

AN EXPLORATORY STUDY OF EFFECTIVENESS OF CONSTRUCTIVE APPROACH

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ABSTRACT: Purpose of this study was to compare the relative effectiveness of constructive approach “focusing 5E Learning Approach” and traditional textbook methods with an intention of identifying most appropriate method of teaching biology at secondary school level to enhance the conceptual understanding of biology among them. To guide this study hypothesis were stated and tested at 0.05 (significance level). The design of the study was pre-test post-test experimental design, sample was consisted of 60 biology students from Govt. Boys High School of Kahuta Rawalpindi and an equal number of students were randomly assigned to control and experimental groups. Experimental group was treated through 5E Learning Approach. Same test was administered as pre-test and post-test and scores were compared using t-test. It was concluded; constructive approach proved to be more effective for teaching biology at secondary level and students treated through constructive approach showed more interest and better understanding of the concepts.

INTRODUCTION

Instruction of science subjects for conceptual study is difficult and compound issue. It comprises learning of macroscopic characteristics of occurrences, clarifying the macroscopic occurrences and methods expending models (stimulations), using codes or signs in mathematical or calculated problem resolving, and understanding practices used scientists in inquiry for teaching to be actual, sciences are required to be presented and taught in planned and organized pyramid so as one concept constructs upon other. There might be no single pyramid that would be most efficient and effective for pupil's learning. Instructional programs that constantly use added comprehensive style, such that used in the Learning Cycle Approach (LCA) and STS, will prove very successful as they display pupils the relevance of content they are trying to learn. Science teachers must continue their efforts to explore the ways not only for improvement of pupil's conceptual understanding of scientific concepts but of aiding them to see applicability in practical world [1].

The theoretical change approach (TCA) or conceptual change methods (CCM) recommends that if pupils are to change their thoughts they should get to be disappointed with their current conditions (disappointment), new ideas must give a superior clarification and be justifiable (comprehensible), these ideas must seem to propose answers for issues and should be as per learning in different thoughts and be convincing (conceivable), and they should lead to new bits of knowledge (productive) and have potential for new disclosures [2].

Constructivism is kind of learning theory explaining learning or knowing as active and lively process, in which students are expected to be involved in a way as they construct knowledge on the basis of their prior (previous) knowledge. In view of constructivists, learners must not be considered as empty or blank vessels required to be filled; instead students are energetic and active participants making meaning and sense of the newly received knowledge in relation to (based) on knowledge already existing in their mind i.e, prior knowledge along with previous evidence based knowledge and experiences [3, 4].

Construction of information by the learners is a ceaseless and dynamic procedure. Along these lines, the essential guideline of the constructivist approach is that pupils themselves develop their own particular comprehension by means of playing a dynamic part in building new information and their earlier learning is commanding in the development process [5]. Mahoney 2004 states Students come into a classroom with their own particular concepts and a subjective structure in light of those concepts. These biased structures are substantial, invalid or deficient. The learner will reformulate his/her current structures just if new data or concepts are associated with information already existing in memory. Inductions, elaborations and connections between old discernments and new thoughts must be actually drawn by the learners all together so as the new concepts could end up as coordinated, helpful piece of knowledge for his/her memory. Knowledge which is just learnt without active involvement of learners and is not connected with their previous knowledge fad away or overlooked very soon. Shortly, the pupil must be involved actively to construct latest information on his/her already existing cognitive structure to gain meaningful and workable learning [6].

Having acknowledged the constructivist rationality in education, beginning from 2005 in Turkey, the essential point of the direction has ended up offering pupils some assistance and guidance with acquiring skills as opposed to increase bookish scientific and experimental information [7]. As an intelligent result of this change, science learning has been seen as a development of exploratory information by the learner by means of perception and experimentation. In this manner, the representation "Pupils as researcher" [8] moved on with its primary emphasis on logical procedural abilities. In this line, teaching techniques moved from Socratic lecture based towards pupil-centered methodologies, the research area significantly showed the result of the effectiveness of constructive approach on the biology students [9].

The teaching philosophy (TP) constructed on the notion, idea and concept that cognition (learning) is the consequence of 'mental construction' pupils create their own ideas by imitating on their individual capabilities, skills and by involving the innovative knowledge (fact base

information) with what they by this time distinguish. Every pupil generates her or his personal plans with different mental-models to create wisdom of the world, and provide somewhere to stay the new acquaintance (learns) by modifying them and one of its main and basic principles is that education (learning) is exploration for meaning and implication, for that purpose, to be in effect, an instructor must assist the learner in determining her or his personal meaning [10].

It appears to be more attainable to use constructivist approach for the instruction of English at B.Ed. level is more practical in drawing in the students in inventive (creative) and innovative exercises [11]. While perceiving diverse sorts of constructivism, it is highlighted that the present study is an investigation of higher secondary science (Biology students) direction considering mental (psychological) type of constructivism as a learning approach that can to a great extent be analyzed without mentioning to epistemological or philosophical positions normally related with constructivism by Bredo and others. Here, constructivism ought to be considered as a point of view on teaching-learning, which accepts that learning happens as an aftereffect of self-managed and self-regulated procedure of development of new information or new representation of information on the basis of former models with new latest bits of knowledge by learners themselves. Constructivism stresses on students' dynamic part, i.e., participating in proper cognitive handling during teaching-learning procedure to assemble new updated development in their learning, makes it a "pupil-centered learning viewpoint" and helps in transfer of focal point of teaching-learning from the educators or mentor to learners. It causes current changes in classrooms to change the part of instructors from authoritative to guide, where they need to help pupils in finding meaning themselves [12].

The backgrounds of educational effectiveness stem from responses to work on equivalence of occasion assumed by James Coleman and his collaborators [13] and Christopher Jencks [14]. These two studies are coming from different backgrounds (i.e., psychological and sociological) came nearly to a similar inference in relation to the degree of variance that can be enlightened by educational features. After compelling into consideration pupil experience characteristics (background), such as capability and family background not much modification in pupil accomplishment was left.

The [15] further explain the educational effectiveness research (EER) as the process of separating current methods and ideas along magnitudes thought to be of assessment. EER does not effort to create innovative ideas or programs or method, but to essence on understanding the educations to be strained from current practices. In this way, educational effectiveness research endeavors to create and test theories which clarify how and why some schools and instructors are more effective than others. The most of research is realistic in nature and provides us material (information) about believability of theoretical notions but some experimental studies were also accompanied in order to help us recognize effect and cause relations.

The UNESCO define the effectiveness as a production of definite analyses/review that quality of achievement of any

specific educational or instructional goal plus the extent to which any advanced educational institution can be estimated to attain precise requirements. It is obviously different from efficiency, as it is dignified by the volume of inputs or outputs used. As a basic degree of success of the program or of an institution, vibrant indicators, significant information and evidence best reproducing educational institution effectiveness with specific respect to student learning plus academic achievement will have to be assembled through numerous procedures [16].

The effectiveness as influences on key products, worth of life and Reliability of effects diagonally subgroups. It inquires following problems with different question; were first one, did program accomplish key targeted outcomes? The second one, did it produce unintentional adverse values? , The third one how did it affect worth (quality) of life? The forth one, what did program cost as fulfilled and what would it cost in your background [17]. Effectiveness discusses to the involvement's aptitude to do more moral than impairment for the target inhabitants in a real world background [18].

The result of the primary effectiveness studies was that a number of influences were connected to effectiveness, such as the major five factors of [19]: - strong leadership, - high expectations of learner achievement, - an prominence on basic skills, - harmless and arranged climate, - recurrent evaluation of learner progress. This study objective and aims at identifying the effectiveness of constructive approach for teaching biology to enhance the conceptual understanding of learners.

METHODOLOGY

Research methodology is step by step process for any researcher to collect, analyze and interpret data [20]. Study was experimental in nature with sample of 60 students; which were further divided in two subgroups of control and experimental and treated with two different methods (traditional and constructivist) to find their comparative effectiveness. This study was conducted in GBHS Kahuta. Pre-test and post -test design was used in this study. This design is the preferred method to compare participant groups and measure the degree of change occurring as a result of treatment. The principle behind this design was relatively simple and involved randomly assigned subjects between two groups a test group and a control group.

R 01 X 02 01 03= pretest

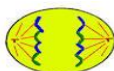
R 03 C 04 02 04= posttest

Instrument

Biology Achievement Test (BAT-I) was the major instrument used to measure the student's achievement upon the instructional unit. The Biology Achievement Test (BAT-I) consisted of 30 multiple choice test items constructed by the researcher with the help of biology teachers and drawn from the 4 weeks instructional unit. This test was used as pre-test prior to the treatment and then post-test after four weeks treatment. The test was constructed in two-tier construction. That is considered to be the most appropriate item structure to get insight of the student's conceptual understanding of any content. First tier was having options (correct option and distracters) from which students were supposed to select any

one option; Second tier was having 4 statements of reasons, from which student was instructed to mark any one which best suited to his/her answer in first tier. i.e.

Q: The cell shown in diagram is ___



Option Reason

- ❖ Prophase • Centrosome are replicating
- ❖ Metaphase • Metaphase plate has formed
- ❖ Anaphase • Sister chromatids are separated
- ❖ Telophase • Sister chromatids are forming scattered

BAT-I was having 30 Multiple Choice Questions, 10 from every topic selected for instructional unit i.e. photosynthesis, respiration and cell division (mitosis). Internal structure of leaf was just taught so as students can get a better insight of the process of photosynthesis.

Treatment Procedure

As the study was experimental in nature so the two groups (control and experimental) were treated differently. Control group was taught with the traditional lecture method while experimental group was treated through constructivist based teaching method following 5E learning approach. In experimental group students were further subdivided in groups of 6 students, they were provided with helping materials and worksheets to be completed after every activity. Duration of the experimental session was 1 hour. Both groups (experimental and control) were taught by different teachers. Each group received three sessions in a week. Same content

was taught to both groups. A pretest was conducted prior to the treatment from control and experimental groups. After a four week treatment same post-test was conducted to measure student’s academic achievement and conceptual understanding.

Data Analysis

In order to find the difference if any, among the performance of control and experimental group on pre and post-test mean and standard deviation for each group was computed. Significance of difference between mean of both groups was tested at level of significance 0.05 using paired t-test.

RESULTS

The demographic characteristics observed under this study were gender, age, parental education level, parent occupation, type of family. All of the male students belonged to first group (14-17) and no one was belonging to second group (18-21). Data for students parental educational level illustrated that most of the student’s fathers were matric which were slightly less than half (45.0%) and 1.7% of them were educated up to 16 years education, The mother education data reported that 26.7% of the mothers were educated up to matric and 11.7% of them were educated up to primary level. Mean of control group which is 6.93 and standard deviation is 1.43 while experimental group’s mean and standard deviation are 6.34 and 1.161. Tabulated value is 1.482 and P-value is 0.144. which is showing that marks of control and experimental group were non-significantly different.

Mean Pre-test scores of the control and experimental G

Variable groups	No	M	St.d	Df	T.v	P.v
Control G	30	6.93	1.43	59	0.654	0.144
Experimental G	30	6.34	1.161			

Results of post-test marks collected from control and experimental groups. Calculated values of mean for both groups are 13.80 and 20.03, calculated 0.041 which is less than 0.05 hence the results are significant. This demonstrates

results of both groups were different one group i.e. experimental group scored well than other that was control group. Experimental group was treated with constructivist instructional model.

M Post-test scores of the control and experimental G

Variable groups	No	M*	St.d	Df	T.v	P.v
Control G*	30	13.80	2.07	59	1.482	0.041
Experimental G	30	23.03	3.08			

G* Group M* Mean

DISCUSSION

Studies related to constructive approach depicted that, strategies focusing constructive tactics of teaching proved effective and productive for enhancing students conceptual understanding, academic achievement and interest towards the subjects under study. A project of IQST (Improving Quality of Science Teaching) 2009 based on prospective constructive approaches concluded that Science teachers become more responsible for their pedagogical choices. Students continually construct meaning of classroom events based on their prior understandings and experiences, and to promote an understanding of a constructivist perspective on learning and its implication for teaching. Constructivism is a key underpinning of the science teaching and learning [21]. The views of [22] and [23] are supportive of the socio-constructivist theories that feature highly in today’s educational environment and are particularly relevant to technological practice.

[24] Reports that questioning leads to critical thinking and it is also the phenomena of consideration near constructivists. 5E learning cycle used in this study is also supportive of questioning leading to initiate fruitful thinking to be utilized in any realistic situation. Constructivist trend is more suitable for engaging students in creative, effective and innovative activities and it is also emerging trend these days for acquisition of education (knowledge) [11]. This study is also done with specific emphasis to find out the difference of constructive based approach and traditional approach.

CONCLUSION

It is concluded that students were almost same on results of pretest held prior to the treatment, almost equivalent rate of misconceptions on basic concepts were found in them. A significant difference was observed in conceptual understanding of the students treated through constructivist

approach and students treated through traditional textbook method. It has also been found that constructivist approach along with collaborative learning activities and use of concept maps while explaining any topic by the teacher brought fruitful results concerning conceptual understanding of the learners, Hence, constructivist approach proved to be more effective for teaching biology at secondary level.

Recommendations

- i. In this experiment constructivist approach for teaching biology proved to be fruitful for enhancement of the conceptual understanding of biology students, it may be applied to others science subjects.
- ii. This method of instruction may be employed all over the country for teaching biology at secondary level, with specific purpose of enhancing conceptual understanding.
- iii. This experimental study revolved around certain topics of biology to enhance the conceptual understanding of students, such studies are needed to be planned and conducted in other areas (topics) of biology.
- iv. This study was conducted in two public schools of Kahuta city, to generalize the results such studies are recommended to be carried out in some other settings.
- v. Such experimental study should be planned for students from different cultural backgrounds so that its results could be effectively and reliably generalized to whole population.

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