Integrating multiple intelligences and learning styles on solving problems , achievement in, and attitudes towards math in six graders with learning disabilities in cooperative groups

Mourad Ali Eissa, PhD [1] **Amaal Ahmed Mostafa** [2]

[1] Dean, College of Education , Arees University, USA, drwesam20002000@yahoo.com

[2] Assist. Prof. Dr., Beni Suef University

Abstract

This study 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.

Key Words: differentiated instruction, multiple intelligences and learning styles, solving problems, academic achievement , attitude, learning disabled.

Introduction

For students to achieve at high levels in a math class, they must not only know a list of formulas and algorithms, but also know how to apply these. As stated by Boaler (2008), “if young people are to become powerful citizens…they need to be able to reason mathematically – to think logically, compare numbers, analyze evidence, and reason with numbers” (p. 7).

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), “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).

History of Differentiated Instruction

Levels of Higher Thinking (knowledge, comprehension, application, analysis, evaluation, and synthesis) are also embedded to ideas of differentiating instruction as they encourage greater rigor for some students and variability among all.

Implementation began in the general education classroom (Hall, 2002) and continues to be predominantly situated there today because of the intent to maximize learning for all students in the same classroom. According to Slavin (1987, 1993), slow learners are rarely more successful when placed in homogeneous groupings. Differentiated instruction supports a community Research suggests that students are more successful when taught in ways that are responsive to their individual readiness levels (Vygotsky, 1978, 1986), interests (Csikszentmihalyi, 1990; Maslow, 1962), learning profiles (Sternberg, Torff, & Grigorenko, 1998), and motivational catalysts (Hertzberg, 1959). Maslow’s hierarchy of needs suggests that students will learn if basic satisfiers are met.

Gardner's theory of multiple intelligences and Sternberg's theory of thinking styles (Sternberg & Williams, 2003) advocate for an understanding of the ways in which individuals process and make sense of information. Hertzberg's work on motivation identifies internal motivators that lead to satisfaction and fulfillment and external motivators that are largely found to be dissatisfies. According to Vygotsky, students learn best when moderately challenged and should, thus, be instructed in their zones of proximal development – the range of learning between what is too easy and what is too difficult to accomplish. Differentiation specifically responds to progress on the learning continuum and helps to bridge what students already know with what they need to learn (Heacox, 2002). "To differentiate instruction is to recognize students' varying background knowledge, readiness, language, preferences in learning, interests, and to react responsively" (Hall, 2002, p. 1). It requires flexibility in both teaching and expectations that drive instruction and allows for multiple sense-making strategies.

In some ways, differentiated instruction emanates from the work of John Dewey (1916) who advocated for alignment of teacher instruction to the needs of students. It prepares students for democracy (Waterman, 2007) as it gives students responsibility for their own learning. However, it may have been Betts' (1946) work on differentiation that was the first pure focus on what he referred to as "differentiated guidance" grounded in the belief that constant evaluation of individual strengths and weaknesses allowed progression through developmental stages.

Differentiated instruction is also situated in research related to cognition and the brain (Jensen, 1998) as well as multiple intelligences (verbal/linguistic, logical/mathematical, visual/spatial, bodily/kinesthetic, musical, interpersonal, intrapersonal, and naturalist) (Gardner, 1993), firmly grounding it in an understanding of how people learn. According to Clark (2002), children learn more quickly when instruction is made relevant. The brain changes physically and chemically when challenged and, without challenge, neurons cease to fire and the brain does not increase in capacity. The idea of student choice is based on brain research conducted by Deci (1995) and Jensen that says students are intrinsically motivated if they have choices. Along similar lines, Bloom's (1994) Six of learners rather than groups of students labeled as slow and fast (Corley, 2005).

Learning is the construction of understanding and application which requires that individuals make their own meaning (Corley, 2005). Differentiation is founded on the notion of student empowerment and is connected to the writings of critical thinkers such as Friere (1970) and hooks (1994) who advocate for dialogical and constructivist teaching methods. Education is the practice of freedom and requires student participation. Differentiated instruction requires the building of community, recognizes and validates the experiences and strengths of all, and allows students to integrate "new" knowledge into their unique perspectives and personal backgrounds.

Practicing Differentiated Instruction

Students come to school with various abilities: low, medium, and high. Some of the students' abilities or lack of ability may be due to inadequate instruction offered in the past, especially in mathematics. However, the blame game will not help the students who are struggling in math with basic mathematical concepts. These basic mathematical concepts

centered on computation, number sense, and problem solving. Teachers must realize what was important for students to know in mathematics and find ways of accomplishing teaching. Burns (2007) lists three important issues that were essential to teaching mathematics:
It's important to help students make connections among mathematical ideas so they do not see these ideas as disconnected facts. It's important to build student's new under standings on the foundation of their prior learning. It's important to remember that student's correct answers, without accompany in explanations of how they reason, are not sufficient for judging mathematical understanding (p.16).

The way to successfully implement these three important issues was through differentiated instruction. Burns found nine strategies for struggling math learners: Determine and scaffold the essential mathematics content; pace lessons carefully; build in a routine of support; foster student interactions; make connections explicit; encourage mental calculations; help students use written calculations to track thinking; provide practice; and build in vocabulary instruction. Out of these nine strategies, five of them were self explanatory in terms of the rationale behind each: pace lesson carefully; build in a routine of support; foster student interaction; help students use written calculations to track thinking; and provide practice. The other four strategies, however, could use more clarification. For determine and scaffold the essential mathematics content, one must decide which concepts and skills were important. Then scaffold the content into manageable and sequential chunks for learning. Next, make connections explicit – struggling students tend not to see how things were related mathematically. They need aid on how to build new knowledge based upon what the students already know. Third, encourage mental calculations – the students were encouraged in this matter because mental calculations build-up their reasoning skills as well as fostering their number sense. Last, build in vocabulary instruction – it was important that students developed a good understanding of mathematical concepts before learning the vocabulary. Also, the vocabulary should be taught in the setting of a learning activity, not by rote memorization.

As mentioned earlier, the basic mathematical concepts were computation, number sense, and problem solving. Recently, in mathematics, there had been an increased focus on number sense. Not only was there a focus on improving students' understanding of number sense, but there is also a focus on professional development for teachers to provide sound instruction. In the state of North Carolina, Faulkner (2009), in our work with hundreds of teachers throughout the state, we have found it necessary to support teachers with a model for number sense development that, first and foremost, supports a deep understanding of mathematics.
In other words, teachers must know the right things to practice in order to have a profound impact on struggling students' mathematical understanding and performance.

Cooperative Groups in a Differentiated Classroom

Differentiating instruction works best when students can collaborate (Tomlinson, 2001). When students are afforded instruction that requires them to make choices, be active in their learning, and produce high quality work, they need to be given the opportunity to converse with one another and work cooperatively. Tomlinson (2001) explained how cooperative groups play an integral part in a differentiated classroom as, "students collaborate ….and can make major contributions toward solving problems" (p. 23). Although White and Dinos (2010) do not advocate for cooperative groups when the collaborators differ in background knowledge, they do give four guidelines to determine when cooperative groups could be beneficial: cooperation is imperative for the task that could not be completed alone, all collaborators are novices at the task, the group constructs a shared representation of the task, and they are to coordinate their background knowledge.

Problem Solving in a Differentiated Classroom

The differentiated classroom works well in cooperative groups that require meaningful problem-based work (Cotic & Zuljan, 2009; Lowrie & Logan 2007). Jausovec (1993) defined a high quality problem to have three main components: “undesired initial situation, a desired end situation, and an obstacle preventing the passage from the initial to the desired end situation” (as cited by Cotic & Zuljan 2009, p. 298). In order to benefit student learning, Boaler (2008) instructed teachers to incorporate four key strategies when teaching mathematics: questioning, reasoning, allowing for multiple mathematical representations, and using flexibility of numbers. These strategies are best implemented through problem solving.

Attitudes Towards Problem Solving

According to Benjamin (2006), Coctic and Zuljan (2009), and Boaler (2008), problems should be “open” work that can be accessed and taken to different levels with various ways to solve the problem. Coctic and Zuljan (2009) provided reasons, including giving students a feeling of success and independence when working on authentic problems rather than “traditional math instruction that involves mainly single-solution problems” (p. 300). Burz and Marshall (1996) conveyed how students respond positively to problem-based curriculum “…when students begin to recognize and improve their competence with each new learning performance”(p. 4). Boaler (2008) also made a distinction between student attitudes towards problem-based learning found on a performance task instead of “small problem” exercises when she stated, “when a teacher…finds challenging problems…these are also the most interesting problems in mathematics so they carry additional advantage of being more engaging” (p. 118).

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.

Differentiating Instruction by integrating multiple intelligences and Student Learning Styles

Multiple intelligences theory has been closely linked with learning styles. Sliver et al.(1997) claims that learning styles and multiple intelligences share some similarities. They claims that learning styles and multiple intelligences should be applied in combination since they believe each theory has some limitations. They suggest "in conjunction, both learning styles and multiple intelligences can work together to form a powerful and integrated model of human intelligence and learning – a model that respects and celebrates diversity and provides us with the tools to meet high standards" (P.27).

Differentiating instruction by learning style is a solution to meeting the needs of a broad spectrum of students and to ensuring that all students achieve the standards of district and state, which is one of the biggest challenges for teachers (Heacox, 2002; Levy, 2008). Dunn, Beaudry, and Klavis (2002) promoted differentiating by learning styles when they stated, “when permitted to learn difficult academic information or skills through their identified preferences, children tend to achieve statistically higher on test and attitude scores than when instruction is dissonant with their preferences”(p.88). As Read (2000) stated, differentiating by learning style will allow students to “interact with course content to facilitate memory retention and to use higher order thinking skills” (p.40). Dunn, Beaudry, and Klavas (2002) also discussed the correlation between student mastery of concepts and learning style when they stated, “most children can master the same content; how they master it is determined by their individual needs” (p. 88).

Similarly, 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. Lazer (2000) 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.

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-test scores mean between control and experimental groups on Solving Problem test ?

2- Are there differences in post-test scores mean between control and experimental groups on Academic Achievement test?

3- Are there differences in post-test scores mean between control and experimental groups on Attitude Towards Math test ?

Method

Participants

Sixty 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 , attitude and problem solving tests (d) absence of any other disabling condition. The sample was randomly divided into two groups; experimental (n= 31 boys only) and control (n= 30 boys only).

The two groups were matched on age, IQ, achievement, attitude, and problem solving tests. Table 1. shows means, standard deviations, t- value , and significance level for experimental and control groups on age (by month), IQ, achievement, attitude and problem solving tests (pre-test)

Table 1. *pretest mean scores , standard deviations ,t- value , and significance level for experimental and control groups on age (by month) , IQ , achievement ,attitude and problem solving tests.*

Variable	Group	N	M	SD	T	Sig.
Age	Experimental	30	145.51	2.42	0.453	-
	Control	30	145.23	2.45		
IQ	Experimental	30	109.19	7.44	-.305	-
	Control	30	109.80	8.05		
Achievement	Experimental	30	12.129	1.14	0.097	-
	Control	30	12.100	1.18		
Attitude	Experimental	30	20.61	0.91	-2.32	
	Control	30	21.50	1.90		
Mathematical problem solving	Experimental	30	6.21	3.00	-.547	-
	Control	30	6.67	3.52		

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 ,attitude and problem solving tests (pre-test).

Instruments

1- Academic Achievement Test: The end-of- year examination results of the participants in math standardized and marked by the teachers , and provided the summative evaluation scores for the analysis. Hence, scores in the math served as the measures of students' achievement.

*2-Attitude Towards Math Scale: (Mourad , 2010).*The scale consisted of 20 three-point Likert-type statements, reflecting feelings towards Mathematics, ranging from positive to negative (e.g. *Learning mathematics makes me nervous*)

3- *Problem Solving competency Test :* The scale consisted of 22 sub- questions . Every right answer was given one point .

Procedures

Screening : Six year primary students who participated 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 118 (c) absence of any other disabling condition.

Pre-intervention testing : All the sixty students in grade six primary completed Academic Achievement Test , which assesses students' Mathematical academic Achievement; Attitude Towards Math Scale, which assesses students' attitude towards math, and Mathematical Problem Solving Test ,which assesses students' problem solving abilities. Additionally , the end-of- year examination results of the participants in math standardized and marked by the teachers , and provided the summative evaluation scores for the analysis. Hence, scores in the math served as the measures of students' achievement. Thus data was reported for the students who completed the study .

General Instructional Procedures: Instruction was delivered to the six year math teacher 3. Before the study started, instructors participated in 10 hours of training to learn how to implement the differentiated instruction . The teacher was provided with a notebook that contained detailed directions for implementing all activities and lessons.

The teacher; Mr. Fahmy MArzook, received training and role-played implementing the strategy until he was able to do so to criterion. To help ensure complete implementation, he was provided with a checklist for each lesson. As he taught a lesson, each step was checked as it was completed. The teacher, however, had the flexibility to respond to individual student needs, backing up and repeating a step, if necessary, or reordering steps. Students received 3 training sessions a week, lasting between 40 and 45 min . Instruction took place in the regular classroom in order to naturalize the situation.

Fidelity of Treatment Implementation: To ensure that strategy instruction was delivered as intended, the following four safeguards were implemented. One, the teacher received training to criterion in how to apply the instructional procedures. Two, teacher met with the author weekly and communicated daily with the author (as needed)to discuss any noteworthy occurrences that took place when implementing instructional procedures. Reported difficulties occurred rarely and usually involved the need to individualize further for a particular student to deal with a behavioral issue. Responses to issues such as these were discussed and implemented. Three, the teacher had a checklist for each student that contained step-by step directions for each lesson. As the teacher completed a lesson step, he placed a check by it. For 42% of the sessions, the researcher also assessed treatment integrity by recording the presence

[3] The researcher wishes to thank to Mr. Fahmy MArzook, the math teacher for his assistance .

or absence of each component. Session integrity was computed by dividing the number of lesson components taught by the total number of components and multiplying the quantity by 100. Average session integrity scores were computed for each participant.

Design and Analysis

The effects of implementing the differentiated instruction on students' academic achievement, problem solving ,and attitude towards math were assessed using a repeated-measures design, pre-post- and follow-up testing.

Results

Mathematics Achievement

Table 2. shows data on ANCOVA analysis for the differences in post- test mean scores between experimental and control groups in Mathematics 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 Mathematics Achievement*

Source	Type 111 sum of squares	df	Mean square	F	Sig.
Pre	3.894	1	3.894		
Group	6327.64	1	6327.64	416.92	0.01
Error		57			
Total	880.27 7208.85	59	880.27		

Table 3. shows T test results for the differences in post- test mean scores between experimental and control groups in Mathematics 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 Mathematics Achievement in the favor of experimental group.

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

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

Attitude Toward Mathematics

Table 4. shows data on ANCOVA analysis for the differences in post- test mean scores between experimental and control groups in Attitude Toward Mathematics . 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 Mathematics*

Source	Type 111 sum of squares	df	Mean square	F	Sig.
Pre	.128	1	.128		
Group	5538.336	1	5538.336	244.722	0.01
Error	1312.607	57	22.631		
Total	7375.73	59			

Table 5. shows T. test results for the differences in post- test mean scores between experimental and control groups in Attitude Toward Mathematics. 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 Mathematics 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 Mathematics*

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

Problem Solving

Table 6. shows data on ANCOVA analysis for the differences in post- test mean scores between experimental and control groups in reading comprehension test. The table shows that the (F) value was (128.009) and it was significant value at the level (0.01).

Table 6. *ANCOVA analysis for the differences in post- test mean scores between experimental and control groups in comprehension test*

Source	Type 111 sum of squares	df	Mean square	F	Sig.
PRE	1.725	1	1.725		
GROUP	217.276	1	217.276	128.009	0.01
ERROR	317.340	57	5.567		
TOTAL	1067.933	59			

Table 7. shows T. test results for the differences in post- test mean scores between experimental and control groups in reading comprehension test. The table shows that (t) vale was (11.67). 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 comprehension test in the favor of experimental group.

Table 7. T- test results for the differences in post- test mean scores between experimental and control groups in comprehension test

Group	N	Mean	Std. deviation	T	Sig.
Experimental	30	13.50	1.10	11.67	0.01
Control	30	6.43	3.12		

Discussion

The main objective of the present study was to explore the effects of 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.

The results of this study as revealed in tables 3, 5, 7 show that the differentiated instruction that integrated multiple intelligences and learning styles was effective in improving solving problems, achievement in , and attitudes towards math 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 integrated multiple intelligences and learning styles, they had statistical increase in solving problems , achievement in , and attitudes towards math. 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 solving problems , achievement in , and attitudes towards math than did control groups in post-tests though 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 traditionally. 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 solving problems , achievement in , and attitudes towards math 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 integrating multiple intelligences and learning styles .

References

Betts, E. A. (1946). *Foundations of reading instruction with an emphasis on differentiated guidance.* New York: American Book Company.

Bloom, B. S. (1994). Reflections on the development and use of the taxonomy. In L. W. Anderson & L. Sosniak (Eds.), *Bloom's taxonomy: A forty year retrospective.* Part II (1-8). Chicago: University of Chicago.

Boaler, J. (2008). *What's math got to do with it?* New York: Penguin Group.

Burns, M. (2007). Nine ways to catch kids up: How do we help floundering students who lack basic math concepts? *Education Leadership*, 65(3), 16-21.

Burz, H. L., & Marshall, K. (1996). *Performance-based curriculum for mathematics.* Thousand Oaks, CA: Corwin Press Inc.

Clark, B. (2002). *Growing up gifted: Developing the potential of children at home and at school* (6th ed.). Upper Sadle River, NJ: Prentice Hall.

Corley, M. (2005). Differentiated instruction: Adjusting to the needs of all learners. *Focus on Basics: Connecting Research and Practice, 7*(C), 13-16.

Cotic, M.,& Zuljan, M. (2009). Problem-based instruction in mathematics and its impact on the cognitive results of the students and on affective-motivational aspects. *Educational Studies,* 35(3), 297-310. Retrieved from ERIC database.

Csikszentmihaly, M. (1990). *Flow: The Psychology of Optimal Experience.* New York: Harper & Row.

Deci, E. L. (1995). *Why we do what we do: Understanding self-motivation*. New York: Penguin Books.

Dewey, J. (1916). *Democracy and education: An introduction to the philosophy of education.* New York: The Free Press.

Dunn, R., Beaudry, S., & Klavas, A. (2002). Survey of research on learning styles. *California Journal of Science Education*, 2(2), 75-96. Retrieved from the ERIC database.

Faulkner, V.N. (2009). The components of number sense: An instructional model for teachers. *Teaching Exceptional Children, 41(5), 24-30.*

Freire, P. (1970). *Pedagogy of the oppressed*. New York: Continuum.

Gardner, H. (1993). *Frames of the mind: The theory of multiple intelligences*. New York: Basic Books.

Hall, T. (2002). *Differentiated instruction.* Wakefield, MA: National Center on Accessing the General Curriculum. Retrieved November 20, 2007 from http://www.cast.org/publications/ncac/ncac_diffinstruc.html

Heacox, D. (2002). *Differentiating instruction in the regular classroom: How to reach and teach all learners, grades* 3-12. Minneapolis, MN. Free Spirit Publishing.

Herzberg, F. (1959). *The motivation to work.* NY: John Wiley.

Hooks, b. (1994). *Teaching to transgress: Education as the practice of freedom.* Taylor and Francis.

Jensen, E. (1998). *Teaching with the brain in mind.* Alexandria, VA: Association for Supervision and Curriculum Development.

Kamel, M. (1990) *Screening Student test for learning disabilities* , Cairo, Al Anglo

Lazer, D. (2004). *Higher-order thinking the multiple intelligence way.* Chicago, IL: Zephyr Press.

Lawrence-Brown, D. (2004). Differentiated instruction: Inclusive strategies for standards-based learning that benefit the whole class. *American Secondary Education*, 32(3), 34-63. Retrieved from ERIC database.

Levy, R (2008). Meeting the needs of all students through differentiated instruction: Helping every child reach and exceed standards. [Electronic version]. *Clearing House,* 81(4), 161-164.

Lowrie, T., & Logan, T. (2007). Using spacial skills to interpret maps: Problem solving in realistic contexts. *Australian Primary Mathematics Classroom*, 12(4), 14-19. Retrieved from ERIC database.

Maslow, A. (1962). *Toward a Psychology of Being.* New York: Van Nostrand Reinhold.

Mosa, Farouk. A.(1989) *Mental Ability Test,* Cairo, El Nahda Al Masrya .

Mourad Ali (2007) . *How the reading disabled brain learns* , Alexandria , Dar El Wafaa.

Mourad Ali, E. Waleed El sayed,& Ahmed Gomaa (2006). *Computer and learning disabilities, theory and practice*, Alexandria, Dar El Wafaa

Read, S. E. (2000). Learning styles in graduate education classes: The river of no return. In R. Dunn, & S. Griggs (Eds.), *Practical approaches to using learning styles in higher education* (pp. 35-41). Westport, CT: Greenwood Press.

Servilio, K. (2009). You get to choose! Motivating students to read through differentiatedinstruction. [Electronic version]. *Teaching Exceptional Children Plus,* 5(5), 2-1l.

Silver , H. & Hanson , J. & Perini , M. (1997). Integrating Multiple intelligences and learning styles . *Educational Leadership ,Vol. 55(1), 22-27*

Slavin, R.E. (1987).Ability grouping and student achievement. Review of Educational Research, 57 (3), 293-336.

Slavin, R. E. (1993). Ability grouping in the middle grades: achievement effects and alternatives. *Elementary School Journal*, 93 (5), 535-552.

Sternberg, R., & Williams, W. (2003). *Educational psychology.* Boston, MA: Allyn and Bacon.

Sternberg, R., Torff, B. & Grigorenko, E. (1998). Teaching triarchically improves student achievement. *Journal of Educational Psychology, 90*, 374-384.

Tomlinson, C.A. (2001). *How to differentiate instruction in mixed-ability classrooms* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

VanSciver, 1. (2005). Motherhood, apple pie, and differentiated instruction. [Electronic version]. *Phi Delta Kappan,* 86(7), 534-535.

Vygotsky, L. (1978). *Mind in Society: The Development of Higher Psychological Processes.* Cambridge, MA: Harvard University Press.

Vygotsky, L. (1986). *Thought and Language.* Cambridge, MA: The MIT Press. (original work published in 1934).

Waterman, S. S. (2007). *The democratic differentiated classroom.* Larchmont, NY: Eye on Education, Inc.

White, R., & Dinos, S. (2010). Investigating the impact of mediated learning experiences on cooperative peer communication during group initiatives. *Journal of Experimental Education*, 32(3), 226-238. Retrieved from ERIC database.