LEVELS OF GEOMETRIC THINKING ACCORDING TO VAN HIELE'S MODEL FOR CLASSROOM TEACHER STUDENTS AT ISRA UNIVERSITY IN JORDAN

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ABSTRACT

This study was conducted to find out the level of geometric thinking according to Van Hiele's Model (VHM) for Classroom Teacher Students in Isra University in Jordan, A total of (55) students participated in the study (20 male and 35 female). The study utilized geometric thinking test. The findings showed that the highest average was for visual level with high percent (80%), While the total level of geometric thinking was intermediate, the results showed that the sample have the first three Van Hiele levels, the findings showed also that There is a statistically significant difference ($\alpha \leq 0.05$) in Geometric Thinking level due gender in favor of female. The researcher recommends using Van Hiele's Model in mathematics teaching.

Keywords: Geometric Thinking, Van Hiele's Model, Classroom Teacher Students.

INTRODUCTION

The modern era is the era of knowledge revolution, as new information and knowledge is constantly being discovered. This calls for preparing the students for these developments, so that they can adapt to them, and train them in ways of thinking and problem solving, which necessitate the development of curricula, to keep aligned with these developments. Mathematics in general and Geometry in particular, is considered a fertile domain for the training of thinking patterns, in order to reach solutions to many lively and Mathematical problems. Geometry can be used to develop observation, measurement, experimentation and proof, by using the concepts and theories in appropriate situations (Afaneh, 2002).

Geometry, as a branch of mathematics, is characterized by realism, the ability to see and feel it. The development of mathematical thinking using Geometry is a necessary and important tool (Smith, 2013: 196), and Geometry education is a sensory and abstract learning that advances to the higher mental processes, in contrast to many other abstract mathematical subjects such as Algebra and numbers (Abbas and Absi,2007: 135), As well as many geometric shapes and models exist in life and used by the individual continuously, and this facilitates the learning of concepts and Geometric generalizations by linking them to reality (Rashid and Khashan , 2009: 15).

One of the latest trends in the development of Geometric thinking: Van Hiele model, developed by Dutch researchers Diana Van Hiele and her husband Pierre Marie Van Hiele, which was of interest at the end of the twentieth century, and many applied researches carried out to study it (Erdogan and Akkana, 2009). This model is based on the idea that learning is not connected process, but that there are leaps in the learning curve, which means that there are separate and different levels of thinking (Olivero, 2002). The Van Hiele model indicates that Geometric thinking is in sequential and seriated levels and stages, each level has its

language and terms which can be used and learned a certain level requires learning to the previous level (Seefeldt & Galper & Stevenson, 2012).
The Van Hiele model consists of five levels of Geometric thinking as follows:

First: the Conceptual Level (Visual recognition)
At this level student learns the names and distinguishes between the shapes as an integrated entity, without recognizing the properties of the shape, as he recognizes them visually only such as copying or drawing a shape and identify its parts (Hassan, 2015).

Second: Analytical Level
At this level, student distinguishes the properties of shapes without recognizing the relations between these properties. He cannot understand and recognize the definition that given to shapes, such as distinguishing between shapes according to their properties and components and test them by measurement (Abu Musa and Nimrawi, 2014), without being asked to explain how the properties are connected. Students can not present and formulate the definition accurately, and identify the necessary and sufficient conditions to achieve this definition (Salem, 2011).

Third: Informal inductive Level
Students classify shapes by their properties and are able to recognize logical relationships between them, but cannot prove a cause by themselves (Hassan, 2015).

Fourth: Formal inductive Level
At this level, the student can think theoretically and recognize the relations between the properties as he understands the importance of mental deduction, and draw deductions from the properties and data provided, and provides logical proofs (Markworth, 2010).

Fifth: Abstract level (Extreme Accuracy)
At this level, the student can compare different Geometric systems, such as Euclidean and non-Euclidean, and is aware of the importance of logic and the various methods of proof (Taha, 2015).

Problem of the study
The international tests such as the TIMES test revealed a lot of defects in the Mathematics Curricula and the levels of students in Jordan, where they pointed to the poor performance of Jordanian students in Mathematics in general and in Geometric in particular, where the average performance of their international student counterparts was lower (National Center for Human Resources Development, 2016), which calls for more attention to the methods of teaching Mathematics and ways to provide to students.

The researcher, through his work as a teacher of Mathematics for undergraduate students in the Department of Classroom teacher, the weakness of the students' Geometric thinking and the low level of their achievement in a basic course in basic concepts of Geometry, starting with the classroom activities and the results of the monthly and final tests, this is due to the teaching method used in the teaching of Geometry, which does not take into account the levels of thinking among students and gradation in teaching, where many previous studies indicated that the lack of sequence of curricula and Geometry subjects commensurate with the levels of thinking and teaching methods can lead to a large number of students will fail in develop a proper understanding of Geometric concepts, Geometric reasoning and solving Geometric skills (Utley 2007, Obaid, 2002: 211).

As all of this, this study was used to identify the levels of Geometric thinking according to the Van Hiele model for students of the Classroom teacher department at Isra University in Jordan.

Therefore, the problem of research was determined in answering the following questions:

- What are the levels of Geometric thinking according to the Van Hiele's model for Classroom Teacher students at Isra University in Jordan?
- Is there a statistically significant difference ($\alpha \leq 0,05$) in the levels of Geometric thinking among Classroom Teacher students at Isra University due to gender?

Importance of The Study

Geometry is one of the important branches of Mathematics. It is the true link between Mathematics and the real world. It is linked to the ability to think. It is a vital and enjoyable subject. It occupies an important place in the curriculum of all levels of education (Van de Walle, 2001).

The study of Geometric can be used for the development of thinking due to its coverage of perceived life problems and the students' need to follow the scientific logic to prove and validate the solution. This led the researcher to choose this particular branch of Mathematics.

The importance of this study is also highlighted in the following aspects:

- Identifying students' Geometric thinking levels may benefit teachers in developing teaching, improving their performance in the classroom, and taking into account van Hiele's geometric thinking levels in building and planning Geometry curricula so that these curricula include appropriate Geometric thinking skills for students.
- The development of the test of Geometric thinking and its application to students in universities is an important means that may help to reveal the extent to which Mathematical methods contribute to the development of Mathematical thinking in general and Geometric thinking in particular. This in turn reflects the need for continuous development of Mathematics curricula and the introduction of educational strategies capable of developing my Geometric thinking students of that stage of education.
- The lack of Jordanian and Arab studies that were concerned with the levels of Geometric thinking, especially in the university education stage (According to the researcher).

Terminology And Procedural Definitions

- Van Hiele's Model: It is a teaching method of Geometry consisting of five main areas, namely, the conceptual level (Visual recognition), the analytical level, the level of Non-formal Reasoning, the level of formal reasoning, the abstract level (Extreme accuracy) (Van Hiele, 1999).
- Levels of Geometric Thinking: they are mental processes and skills of the individual to develop ideas related to Mathematical situations and experiences in Geometry and contain stages of learning through which students progress in a hierarchy (Khasawneh, 2007). It is defined by the researcher as the degree to which students have the five levels of Geometric thinking according to the Van Hiele model and measured by the mark obtained by the student when answering the paragraphs of each level in the Geometric thinking test prepared for this purpose, these levels are: the conceptual level (Visual recognition), the analytical level, the informal level of reasoning, the formal level of reasoning and abstract level (Extreme accuracy).
- Basic Concepts in Geometry: It is the content in the Basic Concepts Course in Geometry 2015-2016, which is taught to the students of the Department of Class Teacher at Isra University using a university book written by (Hamzeh, 2013).

The topics included are: Triangle, quadratic polygons and angles.

- Classroom teacher: is one of the specialties taught in the Faculty of Educational Sciences at the University of Isra and grants the student a bachelor's degree and is prepared to teach the basic stage minimum for the first three grades.

Study Limitations

- The sample of this study included 55 students from a basic concepts course in Geometric in the Classroom teacher department at Isra University in Jordan.
- The study was conducted in the first term of the academic year 2016/2017.
- The study tool is a test in Geometric thinking developed for study purposes, so the generalization of the results depends greatly on the degree of reliability of the tool and its stability.
- The study included five levels of Geometric thinking according to Van Hiele model, which limits the generalization of the results of the study to other models of Geometric thinking.

LITERATURE REVIEW

The study of (Hassan, 2015) aimed to identify the levels of Geometric thinking among the students of the Mathematics Department at the Faculty of Education, University of Baghdad. The study sample consisted of 206 students from the Mathematics department who were randomly selected, in order to achieve the objective of the study, the Harby 2003 standard was adopted for the Saudi environment and consists of 25 paragraphs. The study reached the level of the first level (visual) by 84.5%, while the students did not exceed the four levels and there are no statistically significant differences in the levels of Geometric thinking of gender variable or school year.

Ibrahim (2014) conducted a study aimed at investigating the change of Van Hiele levels of Geometric thinking in the students of the teachers in the classroom (open education) in the Faculty of Education at the University of Damascus after their study of Geometric concepts and methods of teaching and relation to their achievement in school, the study sample consisted of 101 male and female students in the fourth year. The results of the study showed that Van Hiele levels of Geometric thinking in the students of the Classroom teacher in (Open education) has changed positively after studying the concepts and teaching methods, The results of the study showed that there was a strong positive correlation relationship at the level of (0.01) between the students' degrees on Van Hiele's experience of Geometric thinking and their degrees on the achievement test in Geometry.

Abu Musa and Nimrawi (2014) conducted a study aimed at identifying the levels of Geometric thinking in the subjects of the conical sections of the Mathematics students. The study sample consisted of 203 students from the Mathematics Department at Zaytoonah University in Jordan, for four years, a test was built to measure the four levels of Geometric thinking described by Van Hiele as follow: The results indicated that there were statistically significant differences in the performance of students according to the level of the school year. The study of (Ibrahim and Nansour, 2011) aimed at determining the distribution of Van Hiele levels of Geometric thinking among the eighth grade students. The sample consisted of 400 students from the eighth grade students (male and female) from the public schools in Lattakia Governorate. The researcher used the Van Hiele test for Geometric thinking; the results showed that there was no statistically significant difference between the mean scores of males and females in Van Hiele's Geometric thinking.

The study of (Alqurashi, 2010) aims to measure the level of Geometric thinking among the Mathematics students at Umm Al-Qura University. The study sample consisted of 191 students who were exposed to the tests of Geometric thinking according to the Van Hiele model, the results of the study showed a low level of Geometric thinking among students, where about 40% of students in the second level of Geometric thinking levels, which is the analytical level.

In the (Halat, 2008) study aimed at investigating the levels of Geometric thinking of middle and high school teachers during service, the study sample consisted of 148 teachers (49 males and 61 females) randomly selected from schools in Antalya, Turkey, The results of the study showed that teachers possess all levels of Van Heile for Geometric thinking. The results also showed that there were no statistically significant differences in relation to stage or gender.
In 2007, Khasawneh conducted a study aimed at investigating the levels of thinking in the field of space Geometry in the tenth grade students in Jordan. The study sample consisted of 310 students who responded to the first four levels of thought of Van Hiele theory. The results of the study showed that (71,94%) of the students were classified in one The four levels are in descending order: Non-formal Reasoning, formal reasoning, analytical, or visual reasoning, and 19.03% of students were classified below the first level (cognitive), while (9,03%) of the students were not classified within any of the four levels, Results showed also that there is a significant difference due to gender in favor of females.

The study of (Abssi, 2006) aimed to find out the impact of training of the 7th grade mathematics teachers at the geometric thinking levels in the achievement of their students in geometry, the development of their geometry thinking levels and their attitudes towards geometry. (64) students from 7th grade participates in this study, and divided equally into experimental and control groups. The researcher prepared a training program on the geometric thinking levels based on Van Hiele's model and the researcher prepared an achievement test and also prepared a test in the geometric thinking and he also prepared a measure of students' attitudes towards geometry to achieve the purpose of the study. Results of the data analysis showed that there were statistically significant differences between the two experimental and control groups in favor of the experimental group and also results showed that there were statistically significant differences in attitudes of students towards geometry for the two experimental and control groups in favor of the experimental group.
In the study of (Ding and Jones, 2006) that aimed to screen the geometric education in Shanghai schools in china, education strategies employed by teachers and thinking levels employed by the 8th grade students where the class observations, interviews with teachers and students, analysis of students' tests and their homework were used. Results showed that teachers use the common educational model (introduction, revision, new content, exercises, summary and homework), as for students their geometric thinking levels were between the 1st and 4th level of Van Hill levels.

(Al-Qudsi, 2003) conducted a study aimed to find out the geometric thinking levels for Faculty of Education students "pre-service mathematics teachers" in accordance with Van Hill model. The researcher prepared a measure for geometric thinking in accordance with Van Hill standards. The test was applied on a sample of 120 male and female students of Faculty of Education, Sana'a University. Results of the study showed that 27, 5% of the sample individuals they were classified into one level and 28, 3 % of students were under the 1st level.

The study of (Salem, 2001) aimed to explore Van Hill standards of geometric thinking for students of the higher level of basic education in Jerash Governorate. The sample of study consists of 532 male and female students submitted to a test in geometric thinking levels. Results of study showed that the existence of thinking levels absence, where the sample individuals of the second level of Van Hill standards, and there is no differences in statistically significant between the level of male and female in geometric thinking.

General Comments On The Literature Review:
Through the general overview of previous studies can provide the following observations:
- Some previous studies conducted on undergraduate students such as studies of (Hassan, 2015; Ibrahem, 2014; Abu Musa and Nimrawi, 2014; Al-Qurashi, 2010; Al-Qudsi, 2003). While some other studies concerned with teachers during service such as study of (Hallat, 2008; Abssi, 2006) while some studies conducted on students of the basic stage, such as study of (Ibrahim and Nasour; 2011; Khasawneh, 2007; Abssi, 2006; Ding and Jones; 2006; Salem, 2001).
- Some previous studies determined geometric thinking levels in accordance with Van Hill model, but it varied in its results where some previous studies showed that the existence of all Van Hill standards of its sample (Ibrahim and Nasour, 2011; Hallat, 2008). While other studies indicated to the possession of the first four levels by sample (Ibrahim, 2014; Abu Musa and Nimrawi, 2014; Khasawneh 2007; Ding and Jones 2006). While other studies' results indicated to not exceed the sample to the second level (Al-Ramhi, 2014;Al-Qurashi, 2010; Salem, 2001). Other studies' results indicated to not exceed the first level of Van Hill standards by the majority of sample individuals (Hassan, 2015; Al-Qudsi, 2003).
- The results of some previous studies have shown that there are no differences in levels of geometric thinking that are related to gender, such as studies (Ibrahim and Nasour, 2011; Hallat, 2008; Khasawneh, 2007; Salem, 2001).
- Researcher has benefited from previous studies in many aspects including formulation of the study problem, determination of its questions; prepare the study tools and statistical methods of data analysis and benefit from the results of studies and recommendations.
- The current study is characterized by addressing all geometric thinking levels according to Van Hill models and comes to complete the educational literature related to geometric thinking levels of the undergraduate students because the undergraduate students could reach all Van Hill standards for geometric thinking, thus this study is considered one of the little studies (according to researcher) that tried to develop geometric thinking levels for the undergraduate students.
- In addition, this study is characterized by the researcher's development of a test to measure geometric thinking levels for students of class teacher's department in course of "basic concepts in geometry".

METHODOLOGY

Researcher used the descriptive analytical method which is based on the description of what is already existed and its interpretation, interested in determining problems and factual circumstances, as well as interpretation, analysis and classification of data, approve the study of phenomenon as it actually exists and it is treated as an accurate description (Melhem, 2000: 324).

Study Population And Sample

The community of study consisted of students of class teacher department at Faculty of Educational Sciences in Isra University for the academic year 2016/2017, their number

is(390) male and female students according to the statistics of Department of Admission and Registration at the University.

The sample consisted of (55) male and female students, from basic concepts of geometry, of class teacher department students, the sample individuals were chosen by a deliberate manner because the researcher works as a member of the teaching staff at Isra University thus facilitating the study.
The researcher ensured the equivalence of study group according to gender variable, through using "t" test to ensure the equivalence of study sample in the pretest as included in table (1).
Table (1): "t" test for the geometrical thinking pretest due to sex

Sex	Freq.	Mean	S.D	T- Value	Significant
Male	20	9,31	2,08	0,91	0,52
Female	35	8,97	2,51		

Table (1) showed that the difference between the experiment and control group individuals is not statistically significant, where the value of "t" (91.0) is not Significant at the level of ($\alpha \leq$ 0,05) thus there is equivalence between the sample study individuals due to gender variable in geometric thinking levels upon pre-measure.

Study Tool

Researcher prepared a test to measure the five levels of geometric thinking in accordance with Van Hill model (conceptual level (optical recognition), analytical level, informal inductive level, formal inductive level and abstract level), for class teacher students on the subjects of the first unit (basic concepts in geometry) in the course of basic concepts in geometry, after analyzing the content of the unit, which includes three main themes, namely: triangle, polygons and angles. The test included (30) statements of multiple choice, and each statement has four alternatives, one of which is correct, covering the level of five geometric thinking according to Van Hill model, as follows:

- Conceptual level: (8) statements (from 1-8)
- Analytical level: (9) statements (from 9 – 17)
- Non-Formal Reasoning level: (5) statements (from 18 – 22)
- Formal Reasoning level: (4) statements (from 23 – 26)
- Abstract level: (4) statements (from 27 – 30)

The following table (2) shows the distribution of test statements at the five levels of geometric thinking and on the topics of the unit.

Table (2): The distribution of test statements at the five levels of geometric thinking and the topics of the unit

Thinking Level	**Conceptual %27**	**Analytical %30**	**Informal inductive %17**	**Formal inductive %13**	**Abstract %13**	**Total %100**
Topics						
Triangle %20	1	2	1	1	1	6
Polygons %63	6	6	2	3	2	19
Angles %17	1	1	2	0	1	5
Total %100	8	9	5	4	4	30

Each statement has one point in the case of the correct answer and zero in the case of the wrong answer and thus the test maximum score is (30) degrees, and the minimum score is (zero). The appropriate time for the test was determined by taking the mean between the fastest and the slowest student in answering the test, based on the sample of the (30) students

who study the same course of the students of the classroom teacher and outside the study sample. It is (45) minutes.

In order to verify the validity of the test, the test and the specifications table were presented to an arbitration committee composed of the members of university teaching staff, who are specialized in the curriculum of mathematics, measurement and evaluation, and then the researcher made the necessary adjustments, which focused on the validity of the distribution of levels of geometric thinking on the contents of the unit, and the validity of the wording of the text of the questions and some alternatives.

The geometric thinking test was applied to a sample of students from the study community and from outside the study sample. The number of students was (30), and the correlation coefficient between the students' scores was calculated on each field of geometric thinking and their marks on the overall geometric thinking test. The results were as follows:

Table (3): Correlation coefficient between the students' scores on each field of geometric thinking and their marks on the overall geometric thinking test

Thinking Level	**Conceptual**	**Analytical**	**Informal inductive**	**Formal inductive**	**Abstract**
Correlation Coefficient	*0,72	*0,48	*0,68	*0,60	*0,56

- Significant at the level ($\alpha \leq 0,05$)

The results shown in Table (3) show that the correlation coefficients between students' scores on each field of geometric thinking and their scores on the total geometry reasoning test are statistically significant. This indicates that the statements of each area of geometric thinking are an authentic indicator of the measurement of total geometric thinking.

In order to verify the stability of the test, it was applied to a sample of (30) male and female students of the Classroom teacher department outside the study sample, from those who studied a course in basic concepts in geometry. The same test was re-applied two weeks later on the same sample, according to the coefficient of correlation between the two application periods using Pearson correlation coefficient. Its value was 86%, which was considered sufficient for the purposes of this study.

Study Procedure

- Reviewing the theoretical literature and previous studies related to the subject of the study.
- Developing the geometric thinking test to be applied to the study sample.
- Determining the study sample by choosing a division for the Basic Concepts in Geometry course from the Classroom teacher Department at Isra University.
- Applying the geometric thinking test on a sample of the study community from outside the study sample to verify the psychometric characteristics of the test.
- Applying the geometric thinking test on the study sample during the first semester of the academic year 2016/2017.
- Correcting the test in order to analyze the data using the statistical package for social sciences (SPSS) and answering the study questions.

Statistical Treatment

In order to answer the study questions, the mean and standard deviations of the students' scores on the geometric thinking test were extracted and for each level. The ratio of student

acquisition to each level of geometric thinking was also calculated according to the degree of dissection. The One-way ANOVA test was used to determine the differences between the average scores of students on the five-level geometric thinking test according to the gender.

RESULTS AND DISCUSSION

Results Related To The First Question: What are the levels of Geometric thinking according to the Van Hiele's model for Classroom Teacher students at Isra University in Jordan?

In order to determine the estimated value of the required level of performance (degree of dissection) to classify the student to acquired or not acquired of the level of geometric thinking, (60%) and above have been adopted to pass each level by the members of the research sample.

The level of students' acquisition of the levels of geometric thinking according to the arithmetic mean was divided into three levels: (high, medium, low). Table (4) presents this classification.

Table (4): Classification Criteria for student's level of geometric thinking (Cut points)

Thinking Level	High	Medium	Low
Conceptual (8 Items)	6,40 and above	4,80- less than 6,40	Less than 4,80
Analytical (9 Items)	7,20 and above	5,40- less than 7,20	Less than 5,40
informal inductive (5 Items)	4,00 and above	3,00- less than 4,00	Less than 3,00
formal inductive (4 Items)	3,20 and above	2,40- less than 3,20	Less than 2,40
Abstract (4 Items)	3,20 and above	2,40- less than 3,20	Less than 2,40
Over all test (30 Items)	24 and above	18- less than 24	Less than 18

Arithmetic means and standard deviations of the student scores on the geometric thinking test were calculated at each level. The frequency and percentage of students' acquisition of each level of geometric thinking was also calculated, depending on the degree of dissection for each level. Table (5) shows these results.

Table (5): Arithmetic means and standard deviations and acquisition of each level of the student scores on the geometric thinking test

Thinking Level	Mean	S.D	Acquisition Level	Order	Frequency*	Acquisition Percentage**
Conceptual	6,90	1,03	High	First	44	%80
Analytical	7,33	1,27	Medium	Second	36	%65
informal inductive	3,39	0,92	Medium	Third	34	%61
formal inductive	1,54	1,83	Low	Fourth	13	%24
Abstract	1,02	0,90	Low	Fifth	8	%15
Total	20,18	1,20	Medium			

*Frequency: The marks ≥ Cut point.

** Acquisition Percentage: The ratio between marks ≥Cut point to the total number of students

It appears from the results in the table (5) that the highest levels of the Geometric thinking in terms of Arithmetical Mean is the Conceptual Level at a high level of (80%) percentage of students, followed by the analytical level at an average of (65%) of students, then the non-Formal Reasoning Level at an average of (61%) of students, then the Induction Formal Level at a low level of (24%) of students, while the Abstract Level was ranked fifth at a low level of (15%) of students, while the Thinking Percentage about the Acquisition in the Geometric thinking of the test was an average, which indicates that the study sample had the first three levels of Van Heel's Levels.

These results can be attributed to the teacher's focus on the Conceptual Knowledge, so the students can identify and name thereof, which contributes to the Conceptual Level comes in the first rank and mind processes of a low-level, and the Professor focuses on the Procedural Knowledge that requires to work in a routine manner, whether understanding or without understanding, which has contributed to the Analytical Level and non-formal Induction Level that inferred at the Average Level and a higher degree of cutting, where the students have showed the ability to analyze the Geometric Shape, and identifying the Characteristics and Definitions Description and formulation and provide the Non-formal Deductions.

The Results showed that the Student's Acquisition degree of formal Abstract Level was low, this may be due to the fact that the Professor rarely focuses on the Applied Knowledge, which it has been shown through the Student's Understanding to the Mathematical Ideas and the interrelationship between these ideas, and the ability to link the ideas that refers to the Meaning, which leads to that the student does not use Logic to justify whether the step is validity or a wrong one, and this is reflected on the Student's Performance in Geometry Concepts, such as: Proofing of unfamiliar relationship, following the Proof Steps, Abstract Deductions, and the use of the Mathematical Logic, which require a widely known and a thinking lives up the Higher Mental Process such as Composition and Evaluation.

The Student's Acquisition of the Geometric thinking Level Sequence and Order may be logical, by knowing the Conceptual Level that requires the Knowledge of the Characteristics of the shapes and their distinction, which this level does not require higher levels of thinking compared to other levels, which rely on the Knowledge of Mathematical Geometry and the Ability to know the elements to reach a set of Compatible Serial Sentences that eventually lead to a logical and correct provision for judging the veracity of the Phrase. These results are consistent with the Geometry Nature, which constitutes an integrated the Construction of a skill, which Knowledge Level relies on the Relationships linkage and discovery thereof (Abssi, 2006).

These results are consistent with Van Heel's Geometry Characteristics, which indicate the constant sequence of students who passed through the previous level before reaching the next level. However, the Students' Number decreased with the High Level, specially, the Last Level requires the Abstract Thinking which was lacking to many of Students, which leads to the Inability of the student to reach the Positive & Negative of the discussed Case correctly, this is in line with what has been pointed out in many previous studies in the Proof & Logical Reasoning Field at mathematics in general and Geometry in particular, which refereed to the Students' Inability to conclude and proof at all School and University Levels (Taha 2015, Ding and Jones, 2006).

The results of this Study are differ from the Studies Results of (Ibrahim and Nansour, 2011; Halaat 2008), which indicated all five Van Heel's Levels for the sample thereof, and also

differ from the Studies of (Ibrahim 2014; Abu Musa and Nimrawi, 2014; Khasawneh, 2007; Ding and Jones, 2006) which referred to the owning only of Van Heel's first four levels, and the Studies of (Al-Ramhi 2014; Al-Qurashi, 2010; Salem, 2001) which indicated that the sample not exceeded the Second Level, and the Studies of (Hassan, 2015; Al-Qudsi, 2003) which indicated that most of Individuals did not exceed Van Heel's First Level, this may be attributed to the difference in the sample and the Educational Material in the Current Study on the Previous Studies.

Results Related To The Second Question: Is there a statistically significant difference ($\alpha \leq 0,05$) in the levels of Geometric thinking among Classroom Teacher students at Isra University due to gender?

To determine the existence of the Statistically Significant Difference in Students' Acquisition of the Geometric Thinking Levels due to gender, the Arithmetic Mean and Standard Deviation have been calculated for the Student's Marks due to their Gender, on all levels of the Geometric thinking and overall test, Table (6) shows these Results.

Table (6): Arithmetic Mean and Standard Deviation due to Gender, on all levels of the Geometric thinking and overall test

Thinking Level	Gender	Frequency	Mean	S.D
Conceptual	Male	20	6,38	1,11
	Female	35	7,42	1,46
Analytical	Male	20	6,76	1,02
	Female	35	7,90	1,25
informal inductive	Male	20	3,19	1,08
	Female	35	3,59	1,37
formal inductive	Male	20	1,42	1,26
	Female	35	1,66	1,22
Abstract	Male	20	0,76	1,00
	Female	35	1,28	1,16
Total	Male	20	18,51	2,64
	Female	35	21,85	3,18

The Results in Table (6) show that there are Significant Differences between the Arithmetic Mean for the Students' Marks due to their Gender, at the four levels of Geometric thinking and the Overall Test, and to determine the differences Significance between the Arithmetic Mean of the Students' Marks on the Geometric thinking due to their Gender, then a One-way analysis of Variance has been used, and the Table (7) shows these Results.

Table (7): One-way ANOVA for students scores on the geometric thinking test levels due to gender

Thinking Level	Source of Variation	Sum of Square	Degree of Freedom	Mean Squares	F Value	Significant
Conceptual	Gender	0,021	1	0,021	6,051	0,042
	Error	0,466	53	0,466		
	Total		54			
Analytical	Gender	0,632	1	0,632	5,380	0,031
	Error	0,31	53	0,31		
	Total		54			
informal inductive	Gender	0,954	1	0,954	7,912	0,034
	Error	0,369	53	0,369		
	Total		54			
formal inductive	Gender	0,242	1	0,242	6,911	0,038
	Error	0,337	53	0,337		
	Total		54			
Abstract	Gender	0,211	1	0,211	7,131	0,030
	Error	0,317	53	0,317		
	Total		54			
Total	Gender	1,850	1	1,850	0.125	0,035
	Error	2,270	53	2,270		
	Total		54			

The Results in Table (7) show that there are Significant Statically Differences between the Arithmetic Mean of the Male & Female Students' Marks on each of the Four Levels of Geometric thinking and on the Overall Geometric thinking, which the value was "T" a statistical function at the Significance Level ($0.05 \geq a$) and according to the Arithmetic Mean in Table (5) the differences go for the Females, which refers to that the Geometric thinking Levels of the Females are better than Males.

The Researcher has attributed the fact that the females in the Class Teacher Department are more serious/active in the Study than the Males, the students have showed great interest in answering the Test Questions on the contrary to the Males, according to the Researcher's Notes, which contributed to the classification of a larger number of Males including the different levels compared to males.

The Females motivation in the study for Class Teacher specialization is different from the Males, while most females seek to the highest marks for the Purposes of Employment in

Schools and the Completion of the Postgraduate Studies in specialization, and most males hope to obtain just the University Degree regardless of the marks for the purpose of their Social outlook, and this what has been confirmed by the study of (Abdul-Haq and Hamzeh, 2014).

This Result is consistent with the Study of (Khaswaneh, 2007), while opposing to the Studies of (Ibrahim and Nansour, 2011; Halaat 2008; Salem 2001), whose results indicate the absence of Differences in Geometric Thinking Levels due to Gender.

RECOMMENDATIONS

In light of the achieved findings, the study recommends the following:
- Paying attention to the application of Van Hiele's levels of geometric thinking in the educational process by teaching, preparing questions and geometric issues in light of the levels of this model, as well as training teachers of mathematics to be employed in the teaching process, through holding of workshops for teachers.
- Reviewing the geometric curricula, methods of teaching in different educational stages and organizing them in sequence according to the levels of Van Hiele for geometric thinking, working to enrich them with activities and exercises appropriating to the level of geometric thinking of students and qualifying them to move to the next level.
- Conducting further studies on the level of student acquisition of levels of geometric thinking on other communities.

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