

# EVIDENCE BASED LEARNING: AN ANALYSIS OF IMPACT ON RETENTION OF KNOWLEDGE



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DOI: <https://doi.org/10.29121/granthaalayah.v8.i10.2020.1883>

**Article Type:** Research Article

**Article Citation:** Prashant Thote, and Gowri. S. (2020). EVIDENCE BASED LEARNING: AN ANALYSIS OF IMPACT ON RETENTION OF KNOWLEDGE. International Journal of Research -GRANTHAALAYAH, 8(10), 224-235.  
<https://doi.org/10.29121/granthaalayah.v8.i10.2020.1883>

**Received Date:** 02 October 2020

**Accepted Date:** 31 October 2020

**Keywords:**

Chemistry

Learning

Conventional Methodology

Learning Outcomes and Innovations

## ABSTRACT

Chemistry is a fundamental discipline of Science that accounts for day to day life at molecular level. The major challenge in the classroom instructions is to bridge the gap between high demand of learning and low efforts of learners due to lack of motivation. In this paper attempt is made to correlate the subject with day to day life. The objectives of the classroom instructions are to make effective and efficient delivery of instruction, knowledge, skill, attitude and competence. The aim of the present study is to make Chemistry subject vivid, joyful understanding of concept to stimulate learners intellectual curiosity to enhance the learning. In this study total 50 students participate. The students are categorized into two groups (study group and the control group). Each group consists of 25 students. Quasi experiment research design is applied. Data is collected by using question paper based on Revised Bloom's Taxonomy (RBT) before and after the experiment. Result of the study reveals that the evidence-based learning approach is used for the classroom instructions and has positive impact on motivation, satisfaction and academic achievement. The present classroom instruction is beneficial because it correlates the subject with day today life and arouses the interest among the learners. Based on the findings of the study some suggestions are made.

## 1. INTRODUCTION

“Education without application is just entertainment” – Tim Sanders

Learning climate influences learners' achievement. Teaching –learning approach where learners are engaged with performing tasks are more advocating. The students interact with their ambience for accumulating information, retrieve and use their knowledge, skill and competence in such a way that it is useful for the society at large. The students face challenges in learning Chemistry due to its abstract nature of concept, need for noteworthy time, committed efforts from learners and teachers also. The contrast between the low input and high demands results in not satisfying performance from learner's side and frustration on teacher's side.

According to modern research, there are large numbers of learners who find it difficult to assimilate concepts during classroom instruction. The low academic performance may be due to poor classroom instructions, ineffective teaching methodology, fragmented content knowledge and students with limited mental ability, not sufficient understanding and learners' common sense. The classroom instructions can improve students' learning by inspiring student's curiosity in the subject.

In the present study the approach used for classroom instructions is to correlate the Chemistry subject with day to day life. Chemistry touches all spheres of life. As a teacher for the past 25 years I am able to connect the depth of Chemistry with everyday life. One may find Chemistry in day to day life like in the air we breathe, food we eat, cleaning chemicals we use and literally in every object we touch and even in our emotions.

All main branches of Science – Biology, Chemistry and Physics are useful to the humanity in one way or other. But leading out of these is Chemistry. There is hardly any aspect of our life where Chemistry does not have impacted. The multicolor cloths we wear utilize different dyes, the cosmetics, creams, shampoos and detergents involve the skills of Chemistry. The most vital of these are various medicines and drugs which are organic compound. We must be grateful to the chemists who carry out these researches in different parts of the world to synthesis new medicines.

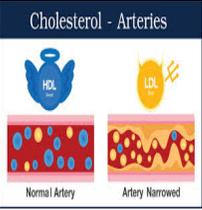
Chemistry teacher employs different teaching methodology in classroom instructions, some work with the students but others may not. The important issue that arises in Science classroom instruction is presenting information through chalk and talk- the passive learning. Learners who receive this type of instructions remain inactive during the classroom instruction and are of the opinion that Chemistry knowledge is fixed and no additional action is required. Students who are passive in the classroom instructions are likely to be the low achiever.

To felicitate learning in core subjects including Chemistry many efforts have been initiated into the wide spectrum of activities that aims to help teachers shift from teacher center pedagogy to learners centered pedagogy including many leaning activities to amalgamate in the classroom instructions.

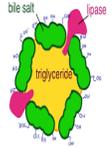
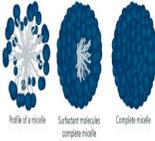
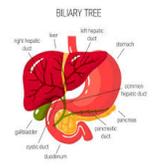
Active learning process provide multiple opportunities and enough time for learner's interactions by engaging them to construct positive understanding of concepts, gain knowledge, acquire skills and apply their competency. Active learning includes conceptual understanding, changing strategies, collaborative learning, co-operative learning, group work, technology enhanced inquiry based, problem based, case study based discovery learning, peer instructions and experiential learning activity. Different engaging teaching techniques have been used in Chemistry classroom. The conceptual visualization has an optimistic effect on Chemistry learning outcomes and concept mapping is effective and efficient in gaining knowledge, acquiring concept and to apply competency. The concept mapping is more effective in enhancing academic achievement than conventional teaching methodology. The highly directed concept mapping techniques produce much better result in learner's academic performance then poor concept mapping.

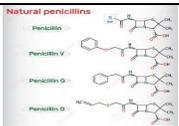
Students construct Chemical concepts at their own paces based on their daily experiences. Therefore, learners' are provided with an opportunity and enough time to develop sound understanding of Chemical concepts during class-room instructions. The best teaching practice is to give students a particular task at both individual and group level at with a given time frame work. Self-determined time produces better academic achievement result at practical Chemistry than the other teaching methodologies such as lectures demonstration etc. The most commonly used teaching methodologies are role play, project, quiz, oral questions, field visit, debate, problem solving, individual work, investigation assignments, practical work, test, presentation and discussion.

**Table 1:** Selected everyday life correlated Chemical Concepts

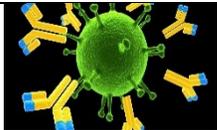
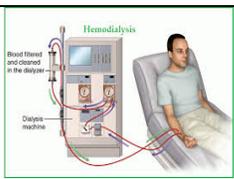
Sl .No	Concepts	Everyday life Connection	Pictures
1	Density	HDL and LDL - good and bad cholesterol	
2.	Second law of thermodynamics	Why is it easy to stay messy while hard to keep neat	

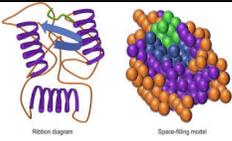
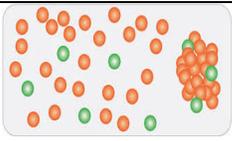
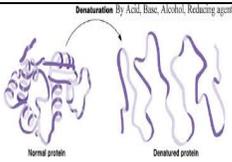
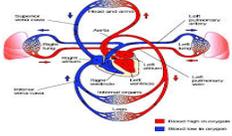
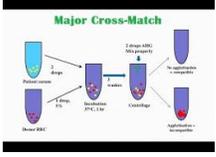
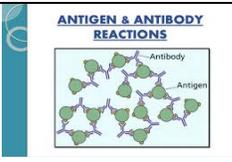
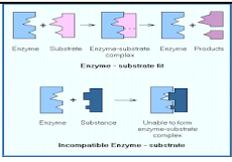
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3	Colligative Properties	Why does salt melt ice?	
4	Intermolecular forces	Why is oil liquid and butter solid at room temperature?	
5	Geometric Isomerism	Formation of trans fat in cooking oil	
6	Stereoisomerism	What is the difference between Prilosec and Nexium?	
7	Micelles	How does soap clean?	
8	Micelles	What is the role of bile salts during fat digestion?	
9	Precipitate	What is soap scum?	
10	Precipitate	What is hard water?	
11	Oxidation reaction	Why is the statue of Liberty blue?	

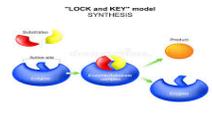
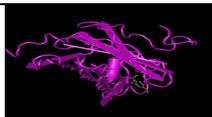
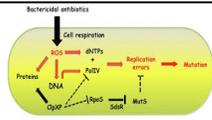
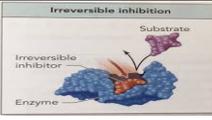
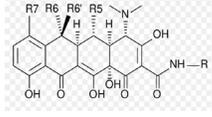
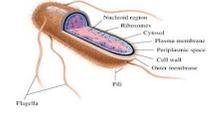
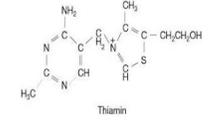
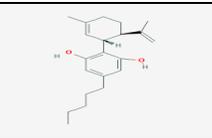
12	Oxidation reaction	How does rust work?	
13	Catalytic hydrogenation	Manufacturing of Margarine	
14	Base catalyzed hydrolysis	How is soap made?	
15	Acid catalyzed hydrolysis	How do drug-sniffing dogs detect illegal drugs?	
16	Nucleophilic addition-elimination	How does penicillin work?	
17	Nucleophilic addition-elimination	How is aspirin made?	
18	Nucleophilic addition-elimination	How is nylon 6-6 made?	
19	Chromic acid oxidation	How do breathalyzers work?	
20	Polymerization of alkenes	How is plastic made?	
21	Polymerization of alkenes	How is PCV made?	

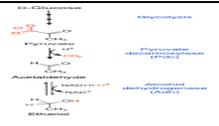
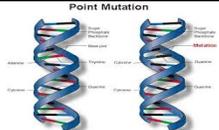
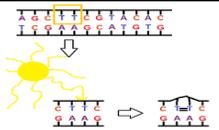
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22	Polymerization of alkenes	How is Teflon made?	
23	Hydrophobic effect	Why do small oil drops in water tend to aggregate together into larger ones?	
24	Oligosaccharides and antigen-antibody complex	What role do blood types play in blood transfusion?	
25	Structure of lipids	Health benefits of Omega-3 fish oil	
26	Lipid membrane fluidity and temperature	Why deep ocean fish contain more unsaturated fatty acids?	
27	Semi-permeable membrane, osmosis and diffusion	How does a kidney dialysis machine work?	
29	Contrast between steroid and peptide hormones	Why do the risks of hormones therapy outweigh the benefits for most women?	
30	Isoelectric point	How is cheese made?	
31	Protein primary structure	How do meat tenderizers work?	
32	Protein primary structure	How different is human insulin from porcine insulin?	

33	Protein tertiary structure- disulfide bond	What is involved in a “hair permanent”?	
34	Fibrous and globular proteins	Why is hair water insoluble while egg white soluble?	
35	Protein Denaturation	Why is raw egg white water soluble while cooked egg white insoluble?	
36	Protein Denaturation	Why does alcohol sterilize things?	
37	Protein Denaturation	Why must we wear goggles in the lab?	
38	Hemoglobin and Iron	Why is venous blood dark red while arterial blood bright red?	
39	Myoglobin	Why is beef red while fish white?	
40	Glycoproteins	Why do we need to do “Type and cross match” test before a blood transfusion?	
41	Antigens and antibodies	Why do we need to do “Type and cross match” test before a blood transfusion?	
42	Enzyme specificity	How is it possible that humans cannot digest grass while cows can?	

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43	Enzyme specificity	What causes lactose intolerance?	
44	Enzyme binding model	Why is Nexium more effective than Prilosec?	
45	Competitive inhibition	How do sulfonamides fight bacterial infection?	
46	Substrate analogues	How do sulfonamides fight bacterial infection?	
47	Noncompetitive inhibition	Why are heavy metals a Hazard to your health?	
48	Irreversible inhibition	How does aspirin work?	
49	Bacteriostatic antibiotics	How do sulfonamides fight bacterial infection?	
50	Bactericidal antibiotics	How does penicillin fight bacterial infection?	
51	Metabolism – oxidative decarboxylation	How does thiamine (Vitamin B <sub>1</sub> ) work?	
52	Metabolism-citric acid cycle (CoA)	How does pantothenate (Vitamin B <sub>5</sub> ) work?	
53	Metabolism-citric acid cycle (FAD/FADH <sub>2</sub> )	How does riboflavin (Vitamin B <sub>2</sub> ) work?	

54	Metabolism-citric acid cycle (NAD/NADH)	How does niacin (Vitamin B <sub>3</sub> ) work?	
55	Metabolism- gluconeogenesis	How do biotin supplements work?	
56	Fate of Pyruvate-lactate fermentation	Why do muscles get sore after vigorous exercise?	
57	Fate of Pyruvate- ethanol fermentation	How is liquor made?	
58	Recombinant DNA	How is real human insulin made?	
59	DNA replication	Why kids look like their parents?	
60	Western blotting	How is HIV detected?	
61	PCR	How is HIV detected?	
62	Gene mutation and chemical mutagens	Why is roast meat bad to your health?	
63	Gene mutation and radiation mutagens	Does suntan cause cancer?	

# Evidence Based Learning: An Analysis of Impact on Retention of Knowledge

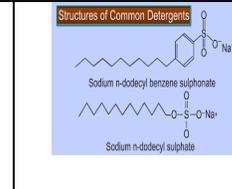
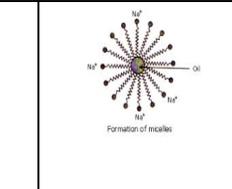
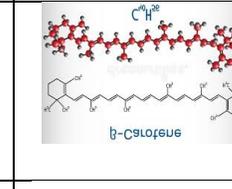
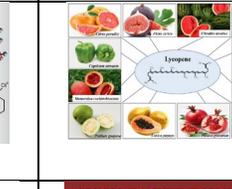
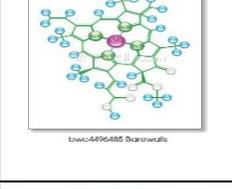
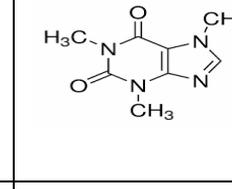
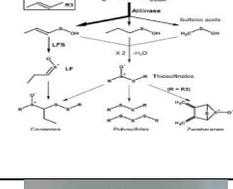
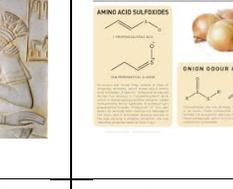
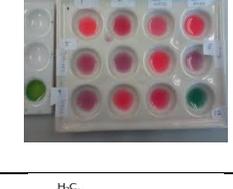
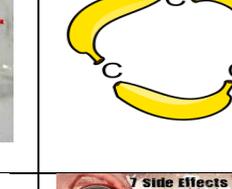
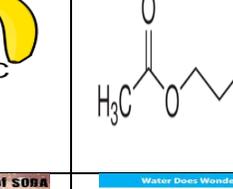
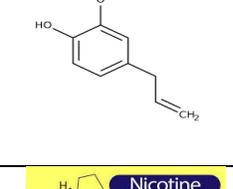
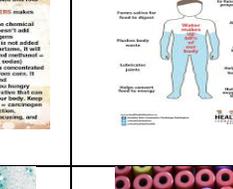
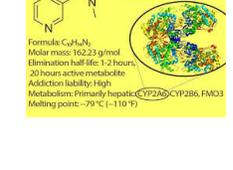
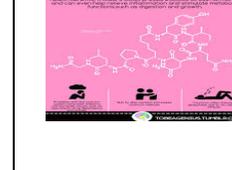
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 bww-6496485 Borewalls				
				
				
				
 <b>Cigarette component</b>	 <b>Nicotine</b> Formula: C <sub>10</sub> H <sub>14</sub> N <sub>2</sub> Molar mass: 162.2 g/mol Elimination half-life: 1-2 hours 20 hours active metabolite Addiction liability: High Metabolism: Primarily hepatic-CYP2A6, CYP2B6, FMO3 Melting point: -79°C (-110°F)			

Figure 1: Chemistry in Everyday Life

## 2. METHODS

### 2.1. SIGNIFICANCE OF THE STUDY

The introduction of alignment of concept of Chemistry to everyday life is improving learning and the academic achievements of the students. This will foster more joyful learning experience and arose the interest in the subject by intrinsic motivation.

The imperial evidences to support the present classroom strategies in Chemistry at intermediate level is not known, without knowing the imperial evidence it is unlikely to convince teachers to use the present classroom instruction method for teaching and learning Chemistry and other core subject of school education at intermediate level.

### 2.2. OBJECTIVES

The present study aims to study the outcome of present teaching learning strategies on academic achievement score of study group and control group.

### 2.3. HYPOTHESIS

There is no noteworthy mean score difference between the academic achievement score of study group and control group after treatment.

### 2.4. RESEARCH DESIGN

The (quasi) experimental research design is applied. The systematic description of design is represented in Fig 2.

### 2.5. SAMPLE

The sample consists of total 50 students of grade 12 studying Chemistry as elective subject. Sample age is from 17-19 years. On the basis of the test conducted before the treatment, the samples are subdivided into two groups (study and control group) – 25 students in each. Both group consists of 25 students.

### 2.6. TOOL

As there is no standard tool available to measure the academic achievement after treatment, test is designed. According to RBT (Revised Bloom's Taxonomy) the content of the instrument is validated by the subject experts.

## 3. RESULT AND DISCUSSIONS

**Table 1:** Independent sample t-test before treatment of student's achievement:

Variables	N	Mean	df	t-value	P
Study Group	25	14.23	58	0.177	.849
Control Group	25	14.02			

**Table 2:** Independent sample t-test after treatment of student's achievement:

Variables	N	Mean	df	t-value	P
Study Group	25	18.52	58	12.68	.000
Control Group	25	16.29			

**Table 3:** Paired Sample test for test before and after treatment

Pair 1	Before and after treatment of test	Mean difference	SD	T	Significance (2 trailer)
		-4.2000	1.45	12.442	.000

The independent t-test sample is applied to calculate the mean score difference between the achievement score of study group and the control group on test before treatment.

Table 1 shows that there is no noteworthy difference between two groups ( $p= .849$ ). It shows that both groups are on equal level of achievement before interventions.

A paired t-test sample is conducted to compare the effect of treatment on academic performance of the study group. Table 2 reveals that there is a noteworthy difference in the academic performance of test before the treatment ( $M= 18.52, SD= 4.261$ ) and after treatment ( $M= 16.29, SD= 3.460$ )  $t(50) = 12.442, p=0.000$ .

#### 4. DISCUSSION

The present study is conducted to reveal the effect of correlation of Chemistry with everyday life to gain sound results. Learners are subdivided into two groups (study group and control group). Study group is taught the subject on the center of correlation of the subject with day to day life and control group is taught by using conventional method. Result of the study indicates that the present study indicates that the present strategy of class room instructions have positive impact on students' academic performance. Result of the present study is in constant with previous study Chunuu and J. Foss (2010).

The present classroom strategy proves to promote learning. Learners in the classroom express their satisfaction with the teaching methodology. Students express their satisfaction as students succeed in Chemistry subject with high grades not only making subject easy but also stay in tune with students. The classroom instructions are understandable to more difficult content like electrochemistry, chemical equilibrium and solid states.

In order to compare the students score with knowledge and competency, the mediocre score of the students are taken and the result reveals that the student's average scores have increased by 18% and exceeded the intended benchmark. The merit of incorporating answers into classroom instructions is advisable that analogy may also cause confusion by itself in two aspects:

- Students are not familiar with analogy of class room instructions
- Students have different understanding of point of instruction which they wish to convey. Hence having proper metaphors and repetitive specifying the differences and similarities between the concepts and analogy is essential.

#### 5. CONCLUSION

- Innovative class-room instructions practices improve both learners and teachers. By involving in innovative practices, students need not be categorized. Students prefer learning by doing (experiential learning).
- Innovative classroom instructions are promising because it supports teachers to involve students with learning.
- Innovative practices are prominence in Science education, curriculum, teaching-learning and value additions.
- Present emphasis is on adopting subject knowledge and skills to everyday life. Hence Science teachers must concentrate on this to connect the subject with daily life to have firsthand knowledge of the subject.
- When teachers and learners fully embrace innovative process in classroom, students' academic achievement enhances greatly in Science subject.

#### 6. SUGGESTION FOR IMPROVEMENT

- Teachers should design, fabricate, innovate various teaching methodology for class room instructions to enhance students active participation in lesson to enhance academic performance.

- In service teacher training should be organized for continuous improvement in class-room instructions and overall quality of education.
- Teachers should visit other schools that utilize innovative classroom practices, observe new methods and material in action.
- Science teachers should be motivated to become more cosmopolitan in applying classroom teaching techniques.

## **SOURCES OF FUNDING**

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## **CONFLICT OF INTEREST**

The author have declared that no competing interests exist.

## **ACKNOWLEDGMENT**

None.

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