

**The Effect of Differentiating Instruction
Using Multiple Intelligences on
Achievement in and Attitudes towards
Science in Middle School Students with
Learning Disabilities**

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Introduction:

Individuals are the main source of improvement of the society and sustainability of its presence if they grown up appropriately. Education being a bridge between human and the life is impressed and shaped by the developments of era, so education of individuals become important parallel with the progress and changes in the society. (Bilgin, 2006).

Teachers should plan science education with respect to their students. For a qualified science education, the curriculum should be planned according to the interests of students. It does not only motivate students but also make them learn the subject in an effective way. (Bilgin, 2006). According to Colleta and Chiapetta (1994), science education should be related with the attitudes and interests of the students. These psychological concepts help motivate students and make the educational process more pertinent. Bybee (1993), also agree that curriculum and instruction should be integrated with the interests and ethical backgrounds of the students. They should guide learning toward (1) understanding and fulfilling basic human needs and facilitating personal development; (2) maintaining and improving the physical environment; (3) conserving natural resources so they are used wisely; and (4) developing and

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understanding the interdependence among people at local, national and global levels- that is a sense of community.

Researchers have demonstrated that differentiated instruction has been effective in some schools (Beecher & Sweeney, 2009). VanSciver (2005) stated, "Teachers are now dealing with a level of academic diversity in their classrooms unheard of just a decade ago" (p. 534). In a single classroom, students' learning abilities may range from above grade level to below grade level. Levy (2008) stated that "students enter classrooms with different abilities, learning styles, and personalities..." (p. 161). Teachers need to find adequate strategies that provide students with the support needed to achieve standards presented through problem solving. Differentiating instruction by integrating student's multiple intelligences and learning style is one such strategy.

According to Lawrence-Brown (2004), Mourad and Amal (2013) "with suitable supports, including differentiated instruction, students ranging from gifted to those with significant disabilities can receive an appropriate education in general education classrooms" (p.34). McBride (2004) stated that "Differentiated instruction is vital to effecting positive change in student performance, because the one-strategy-fits-all approach doesn't work in a real classroom" (p. 39).

Benefits of Differentiated Instruction:

Servilio (2009) stated that differentiating instruction is "an individualized method of meeting all of the students' academic needs at their level" (p. 7). One benefit of differentiating instruction is that it helps teachers address the learning needs of each student. This can be accomplished by targeting the student characteristics Tomlinson (2001) identified as: readiness, interest, and

learning profile. When planning for differentiated instruction, knowing students' interests and dominant learning styles, or profiles, can allow the teacher to plan learning activities that specifically target what students would like to learn and how they learn best (Servilio, 2009). When teachers teach to students' readiness level, they can accommodate a student who has mastered the lesson content, and is ready to be challenged. In this case, a harder text or a more complicated project could be assigned. Once a need is identified, the teacher responds by finding a method or solution to answer the need in order for all students to be successful in learning (VanSciver, 2005). In these examples, the teacher is able to use differentiated instruction to meet the learning needs of their students.

Another benefit of differentiated instruction is that it leads to increased student achievement. Servilio (2009) stated "The combination of a differentiated curriculum and the options for student choice are ideal for promoting success for students with disabilities and it can improve outcomes for other students as well" (p. 10). In a differentiated classroom, when students are engaged and have achieved their goal or completed a task, they are more motivated to continue learning and exceed their original goal or expectation. "With the tools of differentiated instruction, we can ... take each child as far as he or she can go" (Levy, 2008, p. 164) towards further achievement and success.

Methods for Differentiating Instruction: Multiple Intelligences

Harvard professor Howard Gardner first introduced the theory of multiple intelligences in the early 1980s. According to Armstrong (2003) "Gardner argues that traditional ideas about intelligence employed in educational and psychological circles for almost a hundred years require

reform. In particular, he suggests that the concept of a “pure” intelligence that can be measured by a single I.Q. score is seriously flawed” (P.12). Gardner has identified nine intelligences and has indicated there may be many more that people possess at varying levels. Gardner’s theory is that the variability to which people possess a certain intelligence determines how they learn and interact best with other people.

Gardner (2003) summarized the first seven intelligences as follows:

1. Linguistic Intelligence. The understanding of the phonology, syntax, and semantics of language, and its pragmatic uses to convince others of a course of action, help one to remember information, explain or communicate knowledge, or reflect upon language itself.
2. Bodily-Kinesthetic Intelligence. The ability to control one’s bodily motions and the capacity to handle objects skillfully.
3. Spatial Intelligence. The ability to perceive the visual world accurately, to perform transformations and modifications upon one’s initial perceptions, and to be able to re-create aspects of one’s visual experience (even in the absence of the relevant physical stimuli).
4. Musical Intelligence. The ability to understand and express components of music, including melodic and rhythmic patterns through figural or intuitive means (the natural musician) or through formal analytic means (the professional musician).
5. Logical Mathematical Intelligence. The understanding and use of logical structures, including patterns and relationships, and statements and propositions, through experimentation, quantification, conceptualization, and classification.

6. Intrapersonal Intelligence. The ability to access one's emotional life through awareness of inner moods, intentions, motivations, potentials, temperaments, and desires, and the capacity to symbolize these inner experiences, and to apply these understandings to help one's own life.
7. Interpersonal Intelligence. The ability to notice and make distinctions among other individuals with respect to moods, temperaments, motivations, intentions , and to use this information in pragmatic ways, such as to persuade, influence, manipulate, mediate, or counsel individuals or groups of individuals toward some purpose. (P.13-14).

From the extensive literature, it is obvious that students will learn better if they actively participate in educational process. According to Sanfeliz and Stalzer (2003), one way to help students become active agents in their society is by making the educational experience more pertinent, especially regarding science. Students can be motivated to learn a scientific concept and discover the importance that such experience has to offer. If the student has the chance to learn what they find interesting in science, children will feel a sense of control and greater responsibility and enthusiasm toward their learning.

According to Lazer (2004), using MI in the classroom makes lessons more interesting, which causes students to pay more attention to what is taught and then learned. As a result, students are more engaged, they remember more, and achievement increases. He also stated that when students become aware of their intelligence strengths and consider themselves as being "smart" in that area of intelligence, their self esteem is raised.

Mourad Ali & Amal Mostafa (2013) investigated the effect of using differentiated instruction by integrating

multiple intelligences and learning styles on solving problems, achievement in, and attitudes towards math in six graders with learning disabilities in cooperative groups. A total of 60 students identified with LD were invited to participate. The sample was randomly divided into two groups; experimental (N= 30 boys) and control (N= 30 boys).

ANCOVA and (T-test) were employed for data analysis. Findings from this study indicated the effectiveness of differentiated instruction by integrating multiple intelligences and learning styles on solving problems, achievement in, and attitudes towards math in the target students. On the basis of the findings, the study advocated for the effectiveness of using differentiated instruction by integrating multiple intelligences and learning styles on solving problems, achievement in, and attitudes towards math in learning disabled students.

Further research is necessary to build on the vast amount of research into differentiated instruction with learning disabled students. This will allow researchers to determine how differentiated instruction can be best used as an intervention with learning disabled students as there is a dearth of research with this population. In order to address this issue with the lack of research on differentiated instruction with learning disabled students. Thus the present study seeks to give answers to the following questions:

- 1- Are there differences in post (T-test) scores mean between control and experimental groups on Science Achievement Test?
- 2- Are there differences in post (T-test) scores mean between control and experimental groups on Attitude Science Questionnaire?

Method

Participants

61 students identified with LD were invited to participate. Each student participant met the following established criteria to be included in the study:

- (a) A diagnosis of LD by teacher's references, and learning disabilities screening test (Kamel, 1990).
- (b) AN IQ score on the Mental Abilities Test (Mosa, 1989) between 90 and 114
- (c) Low scores on Science achievement and attitude tests
- (d) Absence of any other disabling condition.

The sample was randomly divided into two groups; experimental (N= 31; 28 boys and 3 girls) and control (N= 30; 28 boys, 2 girls).

The two groups were matched on age, IQ, achievement and attitude tests

Table 1. Pretest Scores Means, standard deviations, t- value, and significance level for experimental and control groups on age (by month), IQ, achievement and attitude tests

Variable	Group	N	M	SD	T	Sig.
Age	Experimental	31	145.51	2.42	0.453	-
	Control	30	145.23	2.45		
IQ	Experimental	31	109.19	7.44	-.305	-
	Control	30	109.80	8.05		
Achievement	Experimental	31	12.129	1.14	0.097	-
	Control	30	12.100	1.18		
Attitude	Experimental	31	20.61	0.91	-2.32	-
	Control	30	21.50	1.90		

Table 1. Shows that all t- values did not reach significance level. This indicated that the two groups did not differ in age, IQ, achievement and attitude tests (pre-test).

Instruments

- 1- Academic Achievement Test: The end-of- year examination results of the participants in science

standardized and marked by the teachers, and provided the summative evaluation scores for the analysis. Hence, scores in the science served as the measures of students' achievement.

2-Attitude towards Science Scale. The scale consisted of 20 three-point Likert-type statements, reflecting feelings towards science, ranging from positive to negative (e.g. learning science makes me nervous) the test has demonstrated high internal consistency with Cronbach's α ranging from 0.86 to 0.89.

Procedure

Screening: 61 students identified with LD were invited to participate. Each student participant met the following established criteria to be included in the study:

- (a) A diagnosis of LD by teacher's references, and learning disabilities screening test (Kamel, 1990)
- (b) AN IQ score on the Mental Abilities Test (Mosa, 1989) between 90 and 114.
- (c) Low scores on Mathematical achievement and attitude tests.
- (d) Absence of any other disabling condition.

Pre-intervention testing : All the 61 students in grade one preparatory completed Academic Achievement Test, which assesses students' Science Academic Achievement and Attitude Towards Science Scale, which assesses students' attitude towards science. Additionally, the end of year examination results of the participants in science standardized and marked by the teachers, and provided the summative evaluation scores for the analysis.

Hence, scores in the science served as the measures of students' achievement. Thus data was reported for the students who completed the study.

Experimental – group students were taught in the “Technology Room ” at El Orman Preparatory school after the school day ended .The instructor (author) gave students an idea about the MI theory and how it is useful in helping them achieve their lessons in different school subjects in general , and in science in particular .

General Instructional Procedures

The MI program comprised 3 weekly sessions lasting between 40 and 45 min, and several homework tasks. The program lasted for 2 months. During sessions, students were allowed to work together, and the instructor (the author) gave help and modeling, if necessary. The seven intelligences were employed in all sessions. Employing verbal/ linguistic intelligence requires students to brainstorm, use new vocabulary, and tell the story in their own words. While using logical / mathematical intelligence requires that students asking and answering questions about the text, and explain their answers. Students employed visual / spatial intelligence through illustrations, and using pictures of the new vocabulary. They also used role play, body movements, and concrete materials while learning the new word as part of bodily / kinesthetic intelligence. Musical / Rhythmic intelligence was employed by students. They created rhythmic patterns, and sang songs. Students shared work with one another, assessed peer's work, and worked collaboratively as part of their interpersonal intelligence. Additionally, each student had a space to work individually and reflect on his/her progress and achievement as part of his intrapersonal intelligence.

Experimental Design

An experimental Pretest-Posttest Control-Group design was used in this study. In this mixed design, two groups are formed by assigning 31 of the participants to the experimental group and 30 to the control group. Both groups were pre tested and post tested in the same manner and at the same time in the study. The bivalent independent variable was the multiple intelligences intervention and it assumed two values: presence versus absence of the multiple intelligences intervention. The dependent variables were the gains in scores on achievement in, and attitudes toward science tests.

Results

Science Achievement

Table 2. Shows data on ANCOVA analysis for the differences in (post-test) mean scores between experimental and control groups in Science Achievement. The table shows that the (F) value was (416.92) and it was significant value at the level (0.01).

Table 2. ANCOVA analysis for the differences in (post - test) mean scores between experimental and control groups in Science Achievement

Source	Type III sum of squares	DF	Mean square	F	Sig.
Pre	3.894	1	3.894	416.92	0.01
Group	6327.64	1	6327.64		
Error	880.27	58	880.27		
Total	7208.85	60			

Table 3. Shows T. test results for the differences in post- test mean scores between experimental and control groups in Science Achievement. The table shows that (t) vale was (20.54). This value is significant at the level (0.01)

in the favor of experimental group. The table also shows that there are differences in post- test mean scores between experimental and control groups in Science Achievement in the favor of experimental group.

Table 3. (T-test) results for the differences in post (T-test) mean scores between experimental and control groups in Science Achievement

Group	N	Mean	Std. deviation	T	Sig.
Experimental	31	35.97	2.58	20.54	0.01
Control	30	15.59	4.85		

Attitude toward Science

Table 4. Shows data on ANCOVA analysis for the differences in post- test mean scores between experimental and control groups in Attitude toward Science. The table shows that the (F) value was (244.722) and it was significant value at the level (0.01).

Table 4. ANCOVA analysis for the differences in post-test mean scores between experimental and control groups in Attitude toward Science

Source	Type III sum of squares	df	Mean square	F	Sig.
Pre	.128	1	.128	244.722	0.01
Group	5538.336	1	5538.336		
Error	1312.607	58	22.631		
Total	7375.73	60			

Table 5. Shows (T-test) results for the differences in post- test mean scores between experimental and control groups in Attitude toward Science. The table shows that (t) vale was (16.75). This value is significant at the level (0.01) in the favor of experimental group. The table also shows that there are differences in post- test mean scores between

experimental and control groups in Attitude Toward Science in the favor of experimental group.

Table 5. T. test results for the differences in post- test mean scores between experimental and control groups in Attitude toward Science

Group	N	Mean	Std. deviation	T	Sig.
Experimental	31	41.74	6.46	16.75	0.01
Control	30	21.80	1.42		

Discussion

The main objective of the present study was to explore the effect of differentiated instruction using multiple intelligences on achievement in and attitudes towards science in middle school students with learning disabilities.

The results of this study as revealed in tables 3, 5, show that the differentiated instruction that used multiple intelligences was effective in improving achievement in and attitudes towards science of students in experimental group, compared to the control group whose individuals were left to be taught in a traditional way.

Participants of this study fall into the minimum IQ of 90, nevertheless, they have learning disability. Thus IQ score cannot account for learning disabilities. The results of the present study support that conclusion with evidence that students who participated in the study do not fall into the low IQ range, however they have learning disabilities. When designing a program based on the differentiated instruction that used multiple intelligences, they had statistical increase in achievement in and attitudes towards science. This goes in line with what Mourad Ali et al. (2006) notes that there is one problem " students who are identified as learning disabled often cover any special abilities and talents, so their weakness becomes the focus of

their teachers and peers, ignoring their abilities. Mourad Ali (2007), however, notes that "learning disabled, as well as gifted students can master the same contents and school subjects", but they need to do that in a way that is different from that used in our schools.

Experimental group gained better scores in achievement in and attitudes towards science than did control groups in (T-test) through there were no statistical differences between the two groups in pre- test. This is due to the program which met the experimental group's needs and interests. On the contrary, the control group was left to be taught in a traditional way. This goes in line with our adopted perspective which indicates that traditional methods used in our schools do not direct students as individual toward tasks and materials, and do not challenge their abilities. This may lead students to hate all subjects and the school in general. On the contrary, when teachers adopt differentiated instruction that suits students interests and challenge their abilities with its various modalities.

This indicates that " as we learn more about the scope and complexity of individual differences and how they affect academic progress, we become increasingly convinced that many individuals who do not do well at school due to the instructional methods used to teach them does not complement preferred styles to learn, thus, we should seek strategies that help these students and match their strengths.

Implications

The results of this study have several important implications. This study adds to the literature on the effectiveness of differentiated instruction with learning disabled students. Results appear to indicate that differentiated instruction are an effective instructional strategy for improving achievement in and attitudes towards

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science test scores of students with learning disabilities. This study has referential adequacy because this study could be replicated for any performance task by any teacher wanting to test how students perform when learning through using multiple intelligencies.

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