Teaching is more effective than the Traditional Teaching for academic achievement in the selected TSC in Bangladesh. The statistical data analysis result proved that Digital Content Teaching is more effective to learning higher level of learning skills like comprehension level, application level than the traditional teaching. In Knowledge level Digital Content Teaching and Traditional Teaching are similarly effective to academic achievement.

Keywords*-Digital Content Teaching, Traditional Teaching, Experimental Group, Control Group*

1. INTRODUCTION

In Technical School and College (TSC) the teaching and learning is based on pedagogical contents and practiced due to the advantage of cost-effectiveness in conveying large amounts of information (Tinio, 2003; Griffiths, Oates & Lockyer, 2007).Multimedia has introduced the pedagogical strength in facilitating student learning and supplementing learning with adding

richness and meaning to the information presentation with the use of more than one medium (Shank, 2005; Asthana, 2009).The students are not becoming bored because Multimedia involves the synchronization of media in producing the media-rich outputs and is arranged in some chunks which are linked by the hypermedia. Students can navigate to the source of information in a shorter time, build the connections between relevant topics, and construct their knowledge by associating to the meaningful information (Hede and Hede, 2002; Parekh, 2006). It is important for students to self-adjust the time and determine the information based on individual differences, so that when individual differences can be accommodated by having alternatives in learning, students will then be engaged at a deeper level and appreciate the student-centered learning approach like digital content learning (DCL) with more sense of participation (Alessi and Trollip, 2001; Ma et al. 2008). In addition, Alessi and Trollip(2001) found that when multiple media contents are used to present information simultaneously, students learn more effectively with focused attention than those who studying with separate media where attention is split. This is because human brain will have more processing loads to integrate and re-arrange all different sources of information (SEG Research, 2008).

Today, the use of digital content-based education is getting more popular in many areas of learning and training as it stimulates new ways in information delivery with the concerns of accessibility, reusability and individualization to fulfill the needs for different types of learners, but not just limited to conventional teaching and learning methods. With, the advances in digital technology teachers, students and parents are increasingly using that to teach, learn and communicate to strengthen the student learning experience. It is important to compare the learning effectiveness and learning achievement by digital content teaching (DCL) and that of traditional teaching (TT). However, it is challenging to find out as its development requires experimental studies and planning in incorporating multimedia enabled learning methods into the existing practices in the teaching and learning process (Mishra & Sharma, 2004; Mantin& Klein, 2008).

2. REVIEW OF RELATED LITERATURE

According to information given by e-School Media & e-School News (2014): Digital content increases student participation, engagement, extends learning and improves teachers' skills with technology. Teachers are moving from traditional teaching to digital content delivered to them in ready-to-use formats to wanting easily customizable digital content that they are able to edit and modify. Digital content can have a positive impact on students' various skills. Using digital content enhances lessons and improves learning experiences. Using digital content is a way to develop 21st century skills. Digital resources appear to be most effective when they are integrated into lessons instead of simply being overlaid on a preexisting activity or lesson. According to the information given by the national e-learning movement in Sri-Lanka(2010-2011):"The technology can play a vital role in breaking down the barriers of the Education having access to quality education". Digital content and multimedia technology can help to establish student centered learning environment. According to information given by Center for Digital Education (2014): present learning becomes more student centered. We can create digital learning environments that are tailored to students' individual needs, skill levels and interests so that students have multiple pathways to learn. Students need one-on-one help to learn, and a personalized learning environment is a good way to give them that opportunity with the help of technology. For those perspectives many countries are establishing multimedia class rooms and digital contents of learning experiences. According to information given by British Council,

Bangladesh (2015):The Government has introduced multimedia classrooms in over 23,000 schools across Bangladesh. According to information given by prime minister's office, Bangladesh (2013):In Bangladesh Multimedia Classrooms established in 500 schools. 15,200 secondary schools and 5,300 Madrasa through MoEdu within 2014 And 23,661 primary and secondary teachers create and share multimedia content through teacher's portal, 300+ electronic versions of text books available in primary and secondary levels including technical, vocational and Madrasa education. According to information given by GEE Media and Online publication (2014): ICT- based modern multimedia classroom has opened up a new dimension in teaching-learning system of the educational institutions. The digital contents in the multimedia classroom have emerged as a tool for the students to come out of memorizing knowledge ending a more-than-a-century- old traditional teacher centered learning system. Under the newly introduced student's participatory system to teach students using the digital contents, the students have been preparing their home task in the classroom after visualizing, listening, and holding discussion on the topic with other students at the multimedia classroom set up in some of the schools and colleges across the country. According to information given by Discovery Education (2015):Discovery Education offers a breadth and depth of digital media content that is immersive, engaging and brings the world into the classroom to give every student a chance to experience fascinating people, places, and events. All content is aligned to state standards, can be aligned to custom curriculum, and supports classroom instruction regardless of the technology platform.

According to information given by Current World Environment Journal (2015): Using Multimedia in the classroom the students can enjoy opportunity for interacting with various texts, images, videos, games, animation etc. that give students a solid background in the tasks and content of mainstream of their courses that also make the benefit of increased student motivation. Students are eager to begin class and often arrive early at the computer lab, watch images, videos, animation, games, logging on the Internet, and beginning research on their own.

According to information given by Blackboard Inc (2014):"There's no doubt that the growth of digital learning content is accelerating, and this is affecting the way we teach and learn". Multimedia-mediated content works as important components in learning that improves Student's retention and learning outcomes making the learning experiences more meaningful providing the students with an alternative means to have more choices when learning in the student centered learning environment. The learning attitudes changed as the students realized that learning with multimedia elements was more flexible in exploring and constructing new knowledge that boosted learning interest of the students in this student-centered environment (Leow et al. 2014). According to information given by U.S. Department of Education (2015): Schools can use digital resources in a variety of ways to support teaching and learning. Electronic grade books, digital portfolios, learning games, and real-time feedback on teacher and student performance, are a few ways that technology can be utilized to power learning. Multimedia approach digital content incorporating into the learning environment, the information-rich presentations make the learning instructions more effectively than presenting through traditionally a single medium in rote learning, so the students can obtain the information more meaningfully and repeatedly through different media and choices (Reeves, 1998; Shank, 2005; Dembo and Seli, 2012).The new concepts and the developments like computer-based instruction (CBI), intelligent tutoring systems (ITS), integrated learning systems (ILS), computer aided assessment and computer mediated communication show that the advances in the digital era have broadened the learning processes by enabling higher levels of learner interactions in

order to make learning more fruitful for overcoming the insufficiency in rote learning (Dembo and Seli, 2012). According to Manson (2007), a well-planned learning environment can enhance the quality of learning and encourage students to demonstrate their understanding in the learning activities, so students are given more choices to determine their learning experience. This helps the students to strengthen self-esteem and develop high level thinking skills in a learning community (Suh, 2011). Multimedia approach digital content incorporating into the learning environment, the information-rich presentations make the learning instructions more effectively than presenting through traditionally a single medium in rote learning, so the students can obtain the information more meaningfully and repeatedly through different media and choices (Reeves, 1998; Shank, 2005; Dembo and Seli, 2012). Studies show that with the use of instructional design model, it organizes media-rich information more systematically with the integration of various instructional strategy components (Qureshi, 2004).Due to the advantage of cost-effectiveness in conveying large amounts of information, conventional classroom learning is still being practiced frequently although this approach was found to be the least effective teaching method and less capable to support self-paced learning and interactions between the instructor and learners (Tinio, 2003; Griffiths, Oates and Lockyer, 2007). According to the Independent studies in the United States and Israel they found that using digital teaching platform achieve higher gains of students learning in language arts and mathematics than using traditional teaching methods and curriculum. The digital teaching platform classrooms helps to improve teaching quality, learning environment with fewer disruptions, and increasing student confidence, motivation and enjoyment of math and reading/language arts.

3. METHODOLOGY

Population of the study-Students of Technical School and College (TSC) of Bangladesh.

Sample of the study-The sample was taken from one of the TSC of Bangladesh named Gazipur Government TSC, Gazipur. There were120 students at the class ten. Out of that, 32 students' were taken as a sample based on GPA obtained in previous final exam and using purposive random sampling that were divided into two groups (A and B). One group is Experimental group (A) consists of 16 students were taken from one class (class ten) of the school having digital content teaching and another group is control group (B) consists of 16 students were taken from same class of the school.

Sampling technique & data analysis tools-The purposive random sampling method was used to select the sample. The data were analyzed by MS-Excel and SPSS software.

Tools of the research-The researcher developed the achievement test (MCQ) tool for the collection of data. An Achievement test based on the subject named 'computer application-2' that is taught in the class ten as a compulsory subject was prepared containing 50 items. It was a MCQ test with 50 items based on the content: Computer hardware, MS-Word, MS-Excel, MS-PowerPoint, Computer malware and Use of E-Mail. The Test objective was: to measure the learning scores in light of sub-domains of cognitive domain of learning. The level of "Analysis", "Synthesis" and "Evaluation" focuses the higher learning complexity. Thus, the study uses three sub-domains (Knowledge, Comprehension, and Application) as the students were from secondary level.

Statistical test used-The data were analyzed by using statistical technique (t-test) and the following formula (matching pair technique formula):

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right) - 2r\left[\frac{s_1}{\sqrt{n_1}}\right]\left[\frac{s_2}{\sqrt{n_2}}\right]}} \qquad r = \frac{n\sum xy - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

Where, $\overline{x_1}$ = mean of scores for first group, x_2 = mean of scores for second group, s_1^2= variance of the first group, s_2^2= variance of the second group, n1= number of scores in the first group, n2= number of scores in the second group, n= number of pairs of score, $\sum x\ y$ = sum of the products of paired scores, $\sum x$ = sum of x scores, $\sum\ y$= sum of y scores, $\sum x^2$ = sum of squared x score, $\sum y^2$ = sum of squared y score

Experimental Design- The general procedure of this research was the pre-test post-test equivalent group design. Pre-test which are administered before the application of the experimental and control treatments. Post-test which are administered after the application of the experimental and control treatments. The gain of each student is the difference between their post-test and pre-test scores. And the average/mean gain scores were subjected to a test of statistical significant. The sample of the study was consisting of 32students' purposive randomly assigned out of 120 students that were divided into two groups (A, B). One group is Experimental group (A) consists of 16 students were taken from one class (class ten) of the Gazipur Government Technical School and College (TSC) having digital content to teaching and another group is control group (B) consists of 16 students were taken from same class having traditional approach to teaching. Treatment effect was measured from pre-test and post-test. T_{1c} = pretest score for each student of the control group. T_{2c} = posttest score for each student of the control group, T_{1E} = pretest score for each student of the experimental group, T_{2E} = posttest score for each student of the experimental group. Treatment effect, E= (T_{2E} -T_{1E}) - (T_{2C} - T_{1C}).
After measuring the treatment effect (E), the statistical t-test applied to interpreting the significant of the treatment at the significant level $\alpha = 0.05$.

The structure of the both experimental and control groups:

Variable (Same for both Group)	**Experimental Group (A)**	**Control Group(B)**
Teacher	X	X
Sample size	16	16
Gender	Male (13) & Female (3)	Male (13) & Female (3)
Total class/Lectures taken	10	10
Time duration of each class/Lecture	50 minutes	50 minutes
Handouts/Lecture notes	Provided	Provided
Subject name	Computer Application 2	Computer Application 2
Topics taught	Computer hardware	Computer hardware
	MS-Word	MS-Word
	MS-Excel	MS-Excel
	MS-PowerPoint	MS-PowerPoint
	Computer malware	Computer malware
	Use of E-Mail	Use of E-Mail

Variable (Different for each(Group)	**Experimental Group**	**Control Group**
Treatment Variable	Digital Content Teaching: -Web-based instruction - E-learning Method	Traditional Teaching Method
Teaching Aids	✓ PPT through MMP ✓ Internet ✓ E-books ✓ Audios &Videos ✓ Wikipedia& Email	✓ White Board ✓ Marker pen ✓ Poster paper ✓ Books ✓ Handouts

Activities summary followed to deliver the lectures for both Experimental group and Control group

Lecture no.& content	**Experimental Group**		**Control Group**	
	Teaching techniques	**Teaching aids**	**Teaching aids**	**Teaching techniques**
01-02: Computer hardware Basics	✓ Lecture ✓ Showing PPT slides ✓ Showing E-Book	✓ MMP ✓ PPT ✓ E-book	✓ White Board ✓ Color Marker pen ✓ Poster paper	✓ Lecture ✓ Drawing of picture ✓ Showing poster
03-04: MS-Word 2007	✓ Lecture ✓ Showing PPT slides ✓ Showing YouTube Video	✓ MMP ✓ PPT ✓ YouTube Video	✓ White Board ✓ Color Marker pen ✓ Book	✓ lecture ✓ Drawing of picture ✓ Writing on board
05-06: MS-Excel 2007	✓ Lecture ✓ Showing PPT slides ✓ Showing YouTube Video	✓ MMP ✓ PPT ✓ YouTube Video	✓ White Board ✓ Color Marker pen ✓ Book	✓ lecture ✓ Drawing of diagram ✓ Writing on board
07: MS-PowerPoint 2007	✓ Lecture ✓ Showing PPT slides ✓ Showing video	✓ MMP ✓ PPT ✓ Video	✓ White Board ✓ Color Marker pen ✓ Book	✓ lecture ✓ Drawing of diagram ✓ Writing on board
08: Computer Malware	✓ Lecture ✓ Showing PPT slides ✓ Showing Wikipedia information	✓ MMP ✓ PPT ✓ Wikipedia ✓ Internet	✓ White Board ✓ Color Marker pen ✓ Book	✓ lecture ✓ Drawing of diagram ✓ Writing on board ✓ Discussion
09-10: Electronic Mail	✓ Lecture ✓ Showing PPT slides ✓ Showing through internet	✓ MMP ✓ PPT ✓ Internet ✓ E-mail website	✓ White Board ✓ Color Marker pen ✓ Book ✓ Printed	✓ lecture ✓ Drawing of diagram ✓ Writing on board ✓ Showing Printed

			poster	poster

4. Data analysis and interpretation

Pair wise Pretest-Posttest scores and achievements of the Experimental and Control group

	Control Group		**Experimental Group**		**Achievement Score (Control group)**	**Achievement Score (Experimental group)**
Pair_No	Pre_test (T_{1C})	Post_test (T_{2C})	Pre_test (T_{1E})	Post_test (T_{2E})	$D_C=(T_{2C})-T_{1C}$	$D_E = T_{2E}-T_{1E}$
1	38	70	38	92	32	54
2	40	64	42	84	24	42
3	18	46	16	70	28	54
4	20	44	22	76	24	54
5	16	44	12	66	28	54
6	24	48	16	66	24	50
7	32	54	32	70	22	38
8	18	78	20	92	60	72
9	28	44	26	68	16	42
10	16	50	14	74	34	60
11	22	52	24	68	30	44
12	18	38	16	76	20	60
13	28	62	30	82	34	52
14	24	52	26	84	28	58
15	30	56	32	68	26	36
16	22	34	24	60	12	36

Justification of the Test-The collected data were organized and put to SPSS software to get the mean score, standard deviation, and correlations of the groups. Data analysis results through SPSS are as follows:

Paired Samples Statistics					**Paired Samples Correlations**			
	Mean	N	Std. Deviation	Std. Error Mean		N	Correlation	Sig.
Gain Scores Control Group	27.63	16	10.538	2.635	Gain Scores Control Group & Gain Scores Experimental Group	16	0.717	.002
Gain Scores Experimental Group	50.38	16	10.046	2.511				

The researcher administered a test to determine the nature of the two groups (Control group and Experimental group). F test was applied to determine the homogeneity of the two groups. Using $F_{cal} = s_1^2 / s_2^2$ = variance of the Control group/variance of the Experimental group formula the

calculated F value was, $F_{cal} = (10.538)^2 / (10.046)^2 = 1.10 < F_{critical} = 2.40$ (0.05 level of significance). The variances of the two groups were homogeneous. The data were analyzed by using statistical technique (t-test) and the applied formula (matching pair technique formula):

$$t = \frac{\overline{x_1} - \overline{x_2}}{\sqrt{\left(\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}\right) - 2r\left[\frac{s_1}{\sqrt{n_1}}\right]\left[\frac{s_2}{\sqrt{n_2}}\right]}}$$

$= -11.729$

$t_{ob} = -11.729$

5% level of significance at the degree of freedom (16-1) =15, critical $= 2.131$

$t_{ob} > t_{critical}$ at 0.05 level of significance. So the research null hypothesis is rejected. That means there is significant difference between the mean gain score of Control group and Experimental group.

5. Findings of the study

It was found that there is similarity of the pretest scores obtained by both the Control group and Experimental group in terms of mean achievement score and domain of learning:- highest in knowledge level, secondly in comprehension level and thirdly in application level of cognitive domain of learning. Total posttest scores, as well as score of each pair member of the Experimental group is higher than the Control group. The researcher observed that the test achievement of Experimental group is significantly better than the test achievement of Control group. There is no remarkable change in knowledge level but there are significant difference in achievement in the level of comprehension level and application level of cognitive domain of learning. Finally, it is found that there is significant difference between the mean gain score of Control group and Experimental group. The mean score of Experimental group was more than of Control group. In Control group pretest achievement score it was observed that the domain of achievement distribution was: Knowledge 60%, Comprehension 26%, and Application 14%. Learning achievement based on topics was Computer Hardware 24%,MS-Word 19%, MS-Excel 20%, MS-PowerPoint 11%, Computer Malware 10%, and Use of E-Mail 16%. In Experimental group pretest achievement score it was observed that the domain of achievement distribution was on Knowledge level 61%, Comprehension level 25 %, and Application level 14%. Learning achievement based on topics was Computer Hardware 24%, MS-Word 19%, MS-Excel 19%, MS-PowerPoint 11%, Computer Malware 9%, and Use of E-Mail 18%. In Control group Posttest achievement scores; it was observed that the domain of achievement distribution was: Knowledge 55%, Comprehension 26%, and Application 19%. In Experimental group Posttest achievement scores; it was observed that the domain of achievement distribution was Knowledge 49%, Comprehension 27%, and Application 24%. Finally, it is found that there is significant difference between the mean gain score of Control group and Experimental group. The mean score of Experimental group was more than the mean score of Control group. So the mean score of Experimental group was better than the mean score of Control group.

Conclusion-In this study, it was found that the Digital Content Teaching is more effective than the Traditional Teaching for academic achievement in the selected Technical School and College in Bangladesh. The statistical data analysis result proved that Digital Content Teaching is more effective to learning higher level of learning skills like Comprehension level, application level than the Traditional Teaching. In Knowledge level Digital Content Teaching and Traditional Teaching are similarly effective to academic achievement.

6. Recommendations

Due to limitation of time and research budget, the sample of the study was taken from only one Technical School and College (TSC) of Bangladesh and the Sample size was 32. It may be necessary for further research to be conducted on compare the effectiveness of digital content teaching and traditional teaching to academic achievement with increased number of TSC and sample size, pair matching with more than one variable for broad generalization. The study suggests the following in Teaching with Digital Content to enhance teaching and learning: (1) the study suggests the TSC authorities to develop a leaning community to the best practices for teaching with Digital Content. (2)Teachers should consider why they are utilizing particular digital content within their planning intentionally to make a difference for each learner. (3)the teachers should consider the particular needs and expectations of their learning groups– the age of the students; the learning standards; the values of the parents – before utilizing digital content for instructional purposes.(4) Within the design of a lesson that incorporates digital content, TSC teachers have to scaffold understanding. There should be a variety of types of formative and summative assessments so that students have multiple risk-free opportunities to demonstrate learning and ensure success. (5) Teachers can use digital content to help students compare and contrast new concepts in collaborative groups, and students can create authentic products to demonstrate their learning. There is a need for students to become producers of new digital content rather than just being consumers of information. (6) The TSC teachers can support digital age learning by incorporating the 4 Cs – Communication, Collaboration, Critical thinking, and Creativity – within their classrooms. By collaborating with others through online discussions and assignments, students practice and learn the appropriate netiquette for communication in the digital age. By using critical thinking to build a personalized playlist of digital content, they can learn or review information. Finally, they can create original projects to show what they know and upload them to share with others as new learning objects. (7) As the TSC teachers plan for instruction with digital content, they are able to consider effective lesson design. Beginning with an essential question, teachers are able to prompt critical thinking about the standard or concept. They can show a video segment that encourages student learning and then link to an interactive assignment that supports student creativity as they work collaboratively to solve authentic, real-world problems. Finally, the teacher can utilize another form of digital content along with questioning techniques (involving student response) to provide opportunities for formative assessment. There are so many choices with digital content that enable teachers to be lesson designers in a dynamic learning environment.

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