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# Impact Of Concept Based Activities On Academic Achievement Of Elementary School Students In General Science

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**ABSTRACT**

The major purpose of the study was to explore the impact of concept-based activities (E-7 Model) on academic achievements of students in subject of general science and how concept-based activities (CBA) produce creative and critical thinking ability among students in learning process. This study was experimental in nature; factorial design was used for this research. For this purpose, a sample of 100 students from Government Girls Primary School Dingiand Government Boys primary school Dingiwere selected. The analysis of collected data was done by using mean scores, standard deviation and independent sample T-Test was used with Cohens D for effect size for comparison of the students in both groups in their academic achievement. The result showed a significant difference between scores in two groups. This technique was effective for experimental group.

**Key Words**:E-7 model, Concept Based Method (CBA), Traditional Lecture Method (TLM), Experimental and Control Group, Factorial Design

## INTRODUCTION

Concept building, receiving science education and gaining technical skills in other areas of science and producing creative and critical thinking ability in learners are vision of the planning commission in Pakistan. To meet the global challenges in Pakistan Government of Pakistan has adopted vision 2030. The planning commission states that, in present education system it is essential to provide quality education to children and youngsters of Pakistan and it may enable them to real potential and contribution to development of nation (Government of Pakistan,2009). One and most important way is to change the pedagogical practices in the teaching of science which mostly rely on concept-based method and conceptual learning by which teacher transmit knowledge

and students are passively receive memories and regurgitate for the next test or an examination (Retallick & Farah, 2005). This vision also ensures that all boys and girls complete free, equitable primary education leading to relevant and effective learning outcomes. Furthermore, policy-makers and educational leaders do more focus to prepare the youth to compete the 21st century; vision of better schooling system includes; use of advanced and innovative technology but more focus on concept-based activities, adaptation of self-concept development and retaining memories are important ways of teaching and learning process (Ball& Forzani, 2009).

Concepts are mental categories for facts, objects, events, people, ideas, even skills and competencies that have a common set of features across multiple situations and contexts for learning science. Concept based activities (CBA) in science education method is defined as large or wide picture, ideas and learning activities explained how to organize and categorize information in a systematic way. Similarly, traditional learning pattern or models which concentrate on the ability to recall specific facts, concept-based activities (CBA) focus on understanding wider principles or ideas called by researcher's concepts that can later be applied to a variety of exact in several examples of general science subject. Concepts are ranging from simple to complex according to how easily researcher can be defined relationship of a teacher and student. Concept based activities (CBA) are implemented as top-up approach verses the bottom-up model used in more traditional learning ways for under standing ideas. While, traditional learning activities (TLA) left as a rote memorization of facts and figures in general science subject. The concept-based activities (CBA) empower the students to think more critically about the new subjects and situations they encountered. In order to achieve teaching objectives of student learning, it is essential to select and use the conceptual teaching strategies and tactics (Higgins et al, 2017).

The effective teaching and learning strategies are key to the progress of the education system. The recent research studies point to increasing role of virtual reality plays important role with in higher education to day (Howard, Serpanchy, Kevin, Lewin & kim, 2018) and how these active learning strategies can address the needs and challenges of elementary and undergraduate students of science education learnings. It also helps to develop new teaching and learning strategies for the participating teachers in learning. Hence, the role of teachers is also vital for the success of students through the diversity of teaching and learning tactics used in the classroom at elementary level. Among the teaching and learning strategies that teachers can highlight problem-based learning, inquiry-based learning and project-based learning. Indeed, traditional or conventional teaching strategies to being applied in the classroom in which it is not aligned with the goals of the 21st century education system seeking innovation in teachers. (Jamal, Ibrahim, & Surif, 2019)Hence, the role of teachers in ensuring the teaching and learning tactics that are used can attract students to take interest in science subjects (Jamal et al., 2017). Concept based activities (CBA) are used to solve the

student's conceptual problems and use for their concept buildings and students learn a lot after concept clearance so, left rote memorization.

Due to the complex nature of science, there are many abstract concepts in science that make it difficult to understand, so the concept-based activities provide an opportunity to acquire those concepts (Ozseveç, 2006). The concept- based method involves in critical thinking process and concept clearance. For this purpose, different models used for learning science at various levels for teachers and students to enhance their learnings. The E-5 model is based on, Engage, Explore, Expand, Elaborate, Evaluate (Trowbridge and Bybee, 1990). This model is again recommended as E-6 Model, consist of six basic elements, Excite, Explore, Explain, Enrich, Excel, Evaluate (Chessian& Moore 2004). The E-5 Model is used in the training manual of capacity building of elementary teachers training institutions in KPK (CIDA -ASSISTED) for training of teachers and learning process of students at classroom level. The manual is based on, Dimension of learning (DOL) and E-6 Model has been first recommended by Marzano, et al. (1997) as second edition of Dimension of learning manual. The Marzano teacher evaluation model is based on number of previous related work which basically means for concept clearance and concept building of learners, including what work in schools (Marzano,2003), classroom instructions that works for learning of learners (Marzano,et al.,2001).The classroom management (Marzano,2006) and the art of science and teaching (Marzano,2007) and effective supervision supporting the art and science of teaching (Marzano,et al.,2011). Each of these works was generated from synthesis of educational research and theory. Thus, the model can be considered an aggregation of research on those elements that have traditionally be shown to correlate with learners' academic achievements. The E-7 Learning model incorporate different cognitive levels in hierarchical manner. E-7 learning model is using by the researcher (Eisenkraft, 2003) for planning lessons in general science and based on Elicit, Engage, Explore, Explain, Elaborate, Evaluate, Extend. Accordingly, this learning model is helpful for understanding of basic concept of science subject at elementary level. Therefore, this Model is used for designing concept-based activities. One of the major impacts of concept-based learning is the use of E-7 model on student's mental growth and their capabilities of understandings through systematic way. Hence, this model is also used to improve the scientific literacy among students at elementary level (Fatimah & Anggrisia, 2018). Therefore, these models are helpful for learning process of students and making concept-based method of teaching for students meaningful at various levels (Muslim &Setiawan,2017; Fatimah & Anggrisia, 2018).

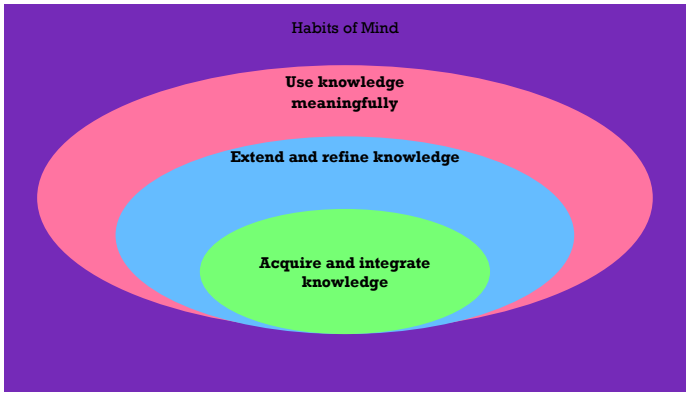


Figure: Dimensions of learning model (Marzano et al. 2006)

This sets all learning, when seen as understanding in a context of attitudes and habits of mind (ways of thinking). Therefore, the focus is now more clearly on understanding and then be equipped to apply that understanding in life around. This will equip learners much more meaningfully for life behind school.

Another approach is the E-6 model. Previously, Trowbridge & Bybee (1990) developed the 5-E model (Engage, Explore, Explain, Expand, Evaluate). The goal is understanding where ideas are connected, undermine the trend to memorizing seemingly unrelated facts. Chessian & Moore, 2004) moves this to a E-6 Model (Excite, Explore, Explain, Enrich, Excel, Evaluate).

In order to include these recommendations in real sense a researched based frame work "E-7" MODEL was exact in using in this process. To test the influence of the proposed learning approach, a factorial design was employed in the study. Research design has been employed by many previous studies in investigating the effects of. learning approaches and strategies (Liao, 2007.Sak & Oz, 2010, Sipe & Curlette, 1996.Yang, 2007). In addition, researcher attempt to investigate the critical factors by using E-7 model that might affect students' concept-based performance via the proposed five-phase learning cycle approach based on individuals' E-7 learning activities recorded during a series of learning activities. Accordingly, to analysis of data, including students' is applied to students in the form of factorial design to investigate the effect of concept-based activities on the students' performance.

## THE E-7 LEARNING MODEL

There have been further developments. Eisenkraft (2003) has proposed a E-7 learning cycle approach. National science education standard (NRC, 1996) also recommended the E-7 modelE-7 Model as a learning model, depending on the nature of the activity related to student's interest, needs and preferences. The model is summarizing in table 2.2.

**Table 2.2 The E-7 'learning cycle model'**

| | |
|---|---|
| **Elicit** | This established the prior understandings of students, often by means of |

| | |
|---|---|
| | brain-storming and visual creative activities |
| **Engage** | This aims to motivate learners by introducing areas where the topic to be studied is relevant or important. |
| E**xplore** | Involve the students in making predictions, designing experiments, and collecting and analyzing data |
| **Explain** | Here the teacher develops the key ideas, concepts and terminology, with students helped to express understandings |
| **Elaborate** | The teachers provide opportunities for students to practice and transfer their learning into to new contexts |
| **Evaluate** | The teacher uses both formative and summative evaluation to address all aspects of the entire learning experience. |
| **Extend** | Understandings are broadened and expanded into wider scientific areas. |

These various models reflect considerable ingenuity and all seek to move science learning away from rote memorization towards an understanding of the essential concepts. In this, they after be applauded.

The aim of focusing science education on conceptual understanding is an excellent goal for learning general science. Therefore, the way national and international assessment are set may undermine this. In such assessment, much of the credit comes from recall and recognition. In addition, if E-7learningmodel (Eisenkraft,2003), is to be useful, then textbooks may need to be recast. Therefore, it was noted that, the sad modern trend of science textbooks that often have a sub-title like: 'all researchers need to know ….', focusing the emphasis back on knowledge to be memorized should be finished and use of E-7 learning model should be adopted for general science at every level generally and essentially at elementary level so that, students understand concepts in general science (Reid,2021).

**RESEARCH QUESTIONS**

According to the purpose of the study described in the introductory section, the research questions addressed are listed below:

Q:What is the impact of concept-based activities on academic achievements of students in General Science at elementary level?

**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&Voegtle,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 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 Dingii and Government Boys Primary school Dingii 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 consistedof 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.

Pilot testing was done on students for removal of difficult items form students' achievement test(SAT)/MCQS.Hence20 MCCQS were removed from 100 MCQS and 80 students' achievement test (SAT)/MCQS were used as a research instrument

To validate teaching with concept-based method (CBA), experimental/investigator and control group was given pre-test at the beginning to both groups and the post-test was given to both groups at the end of research study.

Experimental and Control group were taught by the designated teachers who can use both traditional lecture method (TLM) and concept-based method (CBA). Binary 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 operation was continuing for eight (8) weeks, while the control group was kept busy by the other teacher in traditional lecture method leanings (TLM). `

**DATA COLLECTION**

The data were collected by researcher through research instruments before and 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**

Data analysis were done by using descriptive statistics like mean score, standard deviation, and inferential statistics like, paired samplet-test, use for calculation and the effect of size measured by Cohen's D' formula was applied

**RESULTS**

$H_{01}$:There is no significant difference between mean students' achievement test (SAT) scores of the students taught through concept-based activities (TTCBA) and the students who were not taught through concept-based activities (NTTCBA) in general science before treatment.

Table 1 Comparison of TTCBA and NTTCBA Students achievements test (SAT) score before treatment

| Groups | N | Mean | SD Score | SE Mean | t-value | Sig. | Effect Size |
|---|---|---|---|---|---|---|---|
| TTCBA | 25 | 43.40 | 10.22 | 2.04 | 0.261 | 0.795 | 0.073 |
| NTTCBA | 25 | 42.64 | 10.33 | 2.07 | | | |
| | | | | | Not significant | | |

Table 1 shows that students TTCBA (N=25, Mean=43.40 SD Score=10.21845, SE Mean=2.0436) and NTTCBA (N=25 Mean = 42.6400, SD Score =10.33554 SE Mean= 2.06711). To test the hypothesis, TTCBA as well as NTTCBA statistically found non-significant showed by (t= value=0.261) and (p value=0.795) which is greater than significant value (0.05) (p=0.795 > (0.05) Although the attainment of Cohen's D (0.073) in terms of means for the NTTCBA was less slightly higher. But the score of both groups is

matched in SAT (student achievement test) before treatment in term of their mean value and no flyer case founded. In this case researcher failed to reject the null hypothesis.

Table 2 Comparison of Girls TTCBA and NTTCBA SAT (student achievement test) before treatment.

| Groups | N | Mean | SD Score | SE Mean | t-value | Sig. | Effect Size |
|---|---|---|---|---|---|---|---|
| TTCBA | 25 | 42.92 | 9.695 | 1.9390 | 0.413 | 0.682 | 0.1167 |
| NTTCBA | 25 | 41.76 | 10.182 | 2.0365 | | | |

Not Significant at the level 0.05

Table 2 described that (N=25, M= 42.92, SE Mean= 1.939) and NTTCBA (N=25, M=41.76, SD Score 10.182, SE Mean= 2.0365) with (t value= 0.413) and (p value=0.682)of both groups are non-significant because the p value is greater than the significant value (0.05) (p= 0.682) > (0.05). The mean values of both groups are matched in SAT (Student's achievement test) test with the effect size (0.116). The researcher failed to reject the null hypothesis. It means that the both groups in SAT (Student's achievement test) test have equal achievement scores before treatment and did not find any flyer cases.

$H_{03}$:There is no significant difference between mean students' achievement test (SAT)scores of the students taught through concept-based activities (TTCBA) and the students who were not taught through concept-based activities (NTTCBA) in general science after treatment;

Table 3 Comparison of TTCBA and NTTCBA Students achievements test (SAT)score of boys score after treatment

| Groups | N | Mean | SD Score | SE Mean | t-value | Sig. | Effect Size |
|---|---|---|---|---|---|---|---|
| TTCBA | 24 | 66.83 | 7.794 | 1.591 | 8.159 | 0.00 | 2.308 |
| NTTCBA | 26 | 49.61 | 7.127 | 1.397 | | | |

Significant at the level 0.05

The result of independent sample t-test in a table 3 showed that TTCBA (N=24, Mean= 66.83, SD score= 7.794, SE Mean=1.591 denoted by t-value= 8.159 and p value (0.00) of both groups. The hypothesis tested by p- value (0.00) which is less than (0.05)Level (p= 0.00< (0.05) and effect size of TTCBA which was (2.308). The researcher rejected the null hypothesis because TTCBA efficaciously outperformed in terms of its mean value from TTCBA in students' achievement test (SAT) with greater effect size.

Table 4 Comparison of TTCBA and NTTCBA Students achievements test (SAT) score of Girls after treatment

| Groups | N | Mean | SD Score | SE Mean | t-value | Sig. | Effect Size |
|---|---|---|---|---|---|---|---|
| TTCBA | 25 | 64.88 | 8.819 | 1.763 | 5.409 | 0.00 | 1.537 |

| | | | | |
|---|---|---|---|---|
| NTTCBA | 25 | 52.52 | 7.263 | 1.452 |

Significant at the level 0.05

Table 4 represented that TTCBA (N=25, Mean=64.88, SE Mean= 1.763) and NTTCBA (N=25, Mean= 52.52, SD Score= 8.819, SE Mean= 1.452). The alternative hypothesis tested with t-value (5.409) and the p value (0.00) which is less than (0.05) (p=0.00< (0.05). Thus, the researcher rejected the null hypothesis. It means that TTCBA have attained more score with the great effect of size (1.537) than NTTCBA in short period of time.

Therefore, it can be concluded that the performance of experimental group on posttest in academic achievements of scores in General Science after treatment were significantly better than that of control groups

## CONCLUSIONS

The students taught through concept-based activities (TTCBA) and students not taught through concept-based activities NTTCBA have almost similar performance in SAT (Student's achievement test) and no outlier case has been found at the time of pretest. Hence, it means both groups before treatment were equally matched through stratified random sampling technique for experimentation. After the treatment, the mean scores of the student taught through concept-based activities (TTCBA) in posttest was better as compared to the students taught through traditional lecture method (TLM). It means that students taught through concept-based activities(TTCBA) has performed better than students not taught through concept-based activities NTTCBA due to taking interest to work for concept clearance. Science teachers in present age must be adopted concept-based method of teaching as a strategy because it increases the students' thinking abilities and sharp their IQ level.

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