

*Effect of 4MAT Cycle on the Academic Achievements of the Students ...*

## Effect of 4MAT Cycle on the Academic Achievements of the Students in the Subject of Biology at Secondary Level in Baluchistan

Riaz Ahmed Panezai

PhD Scholar, Department of Education, International Islamic University Islamabad

Dr. Azhar Mahmood

Associate Professor, Department of Education, International Islamic University Islamabad

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### Abstract

The purpose of research study is to investigate the effect of 4MAT Cycle on the academic achievements of the biology students at secondary level in Baluchistan. True Experimental Design was selected for the study specifically Pertest Post-test control group design. The study take place in Tehsil Karazat District Pishin. The population size of the study is all the students of the 9<sup>th</sup> class studding the subject Biology. The sample was drawn using random sampling technique. Two groups were used in the study control and experimental group. 4 MAT Cycle was used in experimental group while traditional lecture method was used in control group. The experiment was lasted for eight weeks. Subject Achievement Test was used as instrument for both the groups in the study. The same test was used as pre-test for both the groups. Research questions was answered using mean and standard deviation. T Test was used and Hypotheses were tested. The same Subject Achievement Test (SAT) with reshuffled version was used after three months to investigate the retention level of the students in both the groups in the subject concern. The major conclusion of the study were to the effect of 4 MAT cycle on students' academic achievement in biology at secondary level. From the findings it was revealed that the experimental group achieved significantly better in the post-test as compared to the pre-test.

**Keywords:** 4MAT Cycle, academic achievements, secondary level, Biology

### Introduction

Biology is one of the essential science subject at secondary level because it occupies unique position in the curriculum of secondary education at school level and it is also called science of life. It is important to achieve national curriculum objectives regarding biology. Teaching learning process is essential regarding the achievements of such goals. This will help the student to construct their own views and knowledge and will be in the position to apply the knowledge in daily life. Cainc (2009) stated that it is essential for the teacher to organize

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classroom in such a way where activity play major role in that classroom. Such activity base teaching will help student to construct their own knowledge and understanding through interacting with environment around them. Studies have shown that effective instructional strategies have not been used in the subject of biology due to that student cannot develop their own knowledge in real life (Nwagbo, 2011). Agame (2012) further stated that in most of the secondary schools teacher use inappropriate instructional method and students are confined to text book taking notes and memorization of the fact. Conventional lecture method does not allow the learner to play active role in the class and construct their own knowledge. Brnice McCarthy's 4MAT Cycle provided systematic approach to organize and deliver instruction that address learning style. This instructional design consists of four quadrants each of the quadrants represent one of four major learning styles. The 4MAT Cycle is constructivist model of pedagogy which is interconnected in four essential phases of learning (McCarthy, 1981). McCarthy called his model as "Natural learning cycle" This models moves students through activities appropriate for four types of learners. They progress from experience to abstraction and from experimentation to assimilation. When teacher move in the circle he use different instruction strategies. In these instructional strategies teacher provide an opportunity to every individual to perceive and process information. This model encourages the teacher to adopt different roles as motivators, facilitator, information giver and evaluators (McCarthy, 1981).

4MAT has recently been used in a variety of educational settings and disciplines, including medicine education (Spatz, 1991), law studies (Kelly, 1990), and scientific education (Bowers, 1987; Ursin, 1995; Jackson, 2001). Many instructional strategies, for example, were used to fit the learning styles of engineering economy students. To swiftly calculate the present value of an alternative, an experiential learning cycle and a creative business game were used (Mare, 1993). Nowacki (2011) applied the 4MAT model to the learning process in order to turn a biostatistics course into a problem-based learning experience. Students felt more passionately, encouraged sharing, and integrated concepts across subjects, according to the findings.

In addition, suggestions for problem-based learning strategies were given. At various levels of education, studies of the 4MAT model were also conducted. The findings revealed that using the 4MAT approach resulted in more positive attitudes, increased academic accomplishment, and more long-term learning (Uyangor, 2012). Kemal and Huseyin (2014) evaluated the impact of learning activities on high school students' academic achievement and attitude toward mathematics, using a method that was compatible with the 4MAT system. Academic achievement and problem-solving skills improved as a result of the study. Uyangor and Sevinc (2012) studied the effects of the 4MAT model on seventh-grade students' academic achievement and attitudes toward mathematics in public schools. The authors used an experimental paradigm with a pre-test and post-test on a control group.

4MAT is an instructional approach based on the concept that learners' perceptions and processing of those perceptions are intertwined. Some students perceive information in two ways: first, through experience, and then, through conceptualization. They sense concepts, are present in the moment, are emotionally captured by the moment, and feel the learning through experience. Furthermore, learners use conceptualization to transfer their experiences into conceptual forms using language, concepts, systems, and an abstract

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approach to figure out what is going on and name it (McCarthy, 1990).

The learning process depends on the interaction between the feeling of experience and conceptualization. It connects learners' personal worth and perceptions to those of experts. Learner's process information in addition to experiencing it, and this information is processed in two ways: by reflecting on it and by acting on it. By reflecting on information, learners apply their knowledge to the outside world, try out things by doing and testing; by action, learners apply their knowledge to the outside world, pondering, questioning, feeling how one feels, observing others, feeling the same way or differently, and figuring out where one is with what is experienced; by action, learners apply their knowledge to the outside world, try out things by doing and testing (Pratoomtong, 2011). The interaction between "viewing" reflections and "performing actions" is critical since it offers the motivation to act on internal ideas. It challenges students to put their theories to the test in the real world and to apply what they've learned to a variety of ambiguous circumstances. Perception and understanding are two terms that describe the entire range of learning experiences (learning style). While learners engage in a variety of learning activities, the majority appear to favour one type of learner over another. Imaginative learners, analytic learners, common sense learners, and dynamic learners are the four categories of students (McCarthy, 2005).

The teacher plays a vital role in the traditional lecture method. In the lecture method, the teacher is at the centre of all activities; the focus is not on the pupil but on the teacher. Control of learning is in the hands of the instructor under the teacher-centered method (McDonald, 2002). The teacher-centered approach is limited to facts and information delivery, and it is currently regarded a poor way of instruction (Mandor, 2002). The lecture approach is the most widely used of the traditional methods. The lecture approach involves presenting ideas, concepts, and facts verbally. The teacher takes an active role in the lecture technique, while the student takes a passive position. According to Ibe (2004), the lecture approach leads to rote memorization since students do not participate in the presentation and instead learn facts and knowledge in the order in which the teacher presents them. In science subjects, especially biology, such an approach is useless. Science courses necessitate direct student participation in the lecture, and the lecture approach is insufficient to clear the student's notion. He goes on to say that traditional methods are insufficient for effective learning. The chalk and speak method has shown to be ineffective. Despite this, the majority of scientific teachers continue to follow the old method, resulting in worse academic standards in the long term (Inanyang & Ekpeyoung, 2000).

The 4MAT model is one of the learning models that takes individual differences in learning into consideration. 4MAT has the advantage of taking into account individual characteristics such as learning styles and brain processing capabilities. Moreover, it provides students with possibilities to comprehend the particulate nature of matter, such as modelling, visualisation, theoretical knowledge, application, demonstrating individual creativity, integrating these opportunities, and knowledge transfer through interaction with tasks.

The 4MAT method is based on Kolb's (1984) brain hemisphere research findings and experimental teaching philosophy (Uyangor, 2012). When it comes to processing new information, a person favours the right or left hemispheres of the brain. The learner with a right hemisphere operational inclination understands images, seeks patterns, produces analogies, and is simultaneous in nature. The student who prefers the left hemisphere of the

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brain works with analysis, languages, abstracts experiences, and has a good sense of numbers. A student, on the other hand, does not employ one hemisphere exclusively. He/she shifts from one hemisphere to the other depending on the situation (BulBul & Ossoy, 2015).

**Objective of the Study**

To investigate the effect of 4MAT Cycle on the academic achievements of the students in the subject of Biology at secondary level in Baluchistan.

**Research Methodology**

This research study was conducted to find out the effect of 4 MAT cycle on the academic achievement of the students at secondary level in the subject of Biology. The academic achievement of science students after eight weeks intervention in experimental and control group was compared to evaluate the effect of the 4 MAT cycle. The study is designed to investigate the effect of 4 MAT Cycle on the academic performance of the students. The students of class 9<sup>th</sup> is divided into two groups control group and experimental group. Group one acted as a control group and taught with traditional method. While the other group is experimental group taught with 4MAT Cycle. Pre-test post-test control group true experimental design is selected for the study.

In this study, the target population was consisted of all the science students at secondary level in Balochistan.it was not possible to reach the target population. Therefore, researcher defined the accessible population of this study. There are 15 high schools in Tehsil Karazat District Pishin. In this connection the 9th class biology students in Government High School (Boys) randomly selected for the study. In this study, the target population was consisted of all the science students at secondary level in Balochistan.it was not possible to reach the target population. Therefore, researcher. Due to fanatical, security and other constrains the study will be limited to only district and one tehsil. The study was conducted in district Pishin and tehsil Karazat. Only one school was randomly selected for the study.

In order to measure the academic achievements of the students in the subject of Biology the researcher has developed and use Subject Achievement Test (SAT), consisting of multiple-choice items. Researcher developed the research instrument named Subject Achievement Test (SAT) with the help of supervisor. SAT was consisted of 40 multi choice questions (MCQs). This research instrument was used for both pre-test and post-test in the experimental and control groups. The entire research question was answered using mean and standard deviation. T Test was applied and the hypotheses was tested. The data was analyzed using latest version Statistical Package for Social Sciences (SPSS). Mean, Standard deviation and difference of mean is computed. T test is be applied to measure the significance of difference between mean of two groups. Result is compiled after analysis of the data.

**Results**

Table 1 *Experimental and Control group Pre-test mean (Group statistics)*

	Male	N	Mean	Std. Deviation	Std. Error Mean
pre test score	Experimental	36	4.7778	2.13957	.35660
male	Control	36	4.7500	2.08909	.34818

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In the Table 1 there was same number of candidates in the control group and experimental group who were tested before the instruction. The mean of scores of experimental group was 4.77 and the mean of scores of control group was 4.75. Standard deviation mean of experimental group and control group was 2.13 and 2.08 respectively.

The means of results of two groups indicate that there was no significant difference in the scores of the experimental group and control group.

Table 2 Comparison of pre test mean of Experimental group and Control group

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
pre test score	Equal variances assumed	.064	.801	.056	70	.956	.027	.498	-.966	1.021
	Equal variances not assumed			.056	69.960	.956	.027	.498	-.966	1.021

It is clear from table 2 that the mean difference in pre- test of experimental group and control group before the treatment was 0.027 and the standard error difference was 0.49. The t value was 0.056 and the significance level was 0.95 which is more than 0.05. It was interpreted that there was no significant difference in the scores of control group and experimental group before the treatment.

Table 3 Experimental group pre-test post-test mean (Paired Samples Statistics)

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Pre test	4.77	36	2.139	.356
	Post test	31.86	36	3.562	.593

Table 3 indicates that there were 36 candidates in the experimental group who were tested before and after the treatment. The mean of marks of pre-test of experimental group was 4.77 and the mean of marks of post test of the same group after treatment was 31.86. Standard deviation means before and after treatment to the experimental group was 2.13 and 3.56 respectively. The means of results indicate that there was improvement in the students before and after the treatment. The experimental group was treated with the 4 MAT teaching model.

Table 4 Experimental group(male) pre-test post-test correlation (Paired Samples Correlations)

		N	Correlation	Sig.
Pair 1	Post test & Pre test	36	-.030	.860

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Table 4 shows the correlation between pre-test and post-test in the experimental group. The correlation of 36 candidates score was -.030 which shows increasing the achievements of the students from pre-test to post test.

*Table 5 Experimental group (male) pre-test post-test comparison t test (Paired Samples Test)*

		Paired Differences				T	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
					Lower	Upper		
Pair 1	Post test – Pre test	-27.08	4.21	.701	-28.50	-25.65	-38.5	.000

Table 4.5 shows that mean score difference between pre-test score and post-test score is 27.08 and standard deviation is 4.21, t value is 38.58 and the significance value is less than 0.05. There was a clear difference between the two values of pre-test and post-test which was a 27.08. The significant difference was interpreted by the value of significance of pre-test score and post-test score which is less than 0.05.

### Conclusions

1. It was concluded that both experimental and control groups were same in the basic abilities and concept of biology before the intervention. From the result, it was found that there was no significant difference in the learning of the students before intervention.
2. Objective 1 is to determine the effect of 4 MAT cycle on students' academic achievement in biology at secondary level. From the findings it was revealed that the experimental group achieved significantly better in the post-test as compared to the pre-test. It was concluded that the students at secondary level can be developed in learning by applying 4 MAT cycle model in the class room.
3. Objective No.2 of the study is to find out the effect of traditional teaching method on students' academic achievement in biology at the secondary level. It was concluded that the achievement scores through traditional teaching methods in control group indicated the significant difference of scores before and after the treatments. The significant difference in the scores of the pre-test and the post-test confirms that students achieved significantly in the post-test.
4. Third objective of the study is to compare the achievement of students in biology based on 4 MAT teaching cycle and traditional teaching method on academic achievement of students at the secondary level, it was concluded that the significant academic achievement difference in the experimental and control group was found after intervention through 4 MAT teaching cycle and traditional teaching methods respectively. Students of experimental group performed better because the 4MAT strategy has several advantages like encouraging



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students to develop their own understanding and perceptions. It also allows the teaching environment to be organized around targeted concepts and supports the use of different strategies by facilitating an integrated teaching approach. It developed interest in learning of the students due to student centred. It is concluded that if teachers have a framework for eight – stage learning activities in a systematic 4 MAT cycle students performed better as compared to lecture method. It also respects student's differences, ensures the transition from subjectivity to objectivity for integrated learning, and improves the holistic thinking style.

5. Retention test confirmed the effect of 4 MAT cycle of teaching method. After the results of post test and comparison of achievements, Retention test was conducted in experimental and control group after three months of post test. The purpose of the retention test was to check the stability and deep learning of the students. It was concluded that there was no significant difference in experimental group.

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