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IMPACT OF TEACHING METHOD BASED ON MULTIPLE INTELLIGENCE THEORY ON ACADEMIC ACHIEVEMENT OF GENERAL SCIENCE STUDENTS AT ELEMENTARY LEVEL

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ABSTRACT
This paper is about to explore the effect of multiple intelligence theory based instructions on 8th grade students' academic achievements in the subject of general science. Multiple intelligence is significant as it provide friendly learning environment to students and variety of ways to assess student's achievement. The present research is true experimental in nature and pre-test post-test with control group design was used. Multiple choice achievement test on the content of general science, multiple intelligence inventory, and multiple intelligence based general science achievement rubric were used as research instruments in this research. Present research was carried out in educational year 2020-2021 in Gujranwala Division Punjab, Pakistan. Participant of the research were comprised of 64 8th grade students' of Govt. High schools No.1 Hafizabad, Punjab. Participants were divided into two groups 32 in experimental group and 32 in control group on the basis of pre-test result. Students' of experimental group were assembled according to their intelligence such as Linguistic/Verbal, Logical/Mathematical, Visual/Spatial, Bodily Kinesthetic, Interpersonal, Intrapersonal, Musical Rhythmic and Naturalistic Intelligences. Students of experimental group were taught by researchers themselves using lesson plans based on multiple intelligence theory based instructions prepared by the researchers, while students of control group were taught through traditional method of teaching. The research was continued for two and half months including Pre-test, intervention period and Post-test. The results exposed that there is a significant mean score difference between traditional method of teaching and multiple intelligence theory based instructional method of teaching. Researchers recommend that multiple intelligence theory based instructional method of teaching might be implemented to fulfill the needs of 21st Century student's.

Keywords: Multiple Intelligence, Multiple Intelligence Inventory, General Science Achievement Rubrics, Student's Academic Achievement, Elementary Level.

Introduction

Education is the process that has changed this planet into a peaceful living place, which does not prevail upon other planets. It is equally contributing in advanced countries (OECD Report 2018). In the educational context of Pakistan, the education ministry has divided the education system into three tires namely primary, secondary and higher education. Primary education and higher education are two extremes predecessor from bottom and successor from top, but if we talk about secondary education it plays the role of bridge between two extremes. On the other side of the coin it is the supreme fact the secondary education is the platform for graduates to acquire higher education, and for skilled workers to acquire prevailing skills for the job market, for businessman to acquire k knowledge best fit to their business, for professionals such as lawyers, doctors, engineers etc. to acquire knowledge according the their profession (GOP, 2017). Secondary education is the start of carrier if a person in position to rightly choose the carrier, the chance of his/her success is bright as compare to pothers who are failed to do so. In short all levels of education plays pivotal role in completion of personality of a person from all aspects, so, we have to take extra care while selecting a specific course of education (GOP, 2017).

To raise the excellence of education latest researches conducted in the field of education have concentrated on identification and eradication of problems met by students in learning science (Brougher, 2015). A number of researches have explored the fact that students feel difficulty in learning the complex topics of science because they have to perform a lot of experiments, calculations and have to memorize different formulas, graphs, and concepts through traditional methods of teaching (Arnold, 2019; Batdı, 2017; Baş, 2016). In order to answer the questions encountered during the process of scientific enquiry, both epistemological and procedural knowledge is necessary. Modern researches explore that to crease the quality and interest of students to learn science, individual differences

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Vol. 6 No.2 2022

must be taken into consideration and educational activities must have to be planned to meet the needs of every individual instead of teaching with traditional methods (Karaduman & Cihan, 2018).

However, the display of such competencies involves an affective element which is the attitude or disposition of students towards science. This attitude will determine their level of interest in science, their motivation to further their knowledge and engagement with scientific knowledge (OECD, 2017). Later another educational reformer, Johann Heinrich Pestalozzi, gave another set of ideas on the transformation of education system. He gave educational methods which were child-centered, took into account the individual differences between the children, involved sense-perception and used student's self-activity (Tröhler, 2013).

We as a teacher/educationist have to inline students' knowledge with true knowledge. Another thing which attractive for everyone that a person acquire better knowledge by doing as compare to listening or watching (Brougher, 2015). While learning and teaching general science a student can acquire knowledge through three dimensions which are educationists, science educators, and cognitive psychologists. Each expert view students according to their own parameters and try to teach with their own set criteria (Brougher, 2015).

Students' specific interest and preferences guide their curricular priorities. Modern researches shows that educators all over the world became fascinated with new theories of education that can provide much better learning environment to pupils as compare to old traditional methods of teaching (Sulaimana, Abdurahman, & Rahim, 2010). Among these new theories of education including multiple intelligence and constructivism are gaining too much fame and growing rapidly all over the world. While the previous education methods were based on sound educational theories and philosophical ideals, they were rarely implemented in their true spirit and with time the complexity of knowledge and introduction of modern technology made them obsolete. Students' specific interest and preferences guide their curricular priorities. (Sulaimana, Abdurahman, & Rahim, 2010).

If a teacher follow traditional teaching method of assessment he/she can measure only specific competency of students in the meanwhile through multiple intelligence theory assessment a teacher is in position to assess a students through variety of ways (Pratiwi, Rochintaniawati, & Agustin, 2018). To identify students multiple intelligence profile a teacher can use students' self-prepared checklist because it is a rich source of information about the individual interest and proficiency (Weber E. , 2001)Multiple intelligence theory approach allows incorporation of creative methods to teach students to make a student-centered activity styled teaching method based on the multiple intelligences given by Gardner. In his model, Gardner proposed eight different types of intelligence which exist in individuals in varying proportions (Ball & Perry, 2009).

These eight different types are:

- **Verbal / Linguistic Intelligence (Word Smart**): Creative and ability to analyze written and oral languages.

- **Logical / Mathematical Intelligence (Number Smart)**: Capacity to recognize patterns, resolve equations and abstract problems.

- **Visual / Spatial Intelligence (Image Smart)**: Ability to visualize thing using mind's eye and manipulating large-scale spatial images. The students who are brilliant in visual spatial intelligence focused on pictures and images. These students' consciously love such type of learning environment where the use of colors, objects, and shapes is focused.

- **Bodily / Kinesthetic Intelligence (Body Smart):** Extra-ordinary ability of bodily coordination and dexterity. These students' have great bodily intelligent. These students' like every such type of activity in which bodily involvement is high like sports, demonstration, and role play etc.

- **Interpersonal Intelligence (People smart):** Ability to assess and comprehend other's emotions, motivations and moods. These students' have great social ability. They are socially very strong and learn from other community members.

ISSN Online : 2709-4030
ISSN Print : 2709-4022
Vol. 6 No.2 2022

- **Intrapersonal Intelligence (Self smart):** An ability of being aware of one's own moods, motivations and emotions. These students' have ability to work alone gently. They fit them according to their inner feelings, believes, and values.

- **Musical / Rhythmic Intelligence (Music/sound smart):** Ability to make meaning, remember and produce different patterns of sound. These students' have brilliant musical rhythmic intelligence ability. They have sensitivity with atmosphere and very sensitive to sounds. They have the ability to make new tunes rhythm of songs etc.

- **Naturalistic Intelligence (Nature smart):** An ability to understand and recognize subtle changes in the environment. These students' are intelligent with respect to nature and have ability to explore nature. They show keen interest to explore natural resources (Slavin, 2009; Gardner & Hatch, Multiple Intelligences Go to School: Educational Implications of the Theory of Multiple Intelligences, 1989; Davis, Christodoulou, Seider, & Gardner, 2011).

Objectives of the study

1. To find out the effect of multiple intelligence based educational method on academic achievement of 8th grade students in the subject of general science.

2. To find out the differences between academic achievements of 8th grade students taught with traditional educational system and multiple intelligence-based education system.

Hypotheses of the Study

To achieve above-mentioned objectives following research hypotheses were made:

H01: There is no significant mean score difference between pre-test scores of both experimental and control groups.

H02: There is no significant mean score difference between post-test scores of both experimental and control groups.

H03: There is no significant mean scores difference on the gained achievement score between experimental and control groups.

Literature Review

The history of intelligence is a bumpy and evolving one with as absurd as relating it with size of head to relationship with evolutionary changes, defined as all or none thing and finally as something having multiple facets. Intelligence over the ages have been called with various names and identified by using different definitions. The earliest word used for intelligence was "reason" by Aristotle, the venerated Greek philosopher. Aristotle defined it as an ability to control one's instincts (Bickhard & Campbell, 1996). Later Hippocrates described it as something related to head size and for the first time changed the center of intelligence from heart to brain or head (Anna, Eleonora, & Shivanand, 2007).

Galton theorized intelligence with physical attributes and quickness which were developed by the evolutionary process and operationalized intelligence which enabled him to measure it using his own scales (Crowther-Heyck, 2005). Later Binet, presented his view of the intelligent as "basic ability to understand, reason and make judgments'. He propounded a singular view of intelligence in which intelligence was normally distributed and expressible with single numerical score (Martha & Suzanne, 2019). However, in this era of science and technology the psychologists have their views about intelligence as "The capacity to understand the world, think rationally, and use resources effectively when faced with challenges" (Feldman, 2015).

ISSN Online : 2709-4030
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Vol. 6 No.2 2022

In his book Frames of Mind Howard Gardner quotes that example of a sailor who studies the stars in the sky and finds his way in the darkness of night using stars, of a student who learns Arabic to memorize Quran and studies under the discipleship of Khumeni to become the future supreme leader, and of a student who masters the computer and learns to compose new melodies in Paris. He argues that all three are intelligent people who will work to have a successful in their respective fields. But how does that world measure their intelligence? The world does not have enough "well-honed" scale to measure their intelligence (Gardner, 2011). Howard posits that the traditional views of human intelligence are too limited and narrow. On another occasion in his book Intelligence Reframed the Howard Gardner again through light on intelligence in this way, "an intelligence is a bio psychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" (Gardner, 1999).

The primary purpose of this theory was not to prescribe any educational practices but to chart the topography and evolution of human mind. However, educational psychologists have been interested in this theory because of its wide educational implications. Teaching students with learning methodologies which are congruous with their intelligence can help them in learning better and faster (Abdi, Laei, & Ahmadyan, 2013; Douglas, Burton, & Reese-Durham, 2008; Gardner, 2000; Jing, 2013; Wares, 2013).

Multiple intelligence theory identify the greatest intelligence in every individual and the mix intelligences of all group members. Intelligence wise grouping is an important clue in multiple intelligence theory. In multiple intelligence theory most important thing is to create such environment in which every individual have opportunity to groom his strongest intelligence (Campbell L. , 1997). Multiple intelligence theory provide track to teacher's for better learning environment in which students have opportunity to groom his all types of intelligences and also have capability to respect diversity. Multiple intelligence theory serve as framework for teacher to modify their style of teaching to such style in which students are able to learn as maximum as possible (McKenzie, 2005; Guignon, 2004).

Material and Method of Data Collection

It was true experimental research in nature and pre-test post-test with control group design was used. The researchers constructed multiple choice achievement test on the content of general science, multiple intelligence inventory, and multiple intelligence based general science achievement rubric to explore the effect of multiple intelligence theory based instructional method of teaching on student's academic achievement in the subject of general science at elementary level. Data was collected at pre-test stage then after intervention period data was also be collected at post-test stage. By comparing the mean score of pre and post tests the effect of multiple intelligence theory based instructional method of teaching was explored.

The population

Accessible population of present research was all 8th grade students studying in public high schools of Division Gujranwala, Punjab, Pakistan. Target population of present research was all 8th grade students studying in public high schools of District Hafizabad, Punjab, Pakistan.

Sampling

The researchers used purposive sampling technique for the selection of sample for present research. Purposive sampling technique is beneficial to explore the effect of independent sample on dependent variables. As present research experimental in nature so purposive sampling technique is used.

Size of the Sample

The size of the sample were 64 8th grade students studying in Govt. High School No.1 Hafizabad, Division Gujranwala, Punjab, Pakistan.

ISSN Online : 2709-4030
ISSN Print : 2709-4022
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Results and Discussion

Table 1: Mean Score Differences in Pre-test scores of both the groups of study

Variance	*Control* (*n*=32)	*Experimental* (*n*=32)	*t(62)*	*P*	*CI*		*d*
	M(SD)	*M(SD)*			*LL*	*UL*	
Pre-Test Scores	39(15.32)	39.81(15.26)	-.21	.83	-10.97	-9.34	.05

If we talk about the statistical analysis then we can rightly said that Independent sample t-test show that there is no significant difference between the pre-test scores of control (*M*=39, *SD*=15.32) and experimental group (*M*=39.81, *SD*=15.26), *t*(62)=-.21, *p*=ns, *d*=.05.

Table 2: Mean Score Differences in Post-test scores of both the groups of study

Variance	Control (n=32)	Experimental (n=32)	*t(62)*	*p*	*CI*		*d*
	M(SD)	*M(SD)*			*LL*	*UL*	
Post-Test Scores	54.81(12.55)	77.38(11.05)	-7.63	.000	-30.42	-14.71	1.91

If we talk about the statistical analysis then we can rightly said that Independent sample t-test show that there is a significant difference between the post-test results of the control (*M*=54.81, *SD*=12.55) and experimental group (*M*=77.38, *SD*=11.05). Means scores indicate that academic achievement of the students of experimental group is significantly high as compare to the academic achievement of the students of control group, *t*(62)=-7.63, *p*<.001, *d*=1.91.

Table 3: Mean Score Differences in Achievement Scores Between Pre-test and Post-test

Variables	*Pre-Test*	*Post-Test*	*t(63)*	*P*	*CI*		*d*
	m(SD)	*m(SD)*			*LL*	*UL*	
	39.41(15.17)	66.09(16.34)	-72.54	.000	-27.67	-25.71	1.69

If we talk about the statistical analysis then we can rightly said that results of paired sample t-test exposed that there is a noteworthy variance between the Pretest scores (*M*=39.41, *SD*=15.17) and Posttest (*M*=66.09, *SD*=16.34) scores of the students. Mean scores point out that there is a noteworthy variance between the scores of Pretest and Posttest, *t*(63)=-72.54, *p*<.001, *d*=1.69.

Discussion

The contemporary research was sought to discover the effect of multiple intelligence theory based instructional method of teaching on student's academic attainment in the subject of general science at elementary level. Results of the study indicate that students who taught through lesson plans based on multiple intelligence theory based instructional method of teaching secure high as compare to the students who taught through traditional method of teaching. The outcomes of contemporary research are in consonance with the outcomes of preceding researches conducted to explore the effect of multiple intelligence theory based instructional method of teaching on student's academic achievement in variety of subjects and on different levels of learning. (Baş, 2010) Conducted a research in

Turkey and results of the study explore that multiple intelligence theory based instructional method of teaching had great effects on learning English at primary level. (Karaduman & Cihan, 2018) Conducted a research and results of the study explore that multiple intelligence theory based instructional method of teaching had positive effects on learning Geometric Shapes in Elementary Schools.

(Aydin, 2019) Conducted a research to sort out the effects of multiple intelligence theory-based instructions on the educational attainment of the students and some other variants i.e., geographical region, level of education and lessons taught. The outcomes concluded that there was a noteworthy positive consequence of multiple intelligence theory-based instructions on the educational attainment of the pupils while all other variants were insignificant.

(Demir-Erdogan & Aksu, 2018) Reported that to check the effectiveness of different methods of teaching on variety of subjects and on multiple occasions different seminars and conferences have been done. One such conference has also done to check the effectiveness of multiple intelligence theory based instructional method of teaching on multiple subjects at different levels of teaching and researches from 2008-2016. Results of all the studies shows that there was positive and significant consequence of multiple intelligence theory based instructional method of teaching on student's academic achievement in variety of subjects and on different levels of learning. (Shahzada, Khan, Islam, & Faqir, 2014) Conducted a local research in Pakistan and results of this research also indicate that multiple intelligence theory based instructional method of teaching had positive significant effect on student's academic achievement.

Conclusion

Before the start of intervention period pre-test of all the students were conducted. On the basis of pre-test results investigational and controller groups were made. Students of experimental group were taught by researcher himself by using lesson plans prepared by the researchers themselves and students of experimental group were taught through ordinary ways of learning chosen by the class teacher. The results of the study concluded that students of experimental group are achieve high when they have choices to learn in variety of ways, on the other hand the assessment criteria of the students of experimental group were also multiple dimensional. So, when the students have choice in learning in terms of teaching and assessment then they have to deliver as maximum as they can. At the end if we talk about the posttest results of experimental group then it was rightly and significantly high as compare to the pretest results.

On the other hand if we talk about the results of the students of control group then we can rightly said that, there were no change in the results. The reason of this is that the students have no choice to deliver, they were taught as in such a manner as they were previously taught. So, there were no slightly difference in the results at posttest stage.

By considering the above all facts we are in position to make a decision about that which educational theory was best fit for the students to achieve high as they can. It is concluded that multiple intelligence theory based instructional method of teaching had noteworthy confident consequence on the educational attainment scores of the students of General Science at elementary level.

Recommendations

Keeping in view that findings of this study, following recommendations could be given:

- General Science, being a complex subject, should be taught with more activities and with inclusive teaching methodology.
- The concepts taught in General Science class should be experimented as well so that students can see such concepts practically happening.
- In-services teachers should be trained from time to time to update their teaching methodology and update their knowledge.
- Lessons plan should be more creative to promote the learning.
- The educational system must be updated to include the notion of multiple intelligence in it.
- Curriculum must be developed considering the multiple intelligences in pupils.

Limitations of the Study

Human Limitations

a. The study was limited to 64 8th grade students of Govt. High School No.1 Hafizabad, Division Gujranwala, Punjab.
b. The study based on to explore the consequence of multiple intelligence theory based instructional method of teaching on student's academic achievement.
c. The overall number of items of general science achievement test were fifty.
d. Multiple intelligence inventory and general science achievement rubrics are also used in this study.

Spatial Limitation

The study was limited to 64 8th grade students of Govt. High School No.1 Hafizabad, Division Gujranwala, Punjab, Pakistan.

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