

5. A Study Of Cognitive Abilities In Biology And Its Impact On Secondary School Students

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Abstract

Cognitive development theorists generally agree that children are not just passive receivers of knowledge; instead they are active meaning-makers. That is, information does not simply seep into a child's brain; children immediately process new ideas — putting them into categories, making connections to other pieces of information they are aware of, and ask questions to develop an interpretation of the world around them. This theory of “constructivism” further states that students need first-hand experience, rather than simply a teacher's explanation, to abandon pre-conceived notions they already have. As a result, rather than always being a “sage on the stage”, an effective teacher should be flexible enough to understand as to when it is appropriate to be a “guide on the side”. The teacher should in fact resort to crafting activities and open ended questions which allows the students to explore their world first-hand on their own. On a cold day, younger students might believe that their sweaters and hats produce heat; for some students, only through testing this notion with thermometers their misconception is exposed (or set straight). The act of making the students explore their own approaches for solving a problem rather than simply telling them “the” way to do it, or letting them “discover” without any supervision or guidance whatsoever gives a teacher the insights into how the child thinks and how the teacher should clarify any misunderstandings.

In this study, an attempt has been made to help the children to imbibe subject knowledge using mind mapping techniques. The outcome has been splendid indeed!!

Keywords: Cognition, cognitive development, cognitive abilities, biology, achievement test

Introduction

Cognition has to do with how a person understands and acts in the world. It is a set of abilities, skills or processes that are part of nearly every human action.

Cognitive abilities are brain-based skills which we should inculcate in order to carry out any task from the simplest to the most complex to the best of our ability. These skills have more to do with the mechanisms of how one learns, remembers, solves the problem, and pays attention rather than having actual knowledge. Any task can be broken down into the different cognitive skills or functions needed to complete that task successfully. For instance, receiving a telephone call involves at least: *perception* (hearing the ring tone), *decision making* (answering or not), *motor skills* (lifting the receiver), *language skills* (talking and understanding caller's language), *social-skills* (interpreting tone of voice and interacting properly with the caller).

The *cognitive training* is based on the framework that cognition consists of different mental functions or cognitive abilities are based on specific constellations of brain structures. For instance, memory skills rely mainly on parts of the temporal lobes (next to the temples) and parts of the frontal lobes (behind the forehead).

The core notion of *cognitive development* is that children should develop skills and abilities in more or less predictable sequences. While all children may not develop at the same rate, they all however pass through common phases of cognitive, physical, and social development. Although we will not explore all of the well-known theorists who have contributed to our understanding of this idea, we can bring down all of those theories into a series of thematic findings that are most relevant to the teachers in a classroom. The following five themes (adapted from Jeanne Ormrod's Educational Psychology: Developing Learners) serve as founding doctrine of cognitive development and provide an important background for teachers:

- (1) At different ages, children think in different ways.
- (2) Children actively construct meaning.
- (3) A child's cognitive development builds on prior knowledge.
- (4) Challenging student thoughts promotes cognitive development.
- (5) Social interactions enable cognitive growth.

The existence of human beings is only because of the cognitive abilities. Cognitive abilities are the brain-based skills and mental processes that are needed to carry out any task - from the simplest to the most complex successfully. Every task can be broken down into different bits that are needed to complete that task successfully. If they are not used regularly, the cognitive abilities will diminish over a period of time.

Every parent asks their children if they have scored good marks but rarely do the parents ask their children if they have understood what is taught in school. Cognitive abilities should be the basis of the student's education. Hence, parents and teachers should together take care to improve the cognitive abilities of the students.

Objectives of the Study

The objectives of the present study are:

1. To study the significant differences between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities in control group.
2. To study the significant differences between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities in experimental group.
3. To study the significant differences between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities of boy students of IX standard in control group.
4. To study the significant differences between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities of girl students in control group.
5. To study the significant differences between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities of boy students in experimental group.
6. To study the significant differences between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities of girl students in experimental group.

Variables of the Study

- **Independent Variable** : Cognitive Ability
- **Moderator Variable** : Gender (Boys and Girls)

Research Design

The present study is an experimental design involving control and experimental groups and the effects on different treatments determined by pre-test and post-test.

Hypotheses of the Study

1. There is no significant difference between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities in control group.

- i. Knowledge ability
- ii. Understanding ability
- iii. Application ability
- iv. Analysis ability
- v. Evaluation ability
- vi. Synthesis ability

2. There is no significant difference between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities in experimental group.

3. There is no significant difference between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities of boy students of IX standard in control group.

4. There is no significant difference between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities of girl students in control group.

5. There is no significant difference between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities of boy students in experimental group.

6. There is no significant difference between pre-test and post-test scores in academic achievements of IX standard students in Biology and different cognitive abilities of girl students in experimental group.

Research Tool

The tool used for the collection of the data was:

- 1) Achievement Test in Biology for IX Standard Students (constructed by the investigator).

Sample of the Study

The present study focused on a sample of 30 students of IX Standard in two groups, namely, experimental and control group containing both boys and girls of different socio-economic and educational background.

Collection of Data

Keeping the above factors in mind, the investigator consulted with the management, principal and Headmaster of these schools and appraised the necessity of visiting and collecting the information from these Schools.

Statistical Technique Used

The statistical technique used is as follows:

- Differential statistics

Data Analysis

Table-1: Results of paired t-test between pre-test and post-test scores of academic achievement in Biology of students in control group

Variables	Test	Mean	Std. Dv.	Mean diff.	SD diff.	Paired t	p-value
Academic achievement	Pre-test	13.47	3.08	-4.97	3.11	-8.7397	0.0000*
	Post-test	18.43	2.62				
Knowledge ability	Pre-test	4.70	1.60	-1.23	1.22	-5.5241	0.0000*
	Post-test	5.93	1.48				
Understanding ability	Pre-test	3.83	1.80	-1.33	1.32	-5.5251	0.0000*
	Post-test	5.17	1.46				
Application ability	Pre-test	1.80	0.92	-0.77	0.82	-5.1385	0.0000*
	Post-test	2.57	0.86				
Analysis ability	Pre-test	1.90	1.27	-0.80	1.06	-4.1201	0.0003*
	Post-test	2.70	1.06				
Evaluation ability	Pre-test	0.93	0.74	-0.80	1.00	-4.3970	0.0001*
	Post-test	1.73	0.87				
Synthesis ability	Pre-test	0.30	0.47	-0.80	0.85	-5.1739	0.0000*
	Post-test	1.10	0.71				

* $p < 0.05$

From the results of the above table, it can be seen that:-

- A significant difference was observed between pre-test and post-test scores of academic achievement in Biology of students in control group ($t = -8.7397$, $p < 0.05$) at 5% level of significance. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. It means that, the post-test scores of academic achievement in Biology of students are higher as compared to pre-test in control group.
- A significant difference was observed between pre-test and post-test scores of cognitive ability of academic achievement in Biology of students i.e., knowledge ability in control group ($t = -5.5241$, $p < 0.05$), understanding ability in control group ($t = -5.5251$, $p < 0.05$), application ability in control group ($t = -5.1385$, $p < 0.05$), analysis ability in control group ($t = -4.1201$, $p < 0.05$), evaluation ability in control group ($t = -4.3970$, $p < 0.05$), and synthesis ability in control group ($t = -5.1739$, $p < 0.05$) at 5% level of significance. Hence, the null hypothesis is rejected and alternative

hypothesis is accepted. It means that, the post-test scores of cognitive ability of academic achievement in Biology of students i.e. knowledge ability of students are higher as compared to pre-test in control group

Table-2: Results of paired t-test between pre-test and post-test scores of academic achievement in Biology of students in experimental group

Variables	Test	Mean	Std.Dv	Mean diff.	SD diff.	Paired t
Academic achievement	Pre-test	12.27	2.95	18.33	5.11	19.6584
	Post-test	30.60	3.53			
Knowledge ability	Pre-test	4.40	1.92	5.37	2.40	12.2504
	Post-test	9.77	1.41			
Understanding ability	Pre-test	3.13	1.74	4.27	2.45	9.5442
	Post-test	7.40	1.65			
Application ability	Pre-test	1.87	0.78	2.83	1.39	11.1511
	Post-test	4.70	1.06			
Analysis ability	Pre-test	1.63	0.89	3.83	1.49	14.1150
	Post-test	5.47	1.04			
Evaluation ability	Pre-test	0.83	0.83	1.43	1.04	7.5487
	Post-test	2.27	0.69			
Synthesis ability	Pre-test	0.40	0.56	1.17	0.83	7.6628
	Post-test	1.57	0.68			

* $p < 0.05$

From the results of the above table, it can be seen that:-

- A significant difference was observed between pre-test and post-test scores of academic achievement in Biology of students in experimental group ($t = -19.6584$, $p < 0.05$), knowledge ability in experimental group ($t = -12.2504$, $p < 0.05$), understanding ability in experimental group ($t = -9.5442$, $p < 0.05$), application ability in experimental group ($t = -11.1511$, $p < 0.05$), analysis ability in experimental group ($t = -14.1150$, $p < 0.05$), evaluation ability in experimental group ($t = -7.5487$, $p < 0.05$), and synthesis ability in experimental group ($t = -7.6628$, $p < 0.05$) at 5% level of significance. Hence, the null hypothesis is rejected and alternative hypothesis is accepted. It means that, the post-test scores of academic achievement in Biology of students are higher as compared to pre-test in experimental group.

Major Findings of the Study

1. The post-test scores of academic achievement in Biology of students are higher as compared to pre-test in control group.
2. The post-test scores of cognitive abilities of academic achievement in Biology of students i.e. knowledge ability, understanding ability, application ability, analysis ability, evaluation ability, and synthesis ability of students are higher as compared to pre-test in control group.
3. The post-test scores of academic achievement in Biology of students are higher as compared to pre-test in experimental group.
4. The post-test scores of cognitive abilities of academic achievement in Biology of students i.e. knowledge ability, understanding ability, application ability, analysis ability, evaluation

ability, and synthesis ability of students are higher as compared to pre-test in experimental group.

Discussion and Conclusions

As per analysis and interpretation of the data, the following results were drawn.

There is a significant difference between pre-test & post-test mean scores related to academic achievements and cognitive abilities in Biology by the IX standard students who have learned through mind mapping and memory techniques.

Therefore, it can be concluded that the use of achievement test in understanding and acquiring the cognitive abilities of the students in Knowledge, Understanding, Application, Analysis, Evaluation and Synthesis concepts and the theoretical part in the content of Biology is effective and beneficial.

The findings of the study may, however, partially be because items in the achievement test used in this study are free from sex-related issues or any form of sex bias. It may not equally be unconnected with the fact that the cognitive abilities and achievements in Biology used in this study is a novel experience to all the students that took part in this study. This situation can be a stimulating factor to all the students regardless of their gender and scoring levels resulting in the observed similar achievements made by both sexes.

References

- *Best, J. W. (1978). Research in Education. New Delhi: Third edition, Prentice Hall of India Pvt. Ltd.*
- *Buzan, T. B. (1989a). Master Your Memory. Typsetters Ltd: Birmingham*
- *Choudhary, S. (2008). Teaching of Biology. New-Delhi: A.P.H. Publishing Corporation.*
- *Garrett, H. E. (1979). Statistics in Psychology and Education. Bombay: Vakil-Feffer and Simon Pvt. Ltd.*
- *Glass, A.L. & Holyoak, K.J. (1986). Cognition. New York: Random House.*
- *Gupta, N. K. (2004). Research in Teaching of Science. New-Delhi: A.P.H. Publishing Corporation.*
- *Menzel, E. W. (1960). How to Study. London: Oxford University Press.*
- *Norman, L. (1967). Introduction to Psychology. Published by Mohan Primalani for oxford, Houghton Muffin. Co. Pvt. Ltd.*
- *Ornstein, R. (1972). The Psychology of Consciousness. Freeman.*
- *Thulajappa, Y & Seetharam. P.L. (1993). A Text Book of Biology. Bangalore: Vol.1, Second year PUC, 6th Edition,.*
- *Verma, P.S. & Agarwal.V.K. (1978). Cell Biology, Genetics, Evolution and Ecology. New-Delhi: Third edition, S. Chand and Company Ltd.*

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