Online ISSN 3007-3197 Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 3, Issue 5 (2025)

Impact of Teaching Strategies on the Conceptual Understanding of the Students of Secondary Level in the Subject of General Science

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Article Details

Keywords: Instruction strategies, conceptual understanding, secondary level, General Science.

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ABSTRACT

The research article examines the impact of various teaching strategies on the conceptual understanding of secondary school students towards General Science subject. The exploration aims to explore the effectiveness of different pedagogical approaches in enhancing students' comprehension and retention of scientific concepts. The research utilizes a quantitative research design to evaluate the pre- and post-assessment scores. The findings reveal valuable insights into the most impactful teaching strategies for promo the population of the research study was consisted of curriculum of General Science for secondary classes, arts group students, experts and teachers in sec. schools. Random sampling technique was used to design the sample. The sample of the study consisted of 150 students of Arts, A five point Likert scale questionnaire was constructed based on items related with traditional and conceptual based styles of teaching instructional strategies and used to collect the data. The tables of frequency, percentage, mean, standard deviation and independent sample t-test were used for statistical evaluation of the data along with EFA through IBM SPSS v. 24 and CFA through IBM AMOS v. 24. The conclusion of the study is based on the need of modernization of teaching strategies along with the enhancement of content, teaching methodologies, system of assessment & evaluation, and teacher training programs to create the critical thinking, artistic process, and problem solving skills.

INTRODUCTION

Education is only way to move forward and to compete with the modern world in this era of research and technology. It is a well-known fact that education is a rout to progress and prosperity but if the rout is unreliable there is no chance to reach the destination. The same is the case of Pakistan where even after 71 years of independence, education which can solve our major problems and drive us on the way of progress, is still a neglected area. There has been speedy inclusion of knowledge to the field of science. A huge development in scientific world and utilization of these scientific attainments in encouraging the welfare of humanity by applying them in factories, computer industry, vehicles, farming, pharmacy, mechanics and electronics has made science very important. Balance society can be formed when it's all departments working properly. The foundation of scientific literacy among secondary level students is crucial for fostering a deeper understanding of the world around them. Studies show that science group is working very well but art group is deserting year after year. General science is very important subject of art group. Its teaching is very important at school level.

General Science is the part of core subjects at Secondary school level. It has been observed that General science is not taught properly in our schools. It is taught by traditional lecture method and use of activity method is rarely observed. Teachers use only blackboard or whiteboard as teaching aid during teaching. Students write and learn only question answer in their note books. There is no use of laboratories or practical activities. General science teachers are not appointed, common teachers teach General science, no refresher courses or workshops are conducted for renewal of knowledge. So the teachers have no information about modern methods of teaching and curriculum development worldwide. General science terminologies are not clear to students. Conceptual understanding of the students has become a mystery at secondary level. General science is not taught experimentally and practically and unfortunately teaching of General Science at school level is merely an exercise of learning scientific content through rote memorization. Education system is failing to make the new scientists due to the lack of creative mind. Studies conducted in this area revealed that lack of instructional resources is the main cause leading to deficiency in conceptualization on parts of students. The other reasons include managerial practices, none serious attitude of students and teachers of General Science group (HEC report, 2002).

General Science is an important optional subject in the arts group. The General Science

students cannot get the similar treatment like Science students. The topics included in the General Science text-book are comprised of the general in nature. It helps to cultivate the conceptual understanding about environment, culture and social values among students. Students can develop social values and skills through General Science education. General science is a subject in which basic concepts of science related to Biology, Chemistry and Physics are taught collectively. Different branches of science are included under the label of General Science in integrated form. It is therefore called as integrated science. Students can learn the significance and role of General Science though this course of study. This specific knowledge can be used by the students and helpful in reshaping the society. Only important concepts are taken in-accordance to need (age + grade) level of students. Descriptions are avoided in this subject (Malik, 2002). All instructional materials and modern technologies are provided to grasp the basic concepts of science. Computer and technology is not a part of General Science. Low rate of enrolment in General Science group reflects that students have least interest in Arts Group rather than Science Group. It is due to the lesser job opportunities. In Pakistan science is integrated up to class – VIII. Each student is given a choice to adopt the subject science or integrated science (General Science) at Secondary Level. Science is taught in the form of three branches Biology, Chemistry and Physics and these three branches of Science are collectively taught as an integrated science under the umbrella of General Science. All three branches of Science have practical aspect but in General Science curriculum, lack of practical work and no relevant and application in day to day life. (Maria, 2011).

Horrow (1972) states that learners, science and society come closer due to the field of Science education and growth takes place in all three dimensions such as cognitive, Psychomotor and affective. There are three domains which help in selecting the objectives in science teaching. Understanding of these domains is very helpful for teaching learning process. Trowbridge and Bybee (1990) explained that it is necessary to think of objectives in three dimensions cognitive, affective and psychomotor. This terminology has come from the work of Blooms Taxonomy.

Learning is depending upon conceptual understanding among students. Conceptual understanding plays a vital role in quality education of General Science. It motivates the learner to achieve the goals and objectives of General Science without any difficulty. It provides a chance to the learner to adopt appropriate learning style. Application of the knowledge and

skills is related to conceptual understanding. Instructional resources along with teaching and learning practices can move the learner to understand the contents plays in the text-book. Conceptual understanding is a driving force towards learning. Gibson (2001) stated that the students are strategic in their utilization of time and all efforts are well situated to achieve the objectives. Efficient learning is based on the minimum difficulties level of content and a fundamental to conceptual understanding.

The term conceptual understanding is commonly used in class rooms. It means the children can grasp ideas in concrete way and help students to take what they learn in class and apply it in relevant situations. The traditional methods of teaching, rote learning are being retained by the modern methods. Giddens (2007) stated that the ability of grasping scientific knowledge and connecting this scientific information to the facts can be possible without support. Integration of new concepts, reflection and making connections enhances profound learning and augments conceptual understanding.

Methods of General Science teaching are often used same as of science. The selection of teaching method depends upon the information or skills that are being taught to the students. Teaching methods may be consisted of reading, memorization, demonstration, student participation or all these things collectively. According to the World Book encyclopedia (1970) a good teacher provides guidance for the students as the result three changes occur in knowledge, skills and attitudes. Teaching methodology encourages the student to proceed towards the increasing knowledge. Following methods of teaching General Science can be used 1. Inquiry based technique, 2. Descriptive method, 3. Cooperative learning approach, 4. Lecture method. 5. Experimental procedure, 6. Project method. 7. Activity method (Jalil, 1998).

Skilled teachers should be required to teach this subject. Teachers should have subject command in various branches of science so that they can develop scientific attitude among the learners. Teachers are facilitators for the learners.

Akhtar (2009) explained role of teachers is that of a facilitator to explain and observe how students are interacting and participating during teaching learning process. Arbab, et al. (1995) reported that students understand the truth of nature but the teaching learning process influenced them a lot. Boylan (1996) agreed to the theory that students have their own interest. If the teachers perform practical, the students having no interest in study will be diversified their thoughts due to apparatus and attractive resources used in experiment. Fairbrother (2000)

Stated that the study and advancement of Science will play greater role for universal future of the nation's Science teachers must play role in directing the people to fiddle with the changes occurring in the world.

The effectiveness of teaching strategies plays a pivotal role in shaping students' conceptual comprehension and long-term retention of scientific principles. The research investigates the impact of different teaching strategies on the conceptual understanding of students in the subject of General Science

In the realm of education, the effectiveness of teaching strategies is a subject of perennial interest, particularly when it comes to fostering conceptual understanding in science subjects at the secondary level. Numerous studies have delved into the impact of various pedagogical approaches on students' comprehension and retention of scientific concepts. This literature review synthesizes key findings from relevant research, highlighting the diversity of teaching strategies and their potential implications on secondary level students' understanding of General Science

A study by Anderson and Smith (2018) examined the effects of hands-on experiments versus traditional lectures on secondary level students' conceptual understanding in science subjects. The findings proved that pupils who showed interest to perform hands-on activities represent meaningfully advanced echelons of understanding and withholding of knowledge of science as compared to those students who learnt scientific knowledge through traditional teaching instructional methods. This conclusion clearly showed the prominence of communicating educational practices in enhancing students' capability to clutch the complex scientific facts and philosophies.

On the other hand, a research study done by Jackson (2016) mentioned another important point by putting more stress on the use of multimedia demonstrations in order to enhance conceptual understanding. The same research designated that when multimedia programing, associative visual and auditory fragments are created carefully have more effectiveness to construct the learning bond between intellectual scientific perceptions and everyday experiences of the material world. This proposes that a sensible incorporation of multimedia resources could be very strong foundation to make teaching instruction more effective and advanced along with their fruitful outcomes.

Collective learning approaches have great power for increasing conceptual

understanding. Smith & Johnson (2019) inspected the impression of discussion in cluster and combined problem-solving actions on secondary students' intellectual capacity of General Science matters. This will lead to social learning and the welfares of peer communication in strengthening scientific thoughts.

Additionally, to prefer individual learning is thought to be essential in deciding and selection of teaching stratagems. A research study conducted by Chen (2017) support the importance of constructing flexible and individually differentiated instructional techniques to provide great deal of knowledge to diverse learning elegances in order to get higher levels of academic engagement, motivation and mastery in the understanding of learners for accommodating the minds of different learning capacity within the same classroom.

Although the above mentioned research studies suggested the importance of instructional approaches but it is also considerable to take the impact of background in which these teaching strategies have been applied such as cultural differences, infrastructure of educational institutions, and the availability of multimedia resources because they have significant effect on the implementation of these teaching strategies. Furthermore, the research performed by Brown & Davis (2020) highlighted the necessity of unceasing professional development for educators in order to apply efficient, advanced, innovative and effective instructional approaches because these approaches required highly trained skilled and effectively adaptable educators for implementation.

Therefore, it is the duty of all educators, policy makers in Pakistan to consider the importance of cooperative or peer learning with the execution of different hands-on activities by considering individual differences along with the use of multimedia resources from well trained teachers in order to put remarkable impression on learners' academic engagement to show interest in understanding of scientific concepts of General Science at secondary school level. Hence, let's have a brief review of teaching strategies

EDUCATIONAL STRATEGIES AND INTANGIBLE UNDERSTANDING: Operative instruction stratagems perform a basic role in determining pupils' conceptual understanding of scientific ideologies. A research carried out by Hake (1998) accentuated the status of collaborative engagement systems, at the secondary school level in indorsing advanced echelons of conceptual understanding compared to traditional lecture-based approaches.

OUTMODED LECTURE-BASED METHOD: Although the educators prefer the outdated

old Traditional lecture-based education to be followed in their classroom to educate the young generation of 21st century but Smith & Valentine's (2018) found that these traditional methods of instruction impart great fundamental knowledge but they frequently unsuccessful to keep engaged learners in their learning process fail to engage students in their learning process due to their passive nature.

AUDIOVISUAL AIDS: Research executed by Mayer (2009) showed that the student of 21st century needs something exciting and interesting to make their study more fruitful for enhancing their level of knowledge for more difficult thoughts of scientific concepts through the integration of multimedia elements, such as animations and diagrams. This recommends that integrating visual and auditory fundamentals into teaching can increase the visualization of abstract ideas and possibly leading to more reflective understanding.

EMPIRICAL LEARNING AND HANDS-ON ACTIVITIES: The experiential learning theory of Kolb (1984) suggests that activity-based and project-based learning in which different hands-on scientific activities have been used can have the ability to actively engaging students in experiments and practical applications to make them able to apply their theoretical knowledge on real world to solve problems and become ready to face the challenges of 21st century through their practical understanding.

COLLABORATION AND GROUP ACTION: Johnson & Johnson (1987) emphasized the positive strong effect of collective learning approaches on students' conceptual understanding because group studies initiate the learners' habit of discussion with their diverse learning perspectives and problem solving nature towards their contribution to in-depth understanding.

CLT: By applying the Cognitive Load Theory (CLT) in General Science, helps educators to construct their lessons that match with the intellectual capabilities of students in order to make the learning strategies more interesting and effective to get maximum educational results.

DIFFERENTIATED INSTRUCTION & INDIVIDUAL DIFFERENCES: Tomlinson (2001) supported modifying instruction approaches to pupils' learning styles and predilections by decorated the teaching strategies with the advanced personalized learning tactics in order to improve the learners' conceptual perspective in General Science at the secondary school level.

GENERAL OBJECTIVE: The main aim of this research study is to explore the impact of teaching strategies on the conceptual understanding of the pupils of secondary level in the General Science subject.

SPECIFIC OBJECTIVES: Specific objectives of this research are;

1. To evaluate the effectiveness of various teaching strategies (e.g., inquiry, problem, and discussion dependent learning and critical thinking) in enhancing the conceptual understanding of secondary level students in General Science.
2. To investigate the relationship between the teaching strategies employed in General Science instruction and the long-term retention of key scientific concepts among secondary level students, with a focus on identifying strategies that promote enduring understanding and knowledge transfer

RESEARCH QUESTIONS

1. What are the specific teaching strategies employed by General Science teachers at the secondary level, and how do these strategies vary across different classrooms or schools?

2. To what extent do different teaching strategies in General Science instruction influence the long-term retention and application of scientific concepts by secondary level students, and are there particular strategies that lead to more sustained conceptual understanding?

HYPOTHESES

Null Hypotheses 1. There is no significant difference in the conceptual understanding of secondary school learners in the subject of General Science when exposed to different teaching strategies.

2. The choice of teaching strategy in General Science instruction at the secondary level does not have a significant impression on the long-term retention and application of scientific concepts by students

Alternative Hypotheses: **1.**There is a significant difference in the conceptual understanding of secondary level pupils in the subject of General Science when exposed to different teaching strategies.

2. The choice of teaching strategy in General Science instruction at the secondary level has a significant impact on the long-term retention and application of scientific concepts by students

LIMITATION: The research will be limited to the secondary school students of Karachi.

METHODOLOGY

RESEARCH DESIGN: Quasi experimental research design for pretests and posttests was adopted to conduct the research study.

POPULATION: All secondary schools of Karachi west, that offer General Science group or Art group for study.

SAMPLE SELECTION: A diverse sample of secondary level students from different schools is selected to ensure a representative range of backgrounds and abilities.

TEACHING STRATEGIES: Several teaching strategies are employed, including best input, positive feedback, problem solving, storytelling, flipped classroom, Socratic questioning, discussion, daily life examples, collaborative learning, presentations, convergent & divergent learning, happy mood, hands-on experiments, active learning by multimedia presentations.

RESEARCH INSTRUMENTS: A questionnaire was designed to collect the quantitative data.

DATA COLLECTION: Data was collected by personal visit of the researcher.

DATA ANALYSIS: The questionnaire was administered by the researcher. The value of Cronbach's Alpha was computed by SPSS which was 0.713. Test was conducted among the students. At first Pre-test was conducted among students to teach them with traditional style test and knowledge based. Then after an hour, the post-test was conducted. It was conceptual based and creative type. Than data was computed with the help of IBM SPSS v. 22 and IBM AMOS v. 24. Data was analyzed statistically. The analysis of questionnaire was done quantitatively, including Paired sample t-test.

TABLE 1: EVOCATIVE STATISTICS OF DIFFERENT TEACHING STRATEGIES

Variables	N	Mean	Std. Deviation
1. best Input	150	3.93	0.91
2. Positive feedback	150	4.15	1.07
3. Problem Solving	150	4.07	0.91
4. Story telling	150	3.91	1.01
5. Flipped classroom	150	3.89	1.08
6. Socratic Questioning	150	3.87	0.91
7. discussion	150	4.06	0.97
8. life examples	150	4.23	0.89
9. collaborative Learning	150	3.99	1.00
10. Presentations	150	4.08	1.02
11. Classroom Gamification	150	4.11	0.95
12. Convergent& Divergent	150	3.94	0.93

13. happy mood	150	3.97	0.88
14. project Based learning	150	4.13	0.96
15. Active Learning	150	4.13	0.90

Table 1 showed that the lectures of the teachers that contain more common day life examples motivate students in order to understand the relevance and application of content of the course has the uppermost mean score (Mean=4.23, Standard Deviation=0.886) means the students take more interest in the explanation of course content along with everyday life examples and experiences. Whereas, the Socratic questioning enhances students 'motivational level to participate in class has the lowest mean score (M=3.87, S=0.971) indicates the Socratic questioning technique is not so effective to grasp the motivation and interest of students in the classroom.

EXPLORATORY FACTOR ANALYSIS (EFA)

Analysis of factors is known as the Exploratory Factor Analysis (EFA) and its main aim is to uncover inter correlated factors in the data set because the bases for Factor Analysis is the correlation of factors present in the research questionnaire (TLS-SEM).

To explore the factorial structure of (TLS-SEM) in the sample 15 items of the research tool were subjected to an exploratory factor analysis with Varimax Rotation to get three major factors named as 1.Critical Thinking (CT), 2. Discussion Based Learning (DBL), and Project Based Learning (PBL).

TABLE 2: *KMO AND BARTLETT'S TEST*

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.872
Bartlett's Test of Sphericity	Approx. Chi-Square	817.121
	Df	105
	Sig.	.000

Table 2 showed The Bartlett's Test of Sphericity $\chi^2(105, N= 150) = 817.121$, $p<.05$, indicating that correlation structure is adequate for factor analysis as the correlation matrix of the variables in the dataset deviates significantly from the identity matri

CONFIRMATORY FACTOR ANALYSIS (CFA)

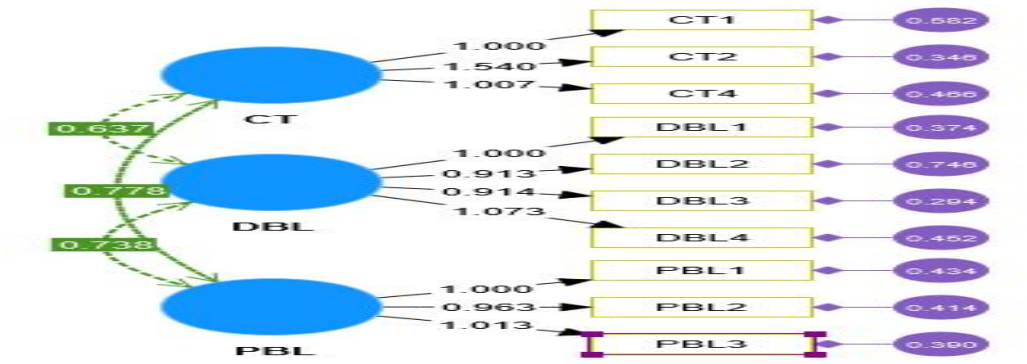

TABLE 3: *CFA- LOADING, RELIABILITY & VALIDITY*

Items	Loadings	Cronbach's (α)	CR	AVE
CT		0.740	0.758	0.503
CT1	0.611			
CT2	0.839			
CT4	0.785			
DBL		0.822	0.819	0.544
DBL1	0.773			
DBL2	0.618			
DBL3	0.782			
DBL4	0.765			
PBL		0.787	0.785	0.549
PBL1	0.735			
PBL2	0.731			
PBL3	0.757			

As portion of the calculation of the CFA model of measurement, only one item including CT3 was uncomplicated from the investigation due to its low factor loading which is less than 0.600 (Geffen & Straub, 2005). In order to examine the construct's reliability, the research study utilized Cronbach's Alpha (α) and Composite Reliability (CR). Table 4 indicates that the values of all the Composite Reliability (CR) were greater than the recommended values of 0.700 (Wasko & Faraj, 2005). Convergent Validity was recognized due to the fact that table 4 mentioned the Average Variance Extracted (AVE) for reliability and validity of factor loadings, was higher than 0.500. Convergent validity was assessed by figuring the average variance

extracted (AVE), as suggested by Fornell and Larcker (1981). The determination of the Average Variance Extracted (AVE) for each factor was the last standard for convergent validity that was applied. A minimal value of 0.500 for AVE was suggested by Nunnally and Bernstein (1994) and Fornell and Larcker (1981). Table 4 showed the findings of analysis which explained that all of the scales' AVE values were higher than 0.500. Therefore, the measurement properties met all three required convergent validity criteria.

TABLE 4: ***INTER-CONSTRUCT CORRELATIONS AND SQUARE ROOT OF AVE (FORNELL–LARCKER CRITERION.)***

Construct	CT	DBL	PBL
Critical Thinking	(***0.709)***		
Discussion Based Learning	0.637**	***(0.737)***	
Project based Learning	0.778**	0.738**	***(0.741)***

Note: **p < 0.01, *** p < 0.001. The square roots of the Average Variance Extracted (AVE) are specified by the variables in bold, italic and parenthesis on the key diagonal.

The Discriminant Validity which was calculated by Forwell-larcker Criterion. Table 5 showed that the Average Variance Extracted (AVE)'s square roots made for the construct, was higher than the inter construct association which sporting the discriminant validity that might be obtained for the construct of the study.

TABLE 5 : ***HETEROTRAIT-MONOTRAIT RATIO (HTMT)***

Construct	CT	DBL	PBL
Critical Thinking			
Discussion Based Learning	0.683		
Project Based Learning	0.781	0.734	

Discriminant Validity was also evaluated by the Heterotrait-Monotrait ratio (HTMT) of correlation (Henseler et al., 2015) along with the values of the variables which were less than threshold of 0.900. Therefore, Discriminant validity of the construct of this study was established.

TABLE 6: ***MODEL FIT INDICES***

Fit Indices	Values	Model Fit
Chi-Sqrt/df	56.563	Acceptable

P-Value	0.162	Acceptable
GFI	0.895	Acceptable
AGFI	0.820	Acceptable
TLI	0.915	Acceptable
CFI	0.939	Acceptable
RMSEA	0.124	Acceptable
SRMR	0.057	Acceptable

The Smart PLS was used to evaluate the CFA- Measurement Models in Figures 1 by using the CFA 1- Basic CB-Sem technique. Many fit indices were engaged to gauge model fit, as suggested by Hair et al. (2010), Harrington (2009), and Kline (2010) respectively. The study's model fit results, shown in Table 7, showed that the research model does a realistic job of fitting the data.The data obtained by the students was analyzed in this section. Score of traditional test and conceptual base test was statistically analyzed and explained.

HYPOTHESIS 1: There is no significant difference in the conceptual understanding of secondary level learners in the subject of General Science when exposed to different teaching strategies, including critical thinking, discussion based learning and project based learning.

TABLE 7: ***PARED SAMPLE T-TEST FOR PRE-TEST & POST TEST & STUDENTS' CONCEPTUAL UNDERSTANDING***

Variable	**Pre -Test**		**Post - Test**		**t**	**P-**
	Mean	**SD**	**Mean**	**SD**	**(149)**	**Value**
Conceptual Understanding	21.44	2.931	4.83	2.161	112.157	.000

N = 150

The table 7 specified that value of P < .05; therefore, hypothesis is rejected. Hence, there is a significant difference between the scores of the test of students taken on the traditional style (Pre-Test) and conceptual based test (Post-Test), contains teaching strategies based on critical thinking, discussion based learning and project based learning for their conceptual understanding about General Science.

TABLE 8: ***PRE-TEST RESULTS BASED ON TRADITIONAL INSTRUCTIONAL STYLE***

Number of Students	**Students' Percentage**	**Score obtained**

05	10.5	0
07	2.8	02
08	4.4	03
04	12.1	04
06	34.3	05
05	16.1	06
06	13.7	07
04	4.8	08
05	04	09
50	100	

This table explained that in Pre- test 05 students which is 10.5% of designed sample got the score 0 , 07 student (2.8%) got 2 score,08 students (4.4%) got 03 score,04 students(12.1%) got 4 score,06 students(34.3%) got score 5,5 students (16.1%) got the score 6 , 06 students (13.7%) got the score 7 , 04 respondents (4.8%) got the score 8 ,05 respondent (0.4%) got the score 9.

TABLE 9: POST-TEST BASED ON CONCEPTUAL BASED TEST

Number of Students	Students' percentage %	Scores Obtained
10	5.2	15
04	1.6	16
04	1.6	17
03	8.9	18
04	5.6	19
10	19.4	20
05	6.0	21
06	12.1	22
04	16.5	24

The table described that in traditional test 10 students which is 5.2% of designed sample got the score 15, 04 students (1.6%) got 16 score,04 students (1.6%) got 17 score,03 students(8.9%) got 18 score,04 students(5.6%) got score 19,10 students (19.4%) got the score 20 , 05 students (6.0%) got the score 21 , 06 respondents (12.1%) got the score 22 ,04 respondents (16.5%) got the score 24 out of total score 30.

CONCLUSION: It is concluded that there is noteworthy difference between the notches of post- test and pre- test. Score shows that students can solve the General Science paper easily which was taken after adopting modern teaching strategies

NULL HYPOTHESIS 2: The choice of teaching strategies, consist of critical thinking (CT), discussion based learning (DBL), and project based learning (PBL) in General Science instruction at the secondary level does not have a significant effect on the long-term retention and application of scientific concepts by students

TABLE 10: ***PAIRED SAMPLE T-TEST FOR PRE-TEST & POST TEST ON LONG-TERM RETENTION & APPLICATION OF SCIENTIFIC CONCEPTS***

Variable	Pre –Test		Post - Test		t	P-
	Mean	SD	Mean	SD	(148)	Value
Long term retention	23.53	2.848	5.93	2.276	124.143	.000
Apply scientific concepts	22.67	2.540	4.89	2.325	126.567	.000
N = 150						

The table 11 specified that value of P < .05; therefore, null hypothesis is rejected. Hence, The

choice of teaching strategies, consist of critical thinking (CT), discussion based learning (DBL), and project based learning (PBL) in General Science instructions at the secondary level have a significant impact on the long-term retention and application of scientific concepts by students of general science.

RESULTS: The pre- and post-assessment scores are analyzed using paired t-tests to determine the statistically significant improvements in students' conceptual understanding following the implementation of different teaching strategies.

The data provide insights into students' preferences and perceptions regarding the effectiveness of teaching strategies. These facts aids in understanding which methods reverberated most with the apprentices.

DISCUSSION: The quantitative data analysis reveals a complete representation of the impression of various instructional stratagems on pupils' intellectual understanding of General Science. The discussion section construes the conclusions and highpoints the approaches that shown to be most effective and efficient in ornamental students' intellectual capacity and academic engagement along with their motivation towards learning General Science.

INFERENCES AND RECOMMENDATIONS: The implications of the research study encompass educators, curriculum developers, and policymakers to offer detailed insights into effective teaching plans for cultivating conceptual understanding of respondents in General Science. Recommendations for assimilating these stratagems into secondary level science education are delivered

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