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DIFERENTIATED INSTRUCTION: USING THEORY OF MULTIPLE INTELLIGENCE TO ENHANCE ACADEMIC ACHIEVEMENT OF GRAGUATE STUDENTS

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ABSTRACT--*Students at higher education come from diverse socioeconomic backgrounds with distinct potentials and need to be catered differently. Their interests, capacities and aptitudes require differentiated instruction to match their learning styles befittingly. The current study was designed to apply theory of multiple intelligence to enhance academic achievement of graduate students by using differentiated instruction. This quasi experimental study was conducted on graduating students of a women college at district Lahore, Pakistan. The study group was consisted of 80 students out of which 40 students were in experimental group and 40 students were regarded as control group. A 'pre-test, post-test control group design' was used to introduce intervention to the experimental group by teaching through differentiated instruction based on Howard Gardner's theory of multiple intelligence. The control group received traditional chalk and talk method. The analysis of pre and post tests was made through paired and independent sample t-test. The results of experimental group revealed a substantial increase in the academic achievement of graduate students as compared to the control group. The study provides evidence that differentiated instruction contributes in students' learning and produces a positive environment. The study also suggests the use of differentiated assessment for measuring individual academic achievement and performance. There are underlined implications of the study for a comprehensive curriculum giving space to individual capacities.*

Keywords-- *Individual differences, multiple intelligences, differentiated instructions*

I. INTRODUCTION

Skilful instructors and mentors give importance to individual differences, because they believe that individual differences have a significant role in the educational or instructional process (Moallem, 2007). The quality of learning depends upon students' capabilities of how they think, process, organize, retain, recall, encode and classify the knowledge they gain. Therefor students' preferences and their learning potentials must be kept in mind while teaching. However, the traditional teachers use 'one size fits to all' style of teaching especially at higher education because they think graduating students are mature and can well adjust with the instruction given to them (Komarraju, 2011).

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According to Legg (2007), "Intelligence is the ability to use memory, knowledge, experience, understanding, reasoning, imagination and judgment in order to solve problems and adapt to new situations." Moreover, Gardner (1993) speculated that, "Intelligence is the ability to solve problems or to create products that are valued within one or more cultural settings."

Differentiated instruction means that teaching is assumed as an instruction which is designed and implemented for catering diverse learners to whom teachers have to convey their concepts in every possible way to inculcate the meaning in its true spirit. The diversity of learners must be acknowledged and respected (Hall, 2002).

Likewise, Dawkins (2017) states that through 'differentiated instruction,' students' needs and learning styles are entertained by adapting divers styles of teaching and providing multiple inputs and materials.

According to Cannon (2017), 'differentiated instruction' is modification of teaching styles and a philosophy for providing each student with multiple options to think, process, make sense and share ideas. The present research intends to determine the effectiveness of differentiated instruction based on students' multiple intelligence.

Statement of the Problem

As per theory of Howard Gardener, students have multiple intelligences and they need diverse instruction to have their potentials fulfilled, therefore, the researchers designed a research to identify the effect of differentiated instruction based on Howard Gardner's multiple theory of intelligence on the academic achievement of graduate students and mitigate individual differences.

Objectives of the Study

1.To identify type of intelligence of students as per theory of multiple intelligence.

2.To find the effect of multiple intelligence based differentiated instruction on graduate students' academic achievement.

Hypothesis

Ho: The academic achievement of graduate students treated with differentiated instruction as per theory of multiple intelligence is not significantly different with those who are taught with traditional method.

II. LITERATURE REVIEW

Nature and importance of individual differences in teaching and learning Human beings are inherently diverse in nature and capabilities. They belong to different ages, gender, race, religion and socioeconomic background, therefore, their mental, physical, spiritual, and socioemotional characteristics vary to a wider range. Likewise, they hold diverse values and social concerns. They possess different personality types, intellectual approaches and reactionary styles to have distinct needs (Buss, 2009).

Such differences of aptitude, motivation, anxiety level and intellectual differences are intertwined and complex in nature. The learning process of individuals is influenced by these differences and certain learning styles evolve from these complexities (Zafar, 2012). In teaching learning situation, these diversities were explained by Aviram (2008) as students' cognitive and conative styles, their learning orientation, intelligence, abilities and propensities need to be catered individually for an ideal knowledge acquisition.

Likewise, Chapman (2006) stated that learning can only be influential and useful if teaching is made relevant to students' individual capacities and their personal experiences to resolve their real life problems.

Similarly, Klinger (2005) reported that students can only achieve high if their cultural values, interests, abilities and hereditary factors are given importance at learning places (Collins, 2011). Aviram (2008) and Samah (2011) were of the opinion that catering individual differences cause satisfaction and interest in students. Students can never show their highest potential in 'one size fits all' learning environment.

Role of intelligence in learning

Webster's Dictionary says "Intelligence is a capacity to perceive and comprehend meaning, information and news." Similarly Ahmed (2011) states that intelligence is the ability to solve problems in novel situation and think convergently and divergently to find multiple ways of doing things.

Bronowski (1977) regarded intelligence as a measurable aptitude. Munn (1966) thought intelligence as 'a capacity to think in abstract and grasp intangible non-concrete concept.'

Gardner (1999) envisaged intelligence as an ability to identify and resolve problems or create an object or idea that is appreciated by society or nation. Dr. Howard Gardner, who was initially a neuropsychologist, in his book 'frames of mind,' mentioned eight types of human intelligences; verbal, numarical, special, kinaesthetic, interpersonal, intrapersonal, musical and naturalistic. He presented this classification contrary to the idea of unitary or general intelligence (Lash, 2004). Gardner regarded first two intelligences; verbal and numerical, important for learning process, the next three intelligences; musical, special and kinaesthetic essential for creativity, while interpersonal and intrapersonal intelligences were related to aptitude of an individual (Yalmanci, 2013). The naturalistic intelligence was discovered in 1999 later. This theory was named as 'Multilpe Intelligence Theory'(Gardner, 1983). Gardner also explored that there are more intelligences which fluctuate in potency and may differ in order or intensity, however, these intelligences can be enhanced through training and practice (Babak, 2008).

Recently, it has been realized that it is more important that what can an individual do rather than what he does. This idea led towards "Multiple Intelligence Theory" which can help in determining innovative techniques to achieve this purpose (Kirk, 2003). According to Gardner (2006) cited by (Phillips, 2010), the initial seven intelligences are a "set of abilities, talents, or mental skills". In fact, 'Multiple Intelligence Theory' plays a significant role in the development of dynamic or encouraging educational environment and consequent diverse intelligence or capabilities of every child. Likewise, Yalmanci (2013) highlighted that multiple intelligence theory can also be implemented for establishing a positive instructional environment.

How differentiated instruction is effective for learning process?

Corno (1995) described that traditional teaching learning process was constrained in the sense that it held generalized ways of instruction where students were passive and there were few opportunities for participation, thinking divergently or grasping abstract ideas through engaging one's individual capacities and utilizing higher order thinking skills. All students were treated with same set of instruction, curricula and activities. They had to

compromise for the same instruction irrespective of their differentiated abilities and perspectives to process the information. That is why the scores in a normal classroom are wider in range.

Tomlinson (2001) & Hall (2002) proposed that only through differentiated instruction, the four education reforms; fairness, harmony, inclusion and academic excellence can be achieved. Therefore, the teachers and mentors should be essentially aware of multiple techniques of presenting learning material and engaging every student in her capacity. Hess (1999) argued that DI helps teachers to deal with students' individual diversities and their specific problems. Sacco (2010) and Alikhan (2011) said that it is the teacher's responsibility to design multiple activities for students with different needs whether through group or individual tasks, all learners should be involved to contribute the learning process. The evaluation tools must correspond to the activities conducted. They regarded differentiation as a qualitative process to identify deficiencies and varied abilities of learners for desired outcomes.

Bal (2016) provides arguments that people have not one of the eight intelligence but all people have all eight intelligences, however, they are different in combinations or recipes, therefore, some may surpass in verbal and numerical tasks and may equally perform specially and kinaesthetically but the others are good in any single intelligence prominently.The other way of enhancing different intelligences is to interact with problems compelling people to acquire or use their rare type of intelligence.

As suggested by Tomlinson (2005), teachers can mange students' interests, desires and readiness with differentiated instruction. Subban (2006), Tomlinson (2001) and Alikhan (2011) reported that learning scope can be enhanced and broadened through presenting and processing content in multiple ways and outcome may be improved. If instruction includes purposeful actions, meaningful opportunities and direct and explicit presentation, learners are more able to self regulate themselves and become independent (Gadd, 2017). In Pakistan, there is scarcity of research on practices of differentiated learning or its effectiveness, especially with reference to implementing theory of 'Multiple Intelligence' in the classrooms.

III. METHODOLOGY/MATERIALS

Method

The research held quantitative positivistic paradigm to provide evidence for the effectiveness of multiple intelligence theory based on differentiated instruction through a quasi experimental "pre-test, post test control group design." The study group was 80 female college graduating students registered in a women college at Lahore, N=80 of which 40 students were included in experimental group and rest of 40 students were regarded as control group. The experimental group was treated with 'differentiated instruction and the control group received traditional chalk and talk (lecture method) instruction.

Sampling

They study group was consisted of N=80 female graduating students in the subject 'Education' having ages from 19-22 years. Forty students were included in experimental group and 40 student formed control group. To homogenize the groups and controlling the extraneous variables, the students were distributed in two groups on

the basis of pre test and, therefore, matched pairs were formed and students were assigned to each group on the basis of equal or nearest scores.

Procedure of the Study

The pre-test, post-test quasi experimental control group design was applied to the participants where both of the groups were pre tested through a 25 items' achievement test including four chapters from subject of 'Education'; (1) British educational system in Sub-continent,(2) Educational movements in Sub-continent,(3) Educational policies in Pakistan (4) Curriculum (subject, Education), in the beginning of the session 2014-2016. The pre and post test included 8 multiple choice items, 5 true and false items, 7 completion items, 10 'match the column' items and five essay type long questions based on the concepts given in the four chapters. The researchers continued intervention for the period of 16 weeks.

A self-assessment inventory by McKenzie (1999) was applied to identify students' type of multiple intelligence. On the basis of identification of the same type of intelligence, 8 groups were formed in the class. Each group contained 3 to 8 members. The instructor provided differentiated activities to each group. The students were encouraged to participate in group activities. The activities contained discussion, presentations, guided reading, role plays, singing jingles, story telling, gallery walk, debates and several educational games to engage students in tasks matching to their specific intelligence type. During lessons, the instructor used figures, diagrams, illustrations, flow charts, graphs, tables and flash cards for presenting concepts in any possible way to cater interest of all students. The instructor provided feedback to groups and the whole class appropriately.

The control group was instructed by the same teacher with chalk and talk (lecture method). The students were provided with notes and text book. Class discussion and question answer sessions were held as per routine of the lecture method and the whole class participated simultaneously.

Instrumentation

The pre and post test instrument was the same with 8 multiple choice items, 5 true and false items, 7 completion items, 10 'match the column' items and five essay type long questions. The face and content validity of the test were determined through expert opinion. The items were constructed from 4 chapters of the text book 'Education' subject. The essay type questions were marked with the help of a rubric and objective type items were ensured having average item difficulty from .40 to .85 through procedure of item analysis. Each objective type item had one mark; score = 20 and 5 essay type questions had 10 marks each; score = 50. Thus, the test had total 70 marks.

Data collection procedure

All 80 participants were administered the achievement test before treatment and after treatment i.e. teaching through differentiated instruction with the gap of 16 weeks. The test had total 100 marks.

Data analysis procedure

The scores obtained through the achievement test were compared within group and between groups descriptively and inferentially using test of significance 't-test' for paired and independent sample. Paired test was applied to the achievement difference of the same group and independent test was used to find significant

difference in experimental and control group. The gain score of two groups was also compared to see the significant difference in their learning improvement. The tests of significance were tested on .05 alpha level.

IV. RESULTS AND FINDINGS

Table 1: Group statistics for pre-test of control and experimental groups

Groups	N	Mean	Std. Deviation
Control group	40	19.15	2.56
Experimental group	40	18.40	2.76

The Table 1 shows that 40 participants of control group gained means score M = 19.15 in the pre test with Standard Deviation of SD = 2.56. Whereas, the mean for 40 experimental group participants was M =18.40 with SD = 2.76, a bit lower than the control group but the two groups were performing approximately equal before intervention.

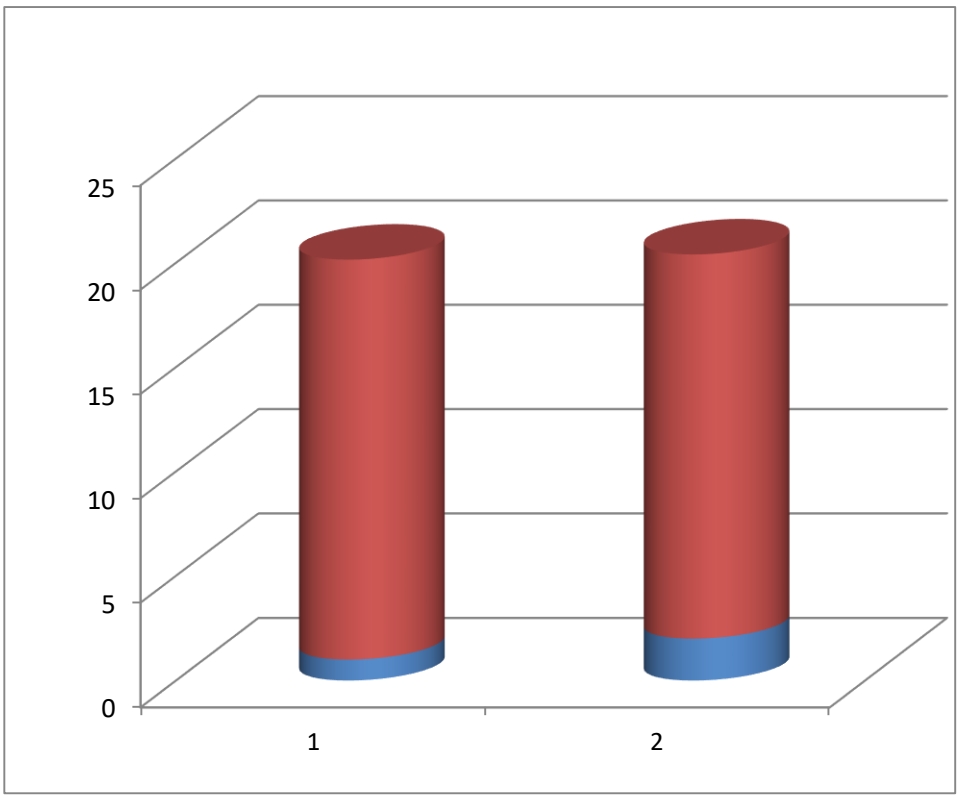

Figure 1: Mean difference in the scores of pre-test of experimental and control group

The figure.1 shows the difference of mean score of experimental group M = 18.40 and control group M = 19.15 in the pre-test score. The control group exhibited a bit higher scores in the beginning of the intervention.

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Table 2: The t-test for comparison of pre-test scores of control and experimental groups

	Levene's Test for Equality of Variances		t-test for Equality of Means 95% Confidence Interval of the Difference		
	F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**
Equal variances assumed	1.195	.281	.891	38	.379
Equal variances not assumed			.891	37.786	.379

The independent sample t-test was administered to compare performance of experimental and control group which shows that there was no significant difference in the performance of control and experimental groups with t (38) = .891, p= .379> .05, i.e. 40 participants of control group gained mean score M = 19.15 in the pre test with Standard Deviation of SD = 2.56. Whereas, the mean for 40 experimental group participants was M =18.40 with SD = 2.76, a bit lower than the control group but the two groups were performing approximately equal before intervention.

Table 3: Group statistics for post-test of control and experimental groups

Groups	**N**	**Mean**	**Std. Deviation**
Control group	40	34.25	5.77
Experimental group	40	58.40	9.79

The Table 3 reveals that 40 participants of control group gained mean score M = 34.35 in the post test with Standard Deviation of SD = 5.77. Whereas, the mean for 40 experimental group participants was M =58.40 with SD = 9.79, substantially higher than the control group. The results declared that the experimental group performed better than the control group after intervention.

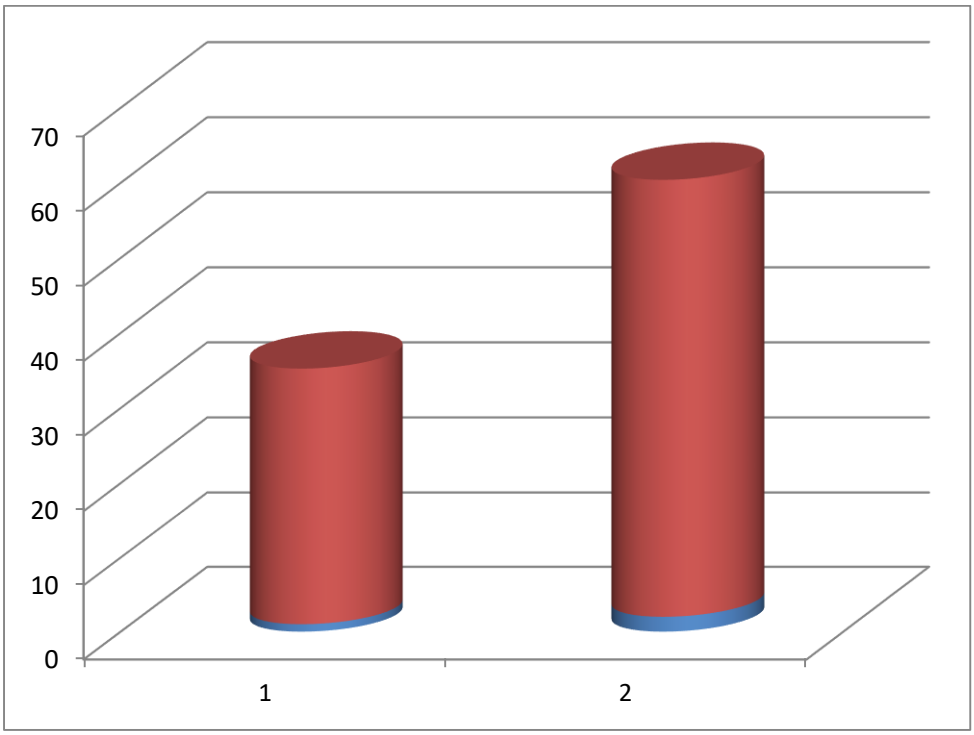

Figure 2: Group statistics for post-test of control and experimental groups

The figure.2 shows the difference of mean score of experimental group M = 58.40 and control group M = 34.25 in the post-test score. The experimental group exhibited much higher scores at the end of the intervention.

Table 4: The independent sample t-test for comparison of post-test scores of control and experimental groups

	Levene's Test for Equality of Variances		**t-test for Equality of Means 95% Confidence Interval of the Difference**		
	F	**Sig.**	**t**	**df**	**Sig. (2-tailed)**
Equal variances assumed	6.201	.017	-9.498	38	.000
Equal variances not assumed			-9.498	30.787	.000

The independent sample t-test was calculated to compare performance of experimental and control group after intervention which shows that there was a significant difference in the performance of control and experimental groups with t (38) = -9.498, p= .000< .05, i.e. 40 participants of control group gained mean score M = 34.25 in the post test with Standard Deviation of SD = 5.77. Whereas, the mean for 40 experimental group participants was M =58.40 with SD = 9.79, which was substantially higher than the control group and the two groups performed

differently after intervention. The results rejected the null hypothesis, 'the academic achievement of graduate students treated with differentiated instruction as per theory of multiple intelligence is not significantly different with those who are taught with traditional method.'

Table 5: Group statistics for comparison of gain score of control and experimental groups

Groups	N	Mean	Std. Deviation
Control group	40	15.10	4.68
Experimental group	40	40.00	7.88

The Table 5 reveals that 40 participants of control group's gain mean score was M = 15.10 in the post test with Standard Deviation of SD = 4.68. Whereas, the mean gain score for 40 experimental group participants was M =40.00 with SD = 7.88, substantially higher than the control group. The results declared that the experimental group performed better than the control group after intervention.

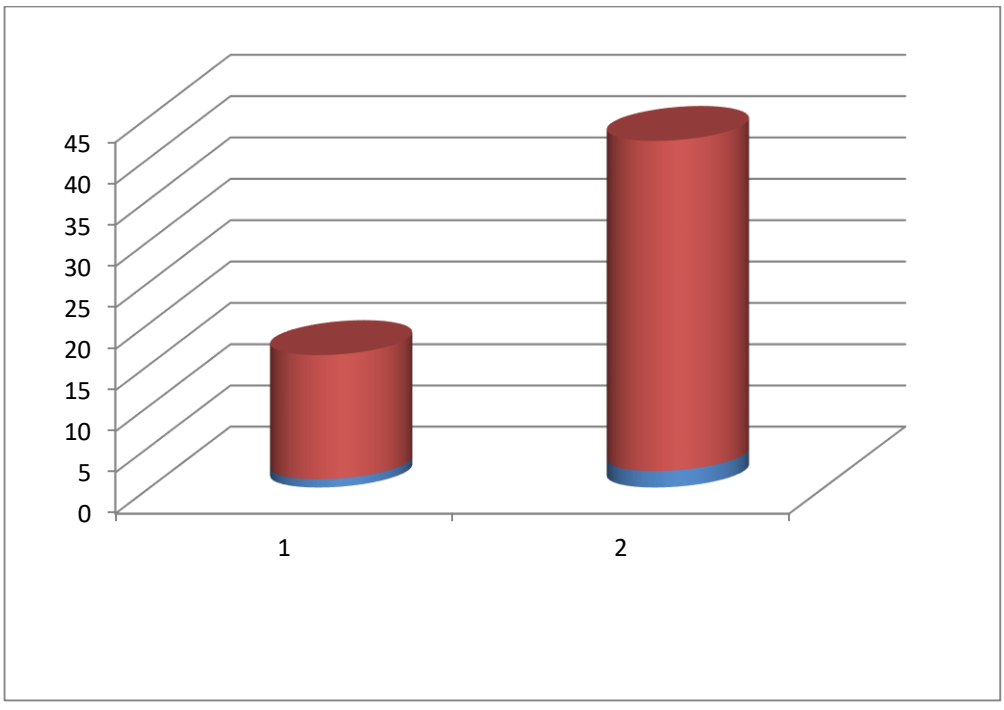

Figure 3: Comparison of gain score of control and experimental groups

Figure.3 shows the difference of mean gain score of experimental group M = 40.00 and control group M = 34.25 in the post-test score. The experimental group exhibited higher gain score at the end of the intervention.

Table 6: Independent Samples t-test for comparing "gain score" of "control group" and "experimental group"

	Levene's Test for Equality of Variances		t-test for Equality of Means			
					95% Confidence Interval of the Difference	
	F	Sig.	t	df	Sig. (2-tailed)	
Equal variances assumed	6.383	.016	-12.136	38.000	.000	
Equal variances not assumed			-12.136	30.940	.000	

The independent sample t-test was calculated to compare the gain score (post test-pre test) of experimental and control group after intervention which shows that there was a significant difference in the performance of control and experimental groups with t (38) = -12.136, p= .000< .05, i.e. 40 participants of control group gained mean score M = 15.10 in the post test with Standard Deviation, SD = 4.68. Whereas, the mean gain score for 40 experimental group participants was M =40.00 with SD = 7.88, which was substantially higher than the control group and the two groups performed differently after intervention.

Findings

The findings of the research are as follows:

- There was no significant difference in the performance of control and experimental groups in the pre test. The experimental group participants performed a bit lower than the control group but the two groups were performing approximately equal before intervention.
- There was a significant difference in the performance of control and experimental groups in the post test. The academic achievement of experimental group was substantially higher than the control group and the two groups performed differently after intervention. The results rejected the null hypothesis, 'the academic achievement of graduate students treated with differentiated instruction as per theory of multiple intelligence is not significantly different with those who are taught with traditional method.'
- There was a significant difference in the gain score of control and experimental groups after being taught with differentiated instruction. The mean gain score of experimental group participants was much higher than the control group.

V. DISCUSSION AND CONCLUSION

This empirical study has provided evidence through experimental design that differentiated instruction based on theory of multiple intelligence is remarkably influential and effective on the academic achievement of graduate students, which suggests that DI can be safely substituted with traditional chalk and talk method for increased outcomes of students' leaning. It was proved that students' abilities, talents and concepts were enriched through DI. The study supported many previously cited researches; Bal (2016), Tomlinson (2001), and (Subban, 2006)

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who advocated the use of differentiated instruction for developing interest of students in learning and nurturing their natural potentials through identifying their diverse needs. It was found that if students find opportunities to work as per their type of intelligence, interests and perspectives, they perform better and achieve high. Differentiated instruction helps students for their full fledge personality development also. Many previous researches emphasized differentiated instruction but a few researches have suggested to use theory of MI to operationalize DI in the classroom. The current study has implications to follow TMI to design differentiated activities as per nature of intelligence of students which seems a perfect match of ability and performance.

Implications of the study

The research provides implications for using theory of Multiple Intelligence by Howard Gardner (1999) after indentification of nature of intelligence of each learner in the classroom. It provides incentive for designing instructional activities matching to each type of intelligence to engage students from all capabilities and learning styles. They study is applicable for all levels of education including lower to higher grades and gender.

Recommendations

- The study recommends identification of individual differences as per TMI (verbal, spatial, numerical/logical, interpersonal, intrapersonal, natural/aesthetic and bodily intelligence) of students and then introducing relevant activities in the classroom.
- Curriculum developers need to include exercises, activities in the text books as per requirement of multiple intelligences of students.
- Teachers, parents, administrators and counsellors need to know about the multiple intelligences of students and should respect their diversity.
- Student teacher ratio needs to be reduced by policy and overcrowded classrooms need to be avoided so that teachers may pay attention to all students individually.
- Students with multiple intelligence have differentiated preferences for careers, therefore, counsellors must provide appropriate guidance as per students' needs, aptitudes, interests and intelligence for their safe and secure future.
- Teachers may design logical, mathematical and research oriented activities for numerical smart students; discussions, debates, role plays, presentations, newspapers etc. for verbally smart students, physical activities and games for kinaesthetically smart students and writing essays, reflections and journals for intrapersonal students. Making posters, charts, models, projects may help spatial and naturalistic smart students. Similarly, making groups for like minded students help them to understand each other and work with synergy.
- Diversity must be encouraged and celebrated in classrooms to provide students positive environment.
- Differentiated instruction leads towards differentiated assessment, therefore, teachers need to assess students as per nature of activities they conduct and the intelligence they possess, rather using same yard stick for all students.
- Finally, working collaboratively helps to adjust students having different pace, mental ability, interest and potential. Teachers need to accommodate students from all cultures, languages, races and mental abilities.

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