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The Effectiveness of Gifted Students Centers in Developing Geometric Thinking

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This study aimed to measure the effectiveness of gifted students centers in developing geometric thinking. The sample consisted of sixty gifted students. The participants were distributed into two equal groups. The control group composed of thirty students studying at Giftedness Resource Rooms in Najran, Kingdom of Saudi Arabia (KSA), and the experimental group composed of thirty students studying at Gifted Center in Najran. A multiple-choice geometric thinking test was used as pretest and posttest for both groups. Based on the analysis of data, results will be discussed.

Keywords: Gifted centers, geometric thinking levels, enrichment activities.

INTRODUCTION

Special education programs depend on the philosophical basis for advocating equal educational opportunities for all without exceptions, irrespective of their capabilities and potentials. These programs aim at providing the circumstances and opportunities enough to take the learners to their utmost potentials and capabilities. Introducing the special education programs requires an adjustment in the educational methodologies and strategies to suit the educational nature and need of the learners with special needs. It also requires an adjustment to the environment in which these programs are introduced. These adjustments are known as educational alternatives in special education. It prepares the environmental, social, and the physical circumstances through which the educational services to the students with special needs are provided (Zeidner and Schleyer, 1999; Rogers 2002).

Gifted and talented students need special educational services different from the traditional educational services available in the regular schools. Providing special educational programs for the talented and gifted students is based on the lack of regular educational curricula to fulfill the needs of talented and gifted students, since it is a group kind of needs and limited in time for every course. In addition, there are a large number of students in most classes. Therefore, talented students are entitled to receiving educational programs that fulfill their needs and challenge their potentials (Jarwan, 2008; Coleman and Gallagher 1995; Rogers, 2002).

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Gifted Centers in KSA

Special education programs for gifted and talented students in KSA vary widely regardless of their recency. KSA started to pay special attention to this group of students, since they are a sort of national treasure that must be taken care of and invested upon because this is a guarantee to their future and security in light of the fast changes that the world and the Arab world in particular is witnessing. Some of the organizations and programs that provide assistance to students with special needs are: King Abdul Aziz Foundation for the Gifted, Acceleration, grouping, enrichment, gifted students committees in regular schools, and gifted students center (Ministry of Educations, 2011).

Establishing the Gifted Students' Center in Najran in KSA goes back to 2001, when the center started providing services to gifted students in three academic stages (elementary, middle school, and secondary). Students come to the center in the afternoon or Thursdays of every week, or in the midterm or semester breaks. The center aims at developing students' gifts, taking care of them, and providing the appropriate environment to develop them through enrichment programs provided in the fields of science, art, and literature. It also aim at providing the students with thinking strategies, problem solving tactics, develop their creative skills, providing them with personal skills and science research skills. Students' are nominated to the center according to a group of criteria defined by the Ministry of Education; some of which are: high academic achievement, good conduct, special skills and talented achievement, also, the accumulative test scores, and personal interview are criteria for nominating students into the center (Ministry of Education, 2011).

Enrichment activities

Enrichment activities are part of the educational programs provided to the students in the Gifted Centers in KSA. Enrichment is introducing adjustments or additions to the designated curricula provided to the regular students, in order to make them suitable for the needs of the gifted students in the cognitive, affective, creative, and psychomotor fields, (Jarwan, 2008; Nogueira, 2006). Enrichment could be in the form of activities, expertise, and materials that take the gifted and the talented students beyond the regular curricula, challenging their capabilities, filling their time, satisfying their curiosity, fulfilling their interest, and achieving their goals and creativity in the cognitive processing of information. These activities broaden students learning in various ways, different from the regular way used in the regular schools (Al Haddaby et al., 2010).

The enrichment activities are simply a group of several teaching methodologies where instruction is adjusted to suit the needs and capabilities of the gifted students (Shneider, 2002). Consequently, enrichment activities must include academic suitable expertise and skills that will ultimately lead to developing the students' cognitive capabilities, since these activities will ultimately lead to boosting the students' achievement (Kaminsky, 2007).

The enrichment activities is characterized that it provides the talented and gifted students with some psychological and social traits, such as assuming leading roles, and socializing with peers from the same age group; therefore, these enrichment activities must suit the students' needs and interests regarding the content. They must also include numerous teaching methodologies that suit their interests (Clarck and Zimmerman, 2002). Enrichment activities and programs for the gifted students contribute to developing motivation and shaping skills of the students; in addition to their positive effect on developing self efficacy and self organization (Heinz and Heller, 2002).

Geometric thinking

The enrichment for the Mathematics syllabus is one of the enrichment programs provided for gifted students in the Center for Gifted in Najran. This program includes numerous subjects in Math, such as geometric thinking and ways of developing it. This program also concurs with the three level enrichment program suggested by Renzulli and Reis (1991) which includes three varied levels for math for talented students , starting with level of understanding the problem, followed by developing tactics of problem solving, and finally presenting the final solutions of the problem.

Geometry is one of the important subject matters included in the modern math syllabus approved by the National Council for Teachers of Math (NCTM). The modern math curricula aim at achieving the following objectives: (1) three and four dimensional shapes analysis and developing the discussion around the geometric relations; (2) locations and description of location relations using coordinate geometry, and organizing other representations; (3) application of transfers and using similes to analyze mathematical situations; (4) using photographic, location, indication, and modeling in solving problems, (NCTM, 2002; Huang and Wits, 2011).

Geometry includes numerous skills accompanied by levels of thinking that govern the nature of performance of these skills, since the development of geometric thinking passes through levels with hierarchical nature, starting with noticing shapes, followed by analyzing their traits, then, understanding the relationship between the different shapes, and finally reaching conclusions about them (Erdogan and Durmus, 2009).

Piaget and colleagues (1981) developed a Stage Theory in geometric thinking in children in Kindergarten stage until puberty. In the first stage children relate to sensorimotor activities to build topological concepts concerned with quantitative geometry; a branch of mathematics concerned with the location of objects in relation to other object (Location relation without size, shape, or distance), such as closed or open objects. In the second stage, children develop concept of projective geometry, concerned with multidimensional problems, such as handling straight lines and right angles. In the third stage, children focus is mainly on shapes and angles, and other subjects; this ways the children will acquire the ability to know and distinguish shapes of two and three dimensions (similarity and difference) (Chang et al., 2007). Whereas, Piaget suggested that the transition from one level to the next is a biological development rather than one stimulated by the learning process. The inability of children to think logically was not as a result of deficit of maturation but from an ignorance of the rules of the game of logic (Choi-Koh, 1999).

It is worth mentioning that the Constructivism Theory in learning has portrayed the teaching-learning process as a construct, so it mixed between Piaget's ideas and Van Hiele where the learners construct their own knowledge by interacting with the subject matter and relates the new concepts with the previous knowledge, which in turn creates advancement and progress in the cognitive construct (Choi – Koh, 1999). Numerous researchers are concerned with studying geometric thinking and Van Hiele is considered a pioneer in the geometric thinking, (Sharp and Zachary, 2004). Van Hiele defined in his theory that geometric thinking develops through a series of five levels, as shown below:

1. Visualization or Recognition level: In this level students can name and recognize geometric shapes that look similar without realizing the properties of the shapes. One of the examples is when a student recognizes a shape from a group of shapes, or draw some simple shapes (John, 2001).
2. Analysis or Descriptive level: In this level, students have the abilities to analyze and recognize and describe the properties of shapes, without relating them to each other; an example is when a student states that a parallelogram has two parallel sides (Carroll, 1998).
3. Informal Deductive level: In this level, students can form concepts for the geometric shapes and using them with the traits and the relations to complete a deductive proof and deduce the relations; an example of which is when a student define a polygon or a parallelogram (Bell, 1998).
4. Formal Deductive level: In this level students can use the assumptions and preliminaries to prove and construct some mathematical proof; in addition to the ability to explain the relation within the proof manner; an example of which would be when a student proves that the sum of angles in a triangle is equal to 180º using the parallel rule, (Battista, 2002).
5. Rigor Level: This is the highest level of the geometric thinking levels, and it is characterized by the ability of the learners to deduct theories from various preliminaries and known geometric shapes, in addition to comparing these systems, (Choi-Koh, 1999).

Van Hiele research focused on the levels of geometric thinking and the role of instruction in helping students move from one level to another, since the levels are hierarchical (Mason and Moore 1997; Huang and Wits, 2010). This is what was stressed by Carroll (1998) who states that students can not perform their duties adequately on any level without having expertise that enables them to think creatively at the previous level. If the language of instruction is higher than the level of the cognitive processes of the students, then students will not understand the geometric ideas presented. Mistretta (2000) indicates that Van Hiele presented levels of learning-teaching that must be included in the educational strategies; these levels are shown below:

1. Information level: In this level the teacher draws students' attention to the things he/she want them to discover; the teacher might ask, "what is a square? or what is a rectangle?"
2. Direction orientation level: Here, the teachers provide activities that allow the students to learn the subject matters being taught; students might cut triangles out of cardboard paper to fulfill the terms of triangles.
3. Explication level: This is a transitional level between students' dependence on themselves and the teachers. The role of the teachers here is only guidance with the least words possible; students might discuss, alone, the traits of the square or the parallelogram.
4. Free orientation level: The teachers in this level are mainly concerned about discovering students' improvising abilities. Tasks are presented to the students in various ways; students might divide a geometric shape into two identical shapes in different ways.
5. Integration level: In this level, students summarize what they have already learned in class in a good way to form a comprehensive image and deduct good traits.

Literature review

Erdoan and Durmus (2009) determined the effects of the instruction based on Van Hiele Model on pre-service teachers' geometrical thinking levels. The study has been carried out with senior students attending the Elementary School Teaching Program. The sample consisted of (142) students. These students were divided into two groups; the control group (n=72) and the experimental group (n=70). The experimental group which were instructed with Van Hiele Model and the control group which were instructed with traditional instruction. The findings showed that the instruction given according to the van Hiele levels was more effective than the traditional method in developing geometrical thinking levels of pre-service teachers.

Chang et al (2007) aimed at studying the effect of using the varied media on improving geometric thinking within the elementary stage students. The sample of the study included two groups; control and experimental; the two groups were administered a geometry level pre-post test. After that the experimental group followed (CeoCal) program, using multi-media teaching geometry; however, the control group followed the traditional way. The results of the study indicated an improvement on the experimental group on the geometry level posttest.

Furthermore, Halat (2007) aimed at uncovering the level of acquiring geometric thinking according to Hail theory in the 6th grade students. The sample consisted of two groups; control and experimental; the control group included one hundred and twenty three (123) students and the experimental group included one hundred and fifty (150) students. The two groups were given multiple tests according to the levels of geometric thinking. The members of the experimental group joined a new curriculum for teaching mathematic; however, the control group members studied mathematics according to the traditional way of teaching. The results of the study revealed the existence of statistically significant differences between the two groups favoring the experimental group.

Duatepe (2005) aimed at investigating the effects of drama-based instruction on seventh grade students' geometry achievement, Van Hiele geometric thinking levels, attitude toward mathematics and geometry. The sample consisted of two groups; control and experimental. The two groups were administered (5) pre-post tests to measure achievement in angles and circles. The groups were also administered the geometric thinking test to measure the students' attitudes towards mathematics and geometry. The members of the experimental group joined an educational program based on drama, where as the members of the control group learned geometry the traditional way. The results of the study showed improvement in geometry favoring the experimental group.

Furthermore, the study by Bani Irsheid (2002) aimed at measuring the effect of teaching geometry using the strategy of cooperative investigation on the achievement of the 7th grade students. The sample of the study consisted of sixty four (64) students, randomly distributed into two groups; control and experimental. Cooperative investigation strategy was used with the experimental group and the control group was taught using the traditional method of teaching. The two groups were administered a geometry level test. The results of the study indicated the availability of statistically significant differences between the two groups favoring the experimental group.

Salem (2001) conducted a study aiming at investigating geometric thinking within the students of the upper elementary stage, and the differences in categorizing them on geometric thinking according to gender in Jordan. The study also aimed at investigating the relationship between geometric thinking and achievement at mathematics. The sample of the study consisted of five hundred and thirty two (532) male and female students in the upper elementary stage in public schools. A test was developed to measure the five levels of geometric thinking. The study revealed that there is a clear low level of geometric thinking within the upper public elementary school students. The study also revealed that there were no statistically significant differences attributed to gender.

Breen (2000) study aims at uncovering the effect of using computers on developing the third level of the geometric thinking levels. The sample of the study consisted of (11) eleven students from the 8th grade and the researcher used a pre-post test design for one group, where the researcher used the geometric level test according to Van Hiele levels as a pretest and posttest. The sample received an educational program through computers for (5) five weeks. The results of the study show that the 8th grade students can indeed achieve the third level of Van Hiele after being taught geometry using computers.

Statement of the Problem

KSA is witnessing a new yet an alarming attention to special education, providing numerous services to the students with special needs, particularly in the category of the talented and the gifted students. Numerous centers providing services to gifted students were founded; however, no study was done to measure the effectiveness of these centers of the gifted students in developing the level of geometric thinking in particular. However, numerous studies were conducted about geometric thinking, and the results indicated that achievement in geometric and the levels of geometric thinking was low (Bani Irsheid, 2001; Al Jarrah, 2001; Salem, 2001). The researchers recommended using new educational strategies in teaching geometry. Consequently, this study aimed at measuring the effectiveness of the gifted centers on developing geometric thinking.

METHOD

The following subsections report the methodology used for this study, including the sample of the study and the achievement test that were applied.

Participants

The sample of the study consisted of 60 gifted students divided into two groups; experimental group is made up of 30 students attending the Gifted Center in Narjan, and a control group is made up of 30 students attending the Gifted Resource Rooms in the public schools in Najran, KSA. The members of the study sample were diagnosed as gifted based on the criteria defined by the Ministry of Education in KSA, and applied to the students while being nominated to attend the programs specially designed for the gifted students.

Instrument

In order to achieve the objectives of the study, uncovering the effectiveness of the gifted centers on developing geometric thinking, an achievement test

Table 1. Means and standard deviations of the overall pre-geometric thinking test

group	gender	No	mean	SD
Experimental	male	15	23.93	3.49
	Female	15	24.46	2.09
control	Male	15	24.93	2.21
	female	15	24.66	3.35

Table 2. ANOVA results of pre-geometric thinking test

Source of variance	Type III Sum of Squares	df	Mean squares	F	Sig.
Group	5.400	1	5.400	0.659	0.420
Gender	0.267	1	0.267	0.033	0.858
Gender * group	2.400	1	2.400	0.293	0.591

Table 3. Means and standard deviations of the overall post-geometric thinking test

group	gender	No	mean	SD
control	Male	15	25.46	3.06
	female	15	25.26	2.05
experimental	Male	15	28.20	1.93
	female	15	29.93	2.18

based on Van Heile Geometric Thinking was designed to measure the levels of geometric thinking using previous studies related to the subject of the study (Bani Irsheid, 2002; Van Hiele, 1999; Erdogan and Durmus, 2009; Chang et al., 2007). The test composes of 40 questions, and to measure the validity of the test, it was given to a group of experts in the mathematic teaching specialists in Najran University, KSA, and the Universities in Jordan. Therefore, the final stages of test became 35 multiple choice questions and true or false. The questions measured the first three levels of geometric thinking; visualization, descriptive, and the informal deductive levels. A grade of one (1) was given to the correct answer and a grade zero (0) to the wrong answer; the highest grade achieved by a student's is 35 and the lowest grade possible is zero (0). To measure the reliability of the test, two ways were used; Test-retest reliability used, where the test reliability factor was (0.84). The second way to measure is internal reliability calculated using KR-20 formula, where the reliability factor was found to be 0.89. Furthermore, the coefficient of difficulty and discrimination of the test were calculated, the coefficient of difficulty was 0.18 - 0.70, and the coefficient of discrimination was 0.27 – 0.53.

RESULTS

Prior to answering the questions of the study, the researcher measured the equivalence of the two groups on the pre-geometric thinking test. Table 1 shows the means and standard deviations.

Table 1 clearly shows the differences between the means of the levels of geometric thinking on the pretest according to the variable of gender and group. In order to discover the statistical significance of the differences on the geometric level test, Two-Way Analysis of Variance (ANOVA) was used, and table 2 shows the results.

It is obvious from table 2 that there are no statistically significant differences on the overall geometric level test attributed to the variables of group and gender, indicating that the two groups are equivalence and there are no circumstances favoring any of the two groups over the other.

Results related to the first question

The first question of this study was as follows: "Are there a significant differences between the achievement of both groups on the post-geometric thinking test?. "For this question, means and standard deviation were calculated as shown in table 3.

Table 3 shows the differences between the means on the post-geometric thinking test according to the differences in the previously mentioned levels of the variables of the study. To reveal the significance of the differences between the means of the two groups and the means of the males and females, and to reveal the effect

Table 4. ANOVA results of the overall post-geometric thinking test

Source of variance	Type III Sum of Squares	df	Mean squares	F	Sig.
Group	205.350	1	205.350	37.095	0.000*
Gender	8.817	1	8.817	1.593	0.212
Gender * group	14.017	1	14.017	2.532	0.117

$\alpha < 0.05$

Table 5. Means and standard devotions of the post-geometric thinking test for the first level; "visualization or recognition level"

group	gender	No	mean	SD
control	Male	15	8.13	1.245
	female	15	8.46	1.302
experimental	Male	15	9.20	0.7746
	female	15	9.20	0.8618

Table 6. ANOVA results for the post-geometric thinking test on the first level; the visualization or the recognition level.

Source of variance	Type III Sum of Squares	df	Mean squares	F	Sig.
Group	12.150	1	12.150	10.587	0.002*
Gender	0.417	1	0.417	0.363	0.549
Gender * group	0.417	1	0.417	0.363	0.549

$\alpha < 0.05$

of interaction between gender and the group on the overall of post-geometric thinking test, Two-Way Analysis of Variance (ANOVA) was used as shown in table 4.

Table 4 shows the existence of statistically significant differences on the post-geometric thinking test attributed to the variable of group, favoring the experimental group, (F= 37.095, P= .000), and this is statistically significant. Furthermore, the result of the study shows that there are no significant differences on the post-geometric thinking test attributed to gender or the interaction between gender and group.

Results related to the second question

The second question of this study was as follows:" Are there significant differences on the geometric thinking levels test due to the group, gender, or the interaction between them?" To discover the existence of statistically significant differences on the geometric thinking sublevels post-test attributed to gender or group or interaction between them, the means and standard deviations of the all the levels were calculated, and table 5 shows performance on the first level of geometric thinking test.

Table 5 shows the differences between means and standard deviations on the post-geometric thinking test on the first level "visualization", according to the differences between the levels of the variables of the study. To discover the significance of the differences between the means of the achievement of the two groups and the achievement of male and female students' in addition to the effect of interaction between gender and group, Two-Way Analysis of Variance (ANOVA) as used, as shown in table 6.

The result of ANOVA in table 6 indicate the existence of statistically significant differences on the first level of geometric thinking, favoring the experimental group in the Gifted Center, (F= 10.587, P= .002), this value is statistically significant. Furthermore, the results indicated that there are no statistically significant differences in performance on the first level on the post-geometric thinking test attributed to gender or the interaction between gender and group. Moreover, means and standard deviations of performance on the post-geometric thinking test of the second level; the "analysis", were calculated as shown in table 7.

Looking at table 7, we see the differences between means and standard deviations on the geometric thinking second level; the analysis level, according to the differences in the levels of the variables of the study. To discover the significance of the differences between the means of the two groups, the means of male and female students, and the effect of interaction between gender

Table 7. Means and standard deviations of the post-geometric thinking test of the second level; Analysis level.

group	gender	No	mean	SD
control	Male	15	10.06	2.153
	female	15	10.26	1.437
experimental	Male	15	11.60	1.764
	female	15	12.53	1.457

Table 8. ANOVA results of the post-geometric thinking test for the second level; Analysis level.

Source of variance	Type III Sum of Squares	df	Mean squares	F	Sig.
Group	54.150	1	54.150	18.136	0.000*
Gender	4.817	1	4.817	1.613	0.209
Gender * group	2.017	1	2.017	0.675	0.415

$\alpha < 0.05$

Table 9. Means and standard deviations of the post-geometric thinking test of the third level; the informal deductive level.

group	gender	No	mean	SD
control	Male	15	7.27	1.667
	female	15	6.53	1.302
experimental	Male	15	7.40	1.404
	female	15	8.00	1.812

Table 10. ANOVA results for the post-geometric thinking test for the third level; the informal deductive level

Source of variance	Type III Sum of Squares	df	Mean squares	F	Sig.
Group	9.600	1	9.600	3.945	0.052*
Gender	6.667	1	6.667	0.027	0.869
Gender * group	6.667	1	6.667	2.740	0.103

$\alpha < 0.05$

and group variables on the second level of geometric thinking test, Two-Way Analysis of Variance (ANOVA) was used as shown in table 8.

ANOVA results shown in table 8 indicate the existence of statistically significant differences on the second level of geometric thinking favoring the experimental group in the gifted center, (F= 18.136, P= .000); this value is a statistically significant. Furthermore, the results of the study indicated that there were no statistically significant differences of performance on the second level post-geometric thinking test attributed to gender or the interaction between gender and group. The means and standard deviations of performance on the third level of post-geometric thinking test, as shown in table 9.

Table 9 shows the differences between the means on the third level post-geometric thinking test; the informal deductive level, according to the different levels of the variables of the study. To discover the significance of the differences between the means of the performance of the two groups and the means of the performance of males and females, and the interaction between gender and the group on the third level posttest, Two-Way Analysis of Variance (ANOVA) was used as shown in table 10.

The results of ANOVA in table 10 show the statistically significant differences on the third level of post-geometric thinking test, favoring the experimental group; (F= 3.945, P= .052); this value is a statistically significant value. The results also indicated that there are no statistically significant differences between the performances attributed to gender or the interaction between gender and group.

DISCUSSION

This study aimed at investigating the effectiveness of gifted students in developing geometric thinking and discovering the performance of the sample members on the geometric thinking test in general, and on each level alone according to the variables of group and gender, or the interaction between them.

The results of the study indicated that the gifted student centers are effective in developing geometric thinking. The results also indicated that the levels of geometric thinking can be mastered by the students when provided by the appropriate circumstances and the educational programs as conducted in the gifted centers, and these results agree with Mason (1995, 1997b).

Gifted centers as an educational alternative for gifted students are not the only alternative in KSA; however, good preparation of these centers makes them an educational alternative that helps develop and improve thinking skills in general and geometric thinking in particular; this is all what this study aimed at proving. Al-Zoubi and Bani Abdel Rahman (2011) indicated the effectiveness of gifted center through the administration, characteristics of center, enrichment and teachers.

The results of this study portrayed the role of the gifted centers in developing geometric thinking by finding out the statistically significant differences in the students' performances on the geometric thinking test and the test of the levels of geometric thinking. This can be attributed to the enrichment programs presented with the mathematic syllabus based on the modern strategies of instruction that helped the members of the experimental group recognize the geometric shapes and distinguish between them and comprehend their characteristics, as shown in Carroll (1998) who believes that we could achieve reasonable progress in geometric thinking when we provide the students with enrichment activities and programs that address their level of geometric thinking. The advancement of the experimental group over the control group members in the first three levels of geometric thinking (visualization, descriptive, and informal deductive levels) is attributed to the enrichment activities and the instructional strategies used in teaching the mathematics course in the gifted center which came in concordance with all the levels of geometric thinking included in this study. The activities and the programs were prepared in light of the educational phases (The information, phase, the direction orientation phase, the explication phase, the free orientation phase, and the integration phase), indicated by Van Hiele (1999) in teaching geometry.

Some might ask about the factor or the group of factors that contributed the most to the development and the improvement of the students' geometric thinking levels in the experimental group; Is it their presence in the gifted center with all the activities and programs and instructional strategies that contributed to the improvement? Is it the enrichment activities and programs specialized for the mathematic course that contributed to the improvement? Or is it the methodologies followed by the mathematics teacher? The answer to this question must take into consideration the general concept of the alternative for the gifted center; the center is the place, the curriculum, the methodology, and the integration medium for the students. Any discrepancy with these basic factors will not fulfill the basic factors of the concept of the alternative for the center. In this study the aim was not to discover the effect of the general meaning of the center; however, all the factors combined. The center, as a place or curriculum, or instructional method, or even the instructional method followed by the mathematic teacher might have had the greatest effect in developing geometric thinking, since it is difficult to control the effect of these factors due to its interference.

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REFERENCES

Al Huddaby D, Al Hammady A, Muthaffer N (2010). The effectiveness of enrichment activities in developing creative thinking in the female 11th grade students in Yemen, *Arab J. for Dev. of Talent*,. 1: 84 – 113.

Al Jarrah A (2001). Development of geometric thinking levels of the 5th to the 8th grade students, an Unpublished MA thesis, Yarmouk Unioversity, Jordan.

Al-Zoubi S, Bani Abdel Rahman M (2011). The effectiveness of gifted center as Perceived by gifted students. *Arab J. for Dev.of Talent*, 2(2): 61-89.

Bani Irsheid A (2002). Teaching geometry using cooperative explorations on sixth grade students' achievement and geometrical thinking in Irbid district. An unpublished MA thesis, The Hashemite University, Jordan.

Battista M (2002). Learning geometry in a dynamic computer environment. *Teaching Children Mathematics*, 8: 333-339.

Bell M (1998). Impact of an inductive conjecturing approach in a dynamic geometry enhanced environment. *Dissertation Abstracts Int.* 59(5): 1498.

Breen J (2000). Achievement of Van Hiele Level two in geometry thinking by eight grade students through the use of geometry computer-based guided instruction. Dissertation Abstract Int. 60: 2415.

Carroll W (1998). Geometric knowledge of middle school students in a reform based mathematics curriculum. *School Science and Mathematics,* 98: 188-195.

Chang K, Sung Y, Lin S (2007). Developing geometry thinking through multimedia learning activities. *Computer in Human Behavior*, 23: 2212-2229.

Choi-Koh S (1999). A student's learning of geometry using the computer. *J. Educ. Res. 92:301-311.*

Clark G, Zimmerman E (2002). Tending the special spark: accelerated and enriched curricula for highly talented art students. *Roeper Rev.* 24: 161-168.

Coleman M, Gallagher J (1995). Appropriate differenced services: Guides for best practice in the education of gifted children. *Gifted Child Today*, 18: 32-33.

Duatepe A (2005). The effects of drama-based instruction on seventh grade students' geometry achievement, Van Hiele geometric thinking levels, attitude toward mathematics and geometry. *Res. in Drama Educ.*10: 65-66.

Erdogan T, Durmus S (2009). The effect of the instruction based on Van Hiele model on the geometrical thinking levels of pre-service elementary school teachers. *Procedia Social and Behavioral Science*, 1: 154-159.

Halat E (2007).Reform-based curriculum and acquisition of the levels. *Eur.J.Mathematics*, *Sci. and technol. Educ.*3: 41-49.

Heinz N, Heller K (2002). Evaluation of a summer-school program for highly gifted secondary-school students. *Eur. J. Psychol. Assessment*, 18: 214-228.

Huang H, Witz K (2009). Developing children's conceptual understanding of area measurement: A curriculum and teaching experiment. *Learning and instruction,*21, 1-13

Jarwan F (2008). Giftedness, talent, and creativity. Amman :Dar Al Fikker.

John W (2001).Elementary and Middle School Mathematics: Teaching Developmentally, (4th ed.).New York: Addison Wesley Longman.

Kaminsky H (2007). The effects of an enrichment program on the academic self-perceptions of male and female culturally diverse minority gifted learning disabled students . PhD Dissertation, Fairleigh Dickinson University.

Mason M, Moore S (1997). Assessing readiness for geometry in mathematically talented middle school students. *J. Secondary Gifted Education. 8:105.*

Mason M (1995). Geometric understanding in gifted students prior a formal course in geometry (ERIC Document Reproduction Service. ED389568).

Mason M (1997b). The Van Hiele Model of geometric understanding and mathematically talented students. *J. Secondary Gifted Educ.*21:38-53.

Ministry of Education (2011). Gifted Students programs in KSA. Riyadh, KSA.

Mistretta R (2000). Enhancing geometric reasoning, *Adolescence*, 35: 365-379.

National Council of Teachers of Mathematics NCTM (2000). Principle and standards for school mathematics. From *http//www.nctm.org.*

Nogueira, S (2006). Morcegos: A Portuguese enrichment program of creativity pilot study with gifted students and students with learning difficulties. *Creativity Res. J.* 18: 45-54.

Piaget J, Inhelder B, Szeminska A (1981). The child's conception geometry. New York: Norton.

Renzulli JS, Reis SM (1991). The schoolwide enrichment model: A comprehensive plan for the development of creative productivity. In N. Colangelo and G. A. Davis (Eds.), Handbook of gifted education (pp. 111–141). Boston: Allyn and Bacon.

Rogers K (2002). Grouping the gifted and talented: Questions and answers. *Roeper Revi.* 24: 102-107.

Salem T (2001). Levels of geometric thinking of the senior elementary school students in Jarash District and their relation to gender and achievement in mathematics, unpublished MA thesis, The Hashemite University, Jordan.

Schneider A (2002). Determining the best possible programming options for gifted and talented students in small rural school district. MA thesis. University of Wisconsin-Stout.

Sharp J, Zachary L (2004). Using the Van Hiele K-12 geometry learning theory to modify engineering mechanics instruction. *J.Stem Educ.* 5: 35-41.

Van Hiele P (1999). Developing geometric thinking through activities that begin with play. *Teaching Children Mathe.* 5: 310-317.

Zeidner M, Schleyer E (1999). Evaluation the effects of full-time vs. part time educational programs for the gifted. *Evaluation and Program Planning*, 22: 413-427**.**