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**Impact Of Concept Based Activities (CBA) on
Retention of Knowledge of Students in General
Science at Elementary School Level**

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Impact of Concept Based Activities (CBA) on Retention of Knowledge of Students in General Science at Elementary School Level

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Abstract

The knowledge that individuals acquire is rapidly forgotten because it is a natural phenomenon. However, various factors are pertinent for one's memory and knowledge retention ability. This skill has not previously been compared between students who passed and failed a specific general science examination. Therefore, this quantitative study investigates how Concept Based Activities (CBAs) affect students' academic performance through retention of knowledge. Using purposive sampling for school selection and random sampling for group selection, 100 pupils from Government Boys Primary School Dingi and Government Girls Primary School Dingi were chosen as a sample for the quantitative study. This sample was first split into two primary groups, namely experimental and control, based on the results of the pre-test. A 2X2 Factorial design was used in present research study. Experimental group was taught through concept -based activities (CBA)while control group were taught through traditional lecture method (TLM). For this purpose, two trained teachers of primary school of GPS Dingi and GGPS Dingi were hired voluntarily. The two teachers were trained by researcher, one was used concept-based method for experimental group and the other was used TLM for control group. After eight weeks of teaching to both groups the researcher administered posttest to both groups. Therefore, after posttest both groups were treated for next four weeks. After twelve (12) Weeks, a retention test was taken from students based on posttest and retention test. The quality of learning positively correlates with the CBA (CONCEPT BASED ACTIVITIES). Long term memory (LTM) and knowledge retention abilities are significantly better and best performer students and statistically correlate with each other. Therefore, it is advised to conduct these tests on a regular basis to evaluate long-term memory and

knowledge retention so that suitable techniques to improve these can be used. The analysis of collected data was done by using mean scores, standard deviation and Paired sample sample T-Test with Cohens D for effect of size to compare student's retention of knowledge in both groups. The results showed a significant difference between scores in two groups. The findings of the study suggested that there was significant positive impact of retention on the academic performance of students present in current research study. The concept-based activities (CBA) as an independent variable was an effective practice for the experimental group.

Keywords; Concept based activities (CBA), Traditional lecture method (TLM), Experimental and Control group, Retention test, Posttest, Factorial Design, Cohens D, Paired sample T-test

INTRODUCTION

Retention (RT) is the ability to keep or hold something in memory, learners have the extraordinary power of retention at the elementary level hence, learners must hear or learn for concept building in science education academic achievement role is imperative. To formulate effective future teaching, it is imperative to devise a strategy that aims to predict and quantify how much initial learning is retrievable or lost and this was only possible that retaining knowledge SAT (students achievement test) scores were applied for experimental and control groups. Therefore, SAT (students achievement test) scores differentiated the students who are high and low achievers in retaining knowledge in posttest and retention tests in the general science subject at elementary level. However, the lack of knowledge retrieval or its practical application results in the loss of conceptual knowledge of science education. The recent science education outlined synthesis explained the suggestions for schools and classroom practices of an emerging agreement for learning and development (Cantor et al., 2018) but in current studies, in various science education subjects' loss of knowledge has been reported for learners due to lack of practical application or knowledge retrieval throughout the study (D'Eon, 2006, Custers, 2010; Dobson & Lindholm, 2015; Williams & Mann, 2017).

Accordingly, the focus is paved on helping learners to acquire knowledge in form of achievement test scores, but unfortunately, newly acquired information easily slips away from memory because of the lack of its practical usage (Ferreira et al., 2016). Memory is a powerhouse that allows us to retain and retrieve information over time. This can be either short-term memory or long-term memory. Short-term memory (STM) consists of an individual's moment-to-moment conscious thoughts and perceptions, while long-term memory (LTM) consists of a semi-permanent memory store, which endures for a long time and helps in assisting new thoughts or information (Revlin., 2011). Working memory (WM) comprises of

such underlying short-term memory features that help in communication with long-term memory (LTM). So, the term working memory refers to an individual's ability to temporarily hold the information and its operational handling for tasks related to cognition, performed daily in science education (Gathercole et al., 2004). Retention of knowledge in form of student's achievement tests, have been the area of study for all levels of science education (Arzi, 1986 & Custers, 2010) Therefore, knowledge retention are factors that affect learning and shows important anatomy for education and serves as a recognized subject matter to learners' development in science education (Bergman et al., 2008; Drake et al., 2014; Jurjus et al., 2014). Various studies related to elementary sciences shows that learners focus on short term memory gains in basic science knowledge and vocabulary building skills (Stahl & Clark, 1987; Semb & Ellis, 1994; Knapp & Barrie, 2001; Klahr & Nigman, 2004). The purpose of this research study is to focus the needs of elementary level students for long-term retention (LTM) of science knowledge in form of SAT scores and an increase retention rate yields a higher financial benefit instead a high retention rates also provides a crucial metric for success that stands to learner's concept clearance and retaining knowledge ability in science subjects (Custers, 2008).

The teaching approach is one of the elements in the curriculum that is essential for just an efficient learning process. The literature suggests that concept-based activities approach is utilized to facilitate concept-based development in the theories of cognitive and metacognitive learning. Because teachers don't know how to create homogenous or heterogeneous groups for an effective learning process, concept-based activities (CBAs) are a multidimensional paradigm that vary depending on the context and demonstrate the inefficiency of using techniques under the necessary circumstances. Methods of teaching, symbolically depicted as long trips with maps but are unable to read? It is also dependent on how much the student knows. Learners want to know how to read maps systematically and construct their concepts, where to stand and how to utilize appropriate tools to attain their research destination, and how to make a conclusion. The topic of debate is undoubtedly students and how they learn and develop skills that are most important, but in this situation, academic minds must consider strategies that capture their degree of participation through group-supported work. Therefore, it is necessary to teach practitioners how concept-based teaching strategies might be applied to enhance the significance of science education. For this purpose, the concept-based activities implementation as a strategy is very essential for general science subject at elementary level children in public and private level institutions.

The achievement of basic science concept-based activities and knowledge retention in the form of student achievement scores at the elementary level are frequently disregarded in Pakistan. Since students are rarely exposed to performing activities in a practical way in most elementary schools, science concept-based achievement is rare. Instead, students are given opportunities through traditional groupwork, which has a negative impact on students'

achievement and retention of knowledge in the subject of general science. Additionally, due to inadequate conceptual clarity, elementary school pupils struggle to understand some concept growth and experience fear and lack of confidence. Therefore, modern and pertinent research focuses less on general academic achievements in science and more on mathematical or other science areas like physics, chemistry, biology, and medicine. So, the focus of this study is on concept-based activities, retention in form of SAT scores, which is determined by experimental and control groups. Most of the researchers focused on different elements of concept-based activities and retention of knowledge at elementary school level. Students are unable in understanding basic science concept and retaining knowledge in form of student's achievement test scores. They lack a fundamental understanding of scientific concepts, such as how to measure, categorize, formulate, and test hypotheses, as well as how to collect data and draw conclusions from it. Therefore, it is critical to compare the efficiency of concept-based activities to traditional lecture activities in groups or pairs and to make research-based decisions about how to better engage students in the learning process in order to help them develop fundamental general science skills and ensure that knowledge retention among students is reflected in achievement scores (Majeed & Rana, 2017).

RESEARCH QUESTION

The following question was addressed to this research study;

Q; What is the effect of concept-based activities on students' retention of knowledge in the subject of General Science?

RESEARCH METHODOLOGY

As the study is experimental in nature, factorial 2x2 design involved at two levels with two groups, both of which were formed by random assignment (Lodico&Voegtler,2010) based on literature review (Creswell,2014). The one variable was method (use of concept-based method for experimental group and there was no use of concept-based method for control group) and the other variable was gender.

To conduct the experiment two government girls/boys schools were selected in addition, 50 boys and 50 girls selected for both groups from two schools. The total sample divided in to four strata, for example from 107 population 100 sample chosen For Experimental Group (n = 25) boys and (n = 25) girls' students where students were taught by concept-based method using E-7 Learning model, the control group was also consisting of (n = 25) boys and (n = 25) girls in which traditional teaching were applied. The outliers were removed from the study (Muijs, 2004). The selected students were divided into two groups (1) experimental group (2) control group. Both groups were divided on the basis of their pre –test scores. Each group composed of 50 students. The content validity was established by using expert judgmental procedures. Reliability of achievement test was determined using Cronbach Alpha. It was 0.817.

PROCEDURE

An experiment was conducted at Government Girls Primary School Dingi and Government Boys Primary school Dingi Haripur. 107 students were enrolled in both boys' and girls' primary schools. The 7 outliers were removed. The 50 male and 50 female in both schools were chosen in subject of general science. Binary groups were formed consisted of 50 male and 50 females taken to conduct the experiment, further consisted of 25 pairs (25 Boys and 25 Girls) for experimental group, same repetition was applied on control group also consisted of 25 pairs (25 Boys and 25 Girls). Appropriate agenda was achieved before teaching to both groups. Throughout the treatment/ conduction experimental/ investigational group was taught through concept-based method (CBA) while the control group was taught by traditional lecture method (TLM). Six chapters of General Science of grade 5 were taught in eight weeks.

Each chapter was divided into sub-units consist of six lessons, using E-7 learning model steps under consideration of researcher designed for lesson planning for experimental/investigator group while, control group was taught by traditional lecture method (TLM). Coaching for each unit was spread on one week for a short unit, whereas for lengthy chapters, coaching was spread on binary weeks, the activities which were arranged and practice by researcher were based on concept-based method (CBA) of teaching. Planned and prearranged lessons were prepared/organized in discussion with research advisor and experts of general science subject in proper manual form. These deliberate/strategic lessons were created on/ flow charts/ web sketch accomplishment by means of communicating plan/ Jig saw activities/ normal setting of environment/pictures observations of animals and plants/charts observation/column completion/observation of natural collection of plants and natural observations of plants structure and function/microbes' observation under microscope.

For the purpose of removing challenging test items from the students' achievement test (SAT)/MCQs, pilot testing on students was conducted. Thus, 20 MCQs from 100 MCQs were removed, and 80 students' achievement test (SAT)/MCQs were used as a research tool to validate teaching with concept-based methodology (CBA). Experimental/investigator and control group were given pre-tests at the beginning of the research study, and the post-test was given to both groups at the conclusion of the research study, and this task was completed in 8 (eight) weeks. Retention test was taken after 12 weeks to both groups and to compared to both groups (EXPERIMENTAL/CONTROL) results in form of posttest and retention test SAT scores. The present research study only showed the posttest and retention test comparisons between Boys/Girls experimental and control groups. Experimental and Control group were taught by the designated teachers who can use both traditional lecture method (TLM) and concept-based method (CBA). The two volunteer/unpaid teachers, both male and female were selected through agreement. The teachers were given the first week direction to

implement the tool in class accordingly. The treatment was continuing for twelve (12) weeks, while the control group was kept busy by the other teacher in traditional lecture method leanings (TLM). The results of retention test showed that long term memory (LTM) as endures for a long time and helps in assisting new thoughts or information in general science subject and had a positive impact on the experimental group after treatment.

DATA COLLECTION

The data were collected by researcher through research instruments after treatment. The data will be in the form of students’ achievement test score. The data was collected from the experimental and control groups Students by researcher and experts’ teachers.

DATA ANALYSIS

The mean score and standard deviation, as well as inferential statistics like the paired sample t-test, were used in the data analysis. The Cohen's D' formula's effect of size was used.

RESULTS

COMPARISON OF MEAN SCORES EXPERIMENTAL AND CONTROL GROUPS (POST TEST AND RETENTION TEST) AFTER TREATMENT

Ho₁: there is no significant difference between the mean SAT scores of boys experimental group in posttest and retention test taught through concept-based activities (TTCBA) in general science;

Table 1

Comparisons of mean scores of boy’s experimental groups in posttests and retention test

Test	N	Mean	SD	SE Mean	Correlation (p)	Paired Difference			t (p)
						M	SD	SEM	
Post	25	93.32	13.40	2.68	0.937 (0.000)	24.12	23.04	4.60	1.693 (0.103)
Re	25	91.72	11.82	2.36					

Table 1 shows that SAT scores experimental group TTCBA group in post- test (N=25, Mean=93.32SD Score=13.40, SE Mean=2.68) and in retention test (N=25 Mean =91.72, SD Score =11.82, SE Mean=2.36). The value of correlation (r= 0.937) p=0.000 < 0.05 also showed very strong significant relationship between post and retention test scores. Paired differences of posttest and pre-test Mean=1.60, SD=4.72, SE Mean=0.94. The difference of SAT scores

between post -test and retention test is statistically non- significant as t-value=1.693, p=0.103 > 0.05.

Ho₂: there is no significant difference between the mean SAT scores of girls experimental group in posttest and retention test taught through concept-based activities (TTCBA) in general science;

Table 2

Comparisons of mean scores of girl’s experimental groups in posttests and retention test

Test	N	Mean	SD	SE Mean	Correlation (p)	Paired Difference			t (p)
						M	SD	SEM	
Post	25	105.44	8.291	1.658	0.871 (0.000)	0.840	4.089	0.817	1.027 (0.315)
Re	25	104.60	7.582	1.516					

Table 2 shows that SAT scores experimental group TTCBA in post- test (N=25, Mean=105.44, SD Score=8.291, SE Mean=1.658) and in retention test (N=25 Mean =104.60, SD Score =7.582, SE Mean=1.516). The value of correlation (r=0.871) p=0.000 <0.05 also showed very strong significant relationship between posttest and retention test SAT scores. Paired differences of posttest and retention-test Mean=0.840 SD=4.089 SE Mean=0.817. The difference of SAT scores between post -test and retention test is statistically non-significant as t-value=1.027, p=0.315 > 0.05.

Ho₃: there is no significant difference between the mean SAT scores of boys control group in posttest and retention test not taught through concept-based activities (NTTCBA) in general science;

Table 3

Comparisons of mean scores of boys control groups in posttests and retention test

Test	N	Mean	SD	SE Mean	Correlation (p)	Paired Difference			t (p)
						M	SD	SEM	
Post	25	82.04	12.04	2.40	0.963	0.76	3.39	0.678	1.119
Re	25	82.04	12.04	2.40					

Pre	25	81.2 8	10.64	2.128	(0.000)	(0.274)
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Table 3 shows that SAT scores control group NTTCCA in post- test (N=25, Mean =82.04, SD Score =12.04, SE Mean=2.40) and in retention test (N=25 Mean =81.28, SD Score =10.64 SE Mean=2.128). The value of correlation ($r= 0.963$) $p=0.000 <0.05$ also showed very strong significant relationship between post and pre-SAT scores. Paired differences of posttest and pre-test Mean=0.76 SD=3.39 SE Mean=0.678. The difference of SAT scores between post -test and retention-test is statistically non-significant as $t\text{-value}=1.119, p=0.274 > 0.05$.

Ho₄: there is no significant difference between the mean SAT scores of girls control group in posttest and retention test not taught through concept-based activities (NTTCCA) in general science;

Table 4

Comparisons of mean scores of girls control groups in posttests and retention test

Test	N	Mean	SD	SE Mean	Correlation (p)	Paired Difference			t (p)
						M	SD	SEM	
Post	25	81.6 8	8.44	1.68	0.933 (0.000)	1.20	3.095	1.938	0.069 (0.064)
Re	25	80.4 8	7.26	1.45					

Table 4. shows that SAT scores control group NTTCCA in post- test (N=25, Mean=81.68, SD Score=8.44, SE Mean=1.68) and in retention test (N=25 Mean =80.48, SD Score =7.26 SE Mean=1.45). The value of correlation ($r=0.933$) $p=0.000 <0.05$ also showed very strong significant relationship between posttest and retention test scores. Paired differences of posttest and retention-test Mean=1.20, SD=3.095, SE Mean=1.938. The difference of SAT scores between post -test and retention test is statistically non-significant as $t\text{-value}=0.069, p=0.064 > 0.05$.

Therefore, it can be stated that the experimental group's performance on the posttest and retention test in terms of academic achievements of scores in General Science following treatment was considerably superior than that of the control groups.

CONCLUSIONS

The students who were taught using concept-based activities (TTCBA) and the students who weren't use this technique, their SAT (Student's Achievement Test) results for NTTCCA are quite consistent, and no outlier cases were discovered at the time of the pretest. It follows that both groups were similarly matched before treatment using the random sample method. Following the intervention, the posttest mean scores of students who had been taught using concept-

based activities (TTCBA) were higher than those of students who had been taught using the conventional or traditional lecture technique (TLM). Similarly, Results of retention tests in the form of posttests and retention tests revealed that after 12 weeks of treatment, the experimental group outperformed the control group in the topic of general science because CBA had a beneficial impact on students' long-term memories of the science discipline. Memory so has to do with our ability to retain knowledge. It displays our waking awareness. Memory tests are effective instruments for enhancing knowledge retention over the long term. Hence, Memory tests are effective techniques for enhancing long-term retention of general science information after treatment. Due to their motivation in pursuing concept clearance, students who were taught using concept-based activities (TTCBA) outperformed students who were not taught using them (NTTCBA). The concept-based technique of teaching must be used by science instructors in the modern day because it raises students' IQ levels and sharpens their thinking skills.

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