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THE EFFECT OF MULTIPLE-INTELLIGENCE AND MEDIATING ROLE OF THINKING SKILLS ON THINKING PATTERNS AMONG TENTH-GRADE STUDENTS IN PRIVATE SCHOOLS IN ABU DHABI

ALI MOHAMMED AHMED DAWAHDEH

SULTAN IDRIS EDUCATION UNIVERSITY

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ALI MOHAMMED AHMED DAWAHDEH

DISSERTATION SUBMITTED IN FULFILLMENT OF THE REQUIREMENT FOR THE DEGREE OF DOCTOR OF PHILOSOPHY (PEDAGOGY)

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ACKNOWLEDGMENT

Praise be to Allah (SWT) who said: {My Lord, enable me to be grateful for Your favor which You have bestowed upon me and upon my parents and to work righteousness of which You will approve and make righteous for me my offspring. Indeed, I have repented to You, and indeed, I am of the Muslims."} (Surah Al-Ahqaf, verse 15). Allah (SWT) also said: {'If you are grateful, I will surely increase you [in favor]} (Surah Ibrahim, verse 7). Moreover, it was narrated by AbuHurayrah that the Prophet (SAAWS) said: "He who does not thank Allah does not thank people" (Sunan Abi Dawud 4811). I thank Allah (SWT) for what He blessed and honored me for this work of research and granted me success in it. I would also like to thank my teacher and supervisor, Dr. Mohammed Yousef Mai for his advice, encouragement, understanding and a lot of support. He taught me to love and appreciate knowledge and scholars through his supervision and guidance. I am particularly deeply grateful to him for his time and patience. Furthermore, I thank all my lecturers at Sultan Idris University, the staff of the Education department, as well as the library and postgraduate institute staff (IPS). I also thank and appreciate the examiners for their comments and advice. Also, all thanks and appreciation to my family members for the suffering they suffered with me and their great patience throughout the work of this research. I thank everyone who helped me in completing this research. In conclusion, I pray to Allah to accept this thesis for His sake and to be a successful start. I do not claim that I have reached the top of knowledge, I have tried, but perfection belongs to Allah alone. I ask Allah (SWT) to grant us all success in what is in our goodness and contentment. All praise be to Allah, the Lord of the worlds, and peace and blessings of Allah be upon the Prophet Mohammed.

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ABSTRACT

This study aimed at modelling the relationship between multiple-intelligence and thinking skills and its influence on developing patterns of thinking among the 10th-grade students in private schools in Abu Dhabi. The researcher used descriptive approach. Structure equation modelling was used in analysing correlation coefficients between variables to direct or indirect effects, as well as evaluating the relative importance of independent variables in interpreting the total variation of the dependent variable. The study sample constitutes of 350 students from five private schools in Abu Dhabi. The study used three instruments, namely Gardner's multiple-intelligence scale, the thinking skills scale, and the thinking patterns scale. Data were also analyzed using descriptive statistics, correlation coefficient and Amos. The results showed significant positive relationship between multiple intelligences (IV) and thinking patterns (DV) through critical thinking as the MV. A direct relationship was found between linguistic intelligence (IV) and thinking patterns (DV) (r=.284) as well as a positive relationship between social intelligence (IV) and thinking patterns (DV) directly (r=.241), natural intelligence (IV) and thinking patterns (DV) directly (r=.113), musical intelligence (IV) and thinking patterns (DV) directly (r=.270), and between bodily-kinaesthetic intelligence (IV) and thinking patterns (DV) directly (r=.470). However, in the case of creative thinking is the MV, the results showed that there is a significant positive relationship between social intelligence (IV) and thinking patterns (DV) directly (r=.241). While it was found between natural intelligence (IV) and thinking patterns (DV) directly (r=.113), musical intelligence (IV) and thinking patterns (DV) directly (r=.000), and between bodily-kinaesthetic intelligence (IV) and thinking patterns (DV) directly (r=.000). These findings reveal the relationship between multiple-intelligence and thinking skills and their influence on developing patterns. The study recommended conducting more similar studies in government schools, as well as in other school levels and in other academic levels.

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KESAN KECERDASAN PELBAGAI DAN PERANAN KEMAHIRAN BERFIKIR TERHADAP CORAK BERFIKIR DI KALANGAN PELAJAR-PELAJAR GRED KESEPULUH DI SEKOLAH SWASTA DI ABU DHABI

ABSTRAK

Kajian ini bertujuan untuk memodelkan hubungan antara kecerdasan pelbagai dan kemahiran berfikir dan pengaruhnya terhadap pengembangan corak pemikiran di kalangan pelajar kelas 10 di sekolah swasta di Abu Dhabi. Pengkaji menggunakan pendekatan deskriptif. Pemodelan persamaan struktur digunakan dalam menganalisis pekali korelasi antara pemboleh ubah ke kesan langsung atau tidak langsung, serta menilai kepentingan relatif pemboleh ubah bebas dalam menafsirkan total variasi pemboleh ubah bersandar. Sampel kajian terdiri daripada 350 pelajar dari lima sekolah swasta di Abu Dhabi. Kajian ini menggunakan tiga instrumen, iaitu skala kecerdasan pelbagai Gardner, skala kemahiran berfikir, dan skala pola berfikir. Data juga dianalisis menggunakan statistik deskriptif, pekali korelasi dan Amos. Hasil kajian menunjukkan hubungan positif yang signifikan antara kecerdasan pelbagai (IV) dan corak berfikir (DV) melalui pemikiran kritis sebagai MV. Hubungan langsung didapati antara kecerdasan linguistik (IV) dan corak berfikir (DV) (r = .284) serta hubungan positif antara kecerdasan sosial (IV) dan corak berfikir (DV) secara langsung (r = .241), semula jadi kecerdasan (IV) dan corak berfikir (DV) secara langsung (r = .113), kecerdasan muzik (IV) dan corak berfikir (DV) secara langsung (r = .270), dan antara kecerdasan kinaestetik badan (IV) dan corak berfikir (DV) secara langsung (r = .470). Namun, dalam hal pemikiran kreatif adalah MV, hasilnya menunjukkan bahawa terdapat hubungan positif yang signifikan antara kecerdasan sosial (IV) dan pola berfikir (DV) secara langsung (r = .241). Walaupun didapati antara kecerdasan semula jadi (IV) dan corak berfikir (DV) secara langsung (r = .113), kecerdasan muzik (IV) dan corak berfikir (DV) secara langsung (r = .000), dan antara kecerdasan kinaestetik tubuh (IV) dan corak berfikir (DV) secara langsung (r = .000). Penemuan ini mendedahkan hubungan antara kecerdasan pelbagai dan kemahiran berfikir dan pengaruhnya terhadap perkembangan pola. Kajian itu mengesyorkan untuk melakukan kajian yang lebih serupa di sekolah kerajaan, dan juga di peringkat sekolah lain dan di peringkat akademik yang lain.

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A A panel of experts

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CHAPTER 1

INTRODUCTION

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1.1 Introduction

This chapter provides a brief explanation of the study. It includes the background of the study, problem statement, research objectives, research questions, and research hypothesis. Also, it explains the conceptual framework, the significance of the study, the scope of the study, operational definition and summary.

1.2 Background of Study

Multiple-intelligence is a new concept that many teachers might be unaware of, and they still think that intelligence is one type only. Any student has strong and weak intelligence

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capabilities. The strong intelligence capabilities of the students must be used to train their weak capabilities. For example, a student who is weak in math concepts may understand them better if they are embodied musically, and students who are weak in language arts skills can express things through drawing (Jayaseely, 2020). Teachers have to understand the different types of intelligence to help students discover how to use their multiple intelligences in the taught lesson. Besides, teaching them the practical applications needed to enhance and improve the weaknesses in their intelligence abilities and give them the opportunity to use their intelligences in the classroom.

Teaching thinking skills is an important goal of education. Schools should do everything they can to provide thinking opportunities to their students. Moreover, many teachers consider the task of developing the student's ability to think as an educational goal that they place at the top of their priorities (Jarwan, 2007). Developing thinking would develop the learning (educational) process, as it makes students more aware of their mental processes.

Asqool (2009) explained that thinking can be developed within the framework of education which aims at forming the critical mentality of the students, so that they can judge the ideas and perceptions to mentally determine their consistency and harmony. However, critical education is opposed to the conventional teaching; the latter refers the person to a pot where every creative interaction gets shut down, and the only way to integrate into society is to totally accept the perceptions and to comply with the provisions imposed by society, with loss of the ability to revise preconceptions or produce new ideas. (Asqool, 2009)

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Those who are interested in the education field should stay away from indoctrination as much as possible, because it is a major impediment to all mental and psychological agitations and the main reason for obedience and submission. Our true religion urged us to think and encouraged the use of intellect. Furthermore, thinking is regarded as one of the main reasons for the Islamic call/preaching. Allah (SWT) says in The Holy Quran: {And it is He who spread the earth and placed therein firmly set mountains and rivers; and from all of the fruits He made therein two mates; He causes the night to cover the day. Indeed, in that are signs for a people who give thought} (Surat Al-Ra'd, verse 3). The Holy Qur'an contains many verses that urge us to be rational, to think, to use reason, and to contemplate the creatures of Allah.

Abdel-Lateef (1989) showed that Islam gave thinking a high status and an important role in religion and the world. Thus, it can be said that thinking is one of the characteristics of the visionary believer, and this fact requires Muslims to respect this divine capacity that Allah (SWT) gifted to mankind. They should know its dimensions and nature and work on its development as much as they can (Abdel-Lateef, 1989). Also, specialists and educators have agreed upon the need to teach thinking and develop thinking skills for all students, and at their different stages, and this necessity is confirmed by two things, first, considering thinking as a skill, and second, determine which skill required to be acquired in education. Thinking is a complex and multifaceted process and is influenced by many factors and it passes through many obstacles and thorns (Al-Suhaimat, 2010).

Al-Shamsan (1996) explained that while information becomes old, the thinking skills are new, and thus, thinking is the tool by which one directs the variables of the era, and consists of the individual's tendencies, beliefs and outlook of surroundings. Therefore, the

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interest of societies has become focused on the development of people's thinking skills. Despite the technical development, there are indications that some individuals are still practicing the wrong and irrational ways of thinking and this leads to the emergence of contradictory and wrong concepts and developments, which impedes the intellectual progress of the communities. (Al-Shamsan, 1996)

Atiyyah (2015) noted that the academic failure of university students is due to their inability to think abstractly in solving problems efficiently. In addition, (Schafersman, 1991) pointed out that the low level of thinking among students is due to what teachers do in the classroom, i.e. the deficiency in transferring the academic content in various specialties, like (What to think about?) while it is supposed to be based on the understanding and evaluation of the scientific material (How to think?). Also, Hardadek noted that every student can learn how to think if he/she was granted the opportunity of training and actual adequacy practice (Atiyyah, 2015). The development of thinking skills is considered a fundamental pillar and cornerstone of all aspects of educational learning, because it prepares students for future life and qualifies them to be good and productive individuals.

Al-Otaibi (2007) stated that thinking skills must be learned through human sciences in order not to be misused. Feuerstin has applied the instrumental enrichment program, which is one of the worldwide programs to develop thinking skills, it relies on independent subjects that are not based on a specific context, and its results showed a great ability to the non-verbal deduction and this proved that thinking can be taught (Al-Otaibi, 2007). On the other hand, Ruzouqi and Abdel-Karim (2015) pointed out that thinking is a goal of education, and thus, the development of thinking is an important educational function for all institutions to help the learner in dealing with this era of information, which requires individuals with

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mature mentality, objective outlook of ideas and attitudes, and search for reasons and evidences. Thinking is a necessary process to establish a democratic life and achieve scientific and social progress. (Ruzouqi & Abdel- Karim, 2015)

Jarwan (2014) emphasized that the importance of thinking is that it is vital to discover the universe and has a great role in life and learning success. It also improves the student's achievement level and gives him/her a sense of control over his/her thinking stemming from the achievement level which makes him/her feel confident. The elements of thinking include visualization, imagination, symbolizing, muscle activities and brain functions. However, educators see that the elements and tools of thinking are to expand the student's horizons by looking at ideas including the pros and cons, organizing the ideas of the learner through analyzing the problem to primary and secondary procedures, identify the similarities and differences between the phenomena as well as the interaction between ideas, and provide the environment that helps to stimulate thinking. Educators agreed upon the following thinking patterns: scientific, empirical, logical, high-level, creative, critical, analytical, deductive and reflective thinking. (Jarwan, 2014)

Abu-Hashim (2005) pointed out that the interest in the development of creative thinking is one of the priorities of educational issues in the Arab world. Many studies and researches emphasized the role of the teacher in developing creative thinking among students, including the International Conference on Thinking (1997) and Education Curriculum and Development of Thinking Conference (2000). The Development of Arab Creativity Community made a training workshop that included the development of creative thinking skills and the importance of developing the human mind. The theories of mental formation, which tried to interpret intelligence, differed, reflecting the believers' visions of

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these theories of mental formation on one hand as well as reflecting the developments of methods of measurement and evaluation, and the statistical methods used on the other hand, where psychologists took a variety of ways to understand intelligence and its nature (Abu-Hashim, 2005). Multiple intelligences are not limited to one or two types of intelligences, but rather to several types of intelligences that include many aspects of students' lives, whether in school or practical life.

Also, Hussein (2012) noted that intelligence does not have one fixed ability measured by single measure to be determined. However, multiple intelligences are not just preparations, abilities or talents. To illustrate, Gardner suggested at the evolution of multiple intelligences that each individual possesses these intelligences in varying degrees and has a unique combination of these intelligences that can be improved to varying degrees. Moreover, Gardner showed in his book "Frames of Mind" a new concept of intelligence as an ability of solving the problems faced by the individual with unique and creative abilities that solve the problems creatively in natural situations. (Hussein, 2012)

Furthermore, Gardner considered that thinking is the processes of the mind in handling the situation content to reach a solution. According to him, a learning style is the group of intelligences and thus, the development of one or all of them facilitates the thinking processes of students. However, Gardner has criticized the intelligence tests that measure intelligence as a general mental ability (IQ), and considered to be culturally biased, because they measure only two types of intelligences, which are linguistic and mathematical, and he argued that there is no one intelligence, but multiple-intelligences. The intelligence measured by traditional methods defines one area, while multiple-intelligences are psychological abilities that influence and develop the individual’s motivation, experience and cultural

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factors. Also, Fasko (1992) suggested that the results for multiple intelligences-based programs are bigger and better and students with learning disabilities can improve better (Al-Khafaf, 2010).

Bara'edah (2012) explained that multiple intelligences proved their effectiveness in taking into account the individual differences, raising the students' level of achievement, expanding the teacher's teaching strategies, taking into account the different intelligences of students and their learning styles, and providing plans and teaching methods that grow the different sides of students' intelligences. (Bara'edah, 2012)

1.3 Problem Statement

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Thinking skills are among the most important goals that educational institutions seek to achieve. Thinking and its skills are of great importance in students' lives, so thinking is a catalyst for the students' ability to pay attention, making them able to participate effectively in various situations and encourage them to continue research processes, which ultimately leads to reaching new information and makes the student more willing to move away from wrong habits and behaviors. Also, thinking skills make students more receptive to new ideas so that they become more flexible and adapted to the surrounding environment. Developing students' skills and thinking abilities increases self-confidence and makes them more positive in communicating and dealing with people around him (Zaitoun, 2003).

Education that neglects thinking skills builds knowledge for students through indoctrination and memorization and neglecting all activities that build the student's

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experiences. Also, neglecting thinking in educational institutions lead to neglecting every activity outside the classroom and neglecting the development of positive trends and tendencies. This leads to a reduction of similar learning opportunities for all students, because the construction of tests is limited to retrieving only memorized information and neglects individual differences. Thus, it affects the level of quality education that the student needs in the future. (Langer, 2004)

Teaching thinking should be based on the multiple-intelligence theory because it has dealt in depth with all types of intelligence a student could have. The main problem is that many teachers are unaware of this new theory (Jayaseely, 2020). Since the sixties of the twentieth century, the voices of those interested in education in a number of developed countries have called for the need to review school education and direct it towards developing thinking skills and developing the multiple-intelligence among school students. This is due to the negative effects of the lack of interest in teaching thinking, which includes the inability to adapt to the surrounding environment and this negatively affects the development of plans as the student is an important social pillar of the acceleration of progress. It also affects the student's ability to find solutions to problems and limit his abilities and inability to discover himself, which affects his ability to make decisions, limits the student's acquisition of new experiences. Thus, limits his ability to insight, imagine, judge things, and not feel the joy of achievement and discovery. (Qawasmah and Abu-Ghazaleh, 2013)

Many studies, including Al-Sumaili's (2011) study, have indicated that there are deficiencies in thinking patterns and skills among students. Moreover, the study of Al-Qallab et al. (2006) has also shown that teaching thinking through the study materials is not

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sufficient, as well as the study of Qatami and Melhem (2013) indicated that taking care of students' thinking in school is a necessity. They also mentioned the low level of thinking patterns and skills among students. Furthermore, the study of Al-Saliti (2006) and Al-Atoum (2004) confirmed that huge numbers of students who are graduating from schools without any experience in dealing with problems and finding solutions and they do not have the ability to make decisions, because the learning process is limited to remembering, memorizing, and recalling information while it is being processed.

Moreover, it is necessary to develop educational policies and use strategies and means to enhance thinking in the classes. Many studies have indicated the best educational methods that contribute to the development of thinking patterns among students and the application of multiple-intelligence in the classroom. For example, Yamin (2013) and Tayeh (2016) pointed out the need to base the educational process on the theory of multiple-intelligence. Howard Gardner's theory on multiple-intelligence is an excellent framework for developing students' thinking and taking into account the different thinking styles and skills. Multiple intelligences have not been integrated into the educational curricula. This is confirmed by the study of Al-Khuzaie and Al-Amrani (2013) that the use of learning strategies based on multiple-intelligence in the classroom at an early stage allow students to develop thinking skills and patterns. Thus, students have the ability to make decisions and solve problems, which leads to meet their educational needs and life skills and acquire new experiences to keep pace with the wheel of development.

There is a need to refer to the annual report of the Knowledge and Human Development Authority in the United Arab Emirates, which revealed the results of school control process over the past ten years. The results showed common features between private

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schools with acceptable or poor performance. One of these features is the lack of focus on active and practical learning that encourages thinking and creativity, which leads to depriving many students of developing thinking skills and high-quality independent learning. Also, minority of teachers did not plan to offer activities based on thinking patterns' strategies. Moreover, teachers do not possess the necessary proficiency in using questioning methods in a way that enables students to achieve a deeper understanding and enhances their thinking skills. They do not initiate open-ended problems and applications for their students during classes and assessments. (Knowledge and Human Development Authority, 2011)

Hence, this problem in private schools in the UAE affects the students' ability to find solutions to problems and limits their abilities and inability to discover themselves, which affects their ability to make decisions, which limits the students acquisition of new experiences and ability to insight, imagine, judge things, and not feel the joy of achievement and discovery. Thus, it affects the level of quality education that the students need in the future. Therefore, the researcher believes that there is a need for conducting this research and verification of the development of thinking patterns through the relationship between multiple intelligences and thinking skills in Abu Dhabi private schools.

1.4 Research Objectives

This study has four main objectives as follows:

1. To determine if there is an effect of relationship between multiple-intelligence and thinking skills in developing thinking patterns among 10th grade students in private schools in Abu Dhabi.

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2. To determine if there is an indirect relationship between the study variables i.e multiple-intelligence (IV), thinking skills (MV) and thinking patterns (DV) among the 10th grade students in private schools in Abu Dhabi.
3. To investigate whether the proposed model can be used to explain the relationship between the study variables i.e multiple-intelligence (IV), thinking skills (MV) and thinking patterns (DV) among the 10th grade students in private schools in Abu Dhabi.

1.5 Research Questions

This study will investigate the following four questions:

1. Is there an effect of relationship between multiple-intelligence and thinking skills in developing thinking patterns among 10th grade students in private schools in Abu Dhabi?
2. Is there an indirect effect of relationship between the study variables i.e multiple-intelligence (IV), thinking skills (MV) and thinking patterns (DV) among the 10th grade students in private schools in Abu Dhabi?
3. Can the proposed model be used to explain the relationship between the study variables i.e multiple-intelligence (IV), thinking skills (MV) and thinking patterns (DV) among the 10th grade students in private schools in Abu Dhabi?

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1.6 Study Hypotheses

1. There is an effect of relationship between multiple-intelligence and thinking skills in developing thinking patterns among 10th grade students in private schools in Abu Dhabi.
2. There is an indirect relationship between the study variables i.e multiple-intelligence (IV), thinking skills (MV) and thinking patterns (DV) among the 10th grade students in private schools in Abu Dhabi.
3. The proposed model can be used to explain the relationship between the study variables i.e multiple-intelligence (IV), thinking skills (MV) and thinking patterns (DV) among the 10th grade students in private schools in Abu Dhabi.

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1.7 Conceptual Framework

The conceptual framework of the study is based on Howard Gardner's Multiple Intelligence Theory:

Gardner's states that intelligence has eight types and has identified two characteristics common to all eight types of intelligence:

1. It is not only hereditary; it can also be acquired and developed.
2. It can be learned and trained on.

This theory sees that the multiple intelligence of each individual works independently, as you also see that each individual specializes in a single or combination

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of these types of intelligence that some call (an intelligent imprint) which he uses in his dealings, and in his confrontation of the various situations and problems that he is exposed to in life. Also, everyone can develop their multiple-intelligence or take it to a higher level if they have the motivation and the appropriate encouragement and training (Al-Maloul, 2016).

Hussein (2012) stated that the classification of intelligences expresses certain characteristics, but it does not mean that individuals can be classified on the basis that they have certain traits and no other traits. Each individual has all the intelligences but they vary in different levels from one person to another. For example, a weakness in the ability to speak or write in an individual does not necessarily mean he has a weakness of linguistic intelligence, but he may have another intelligence that is used as an input to develop his linguistic intelligence.

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The theory of multiple intelligences assumes that there is no educational method or educational strategy that can be offered to all students at all times due to the different levels of multiple intelligences each one of them has, using specific strategies may be highly successful with a group of students or less successful with other groups. In order to address the individual differences among students, it is recommended that a wide range of instructional strategies be used to match students 'intelligences to effective learning and to deepen understanding. The teacher can identify students' intelligences and accordingly use appropriate activities as instructional interventions that fit those intelligences (Al-Hashemi, 2013).

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The origin of the multiple intelligences theory has begun in 1979, when Van Leer Foundation asked Harvard University to conduct a research on the evaluation of scientific knowledge and mental abilities of individuals and to demonstrate their effectiveness in different life situations. Thus, many researchers have carried out exhaustive research for many years, including Gerald S. lesser who is a psychologist, Gardner (a specialist in cognitive psychology), Scheffler and Robert La Vine who are specialists in social anthropology, and Merry White who is specialized in education in the Japanese society. The research and studies included the cognitive and mental fields and the exploration of the extent to which this potential was activated practically in reality. They conducted research in human history, science, philosophy, natural sciences and humanities. Also, they conducted many periodic scientific meetings to discuss human development issues in different cultures (Khedr, 2015). Table 1.1 below shows a summary of the multiple intelligences theory.

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Table 1.1

A summary of the multiple intelligences theory

Intelligences	Basic components	Symbolic signs	Future career (Known characters)
1. Linguistic	Sensitivity to sounds, language, structure, meanings and functions	Linguistic studies and the sound of letters in pronunciation, such as English and Arabic.	Writer and orator, such as: Martin Luther King, Abbas Mahmoud Akkad and Charles Dickens.
2. Logical/ Mathematical	Sensitivity to arithmetic and logical operations with numerical indications and long indicative chains	Computer programming and languages (e.g. Pascal language)	A mathematician and software scientist, such as Al-Khawarizmi, John Dewey and Einstein

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3.	Spatial	Visual perception of the world and the ability to correctly and accurately visualize spatial	Imagination and Accuracy	Architect: Reem Colhas
4.	Bodily-Kinesthetic	Express of thoughts using consistent and skilled body moves	Symbolic languages, such as sign language and gestures	Actor, athlete, storyteller, dancer like: Michael Jordan
5.	Musical	The ability of the person to taste musical melody, rhythm and verbal harmony	Musical tunes and rhythm of musical instruments.	Composer, Musical Instrument Maker, Lyrics Writer (Michael Jackson)
6.	Interpersonal (Social)	Capability of understanding personalities and moods	Body language such as: facial expression and insinuations	Political analyst, military leader and social reformer, such as Mother Teresa
7.	Intrapersonal (Self)	Able to understand himself and his emotions and focus on his strengths and weaknesses	Self-programming	Psychologist and therapist, religious reformer, (Freud, men of religion)

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The following framework shows the relationship between the variables of the study (i.e. multiple- intelligence, thinking skills, and thinking patterns). Then, figure 1.2 shows the model that the study hypotheses were derived from.

The studies conducted by (Abdi & Rostami, 2012; Widiana & Jampel, 2016) confirmed that there is an influence of multiple-intelligence in the development of thinking skills, where the studies showed that creative thinking can be developed in middle school students by training students to enhance thinking skills and applying motivational programs, such as modern multiple-intelligence programs that encourage innovation and learning based on multiple intelligence. Also, the study conducted by Yi,

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Sulaiman & Baki (2015) confirmed a relationship between multiple-intelligence and the development of creative thinking skills.

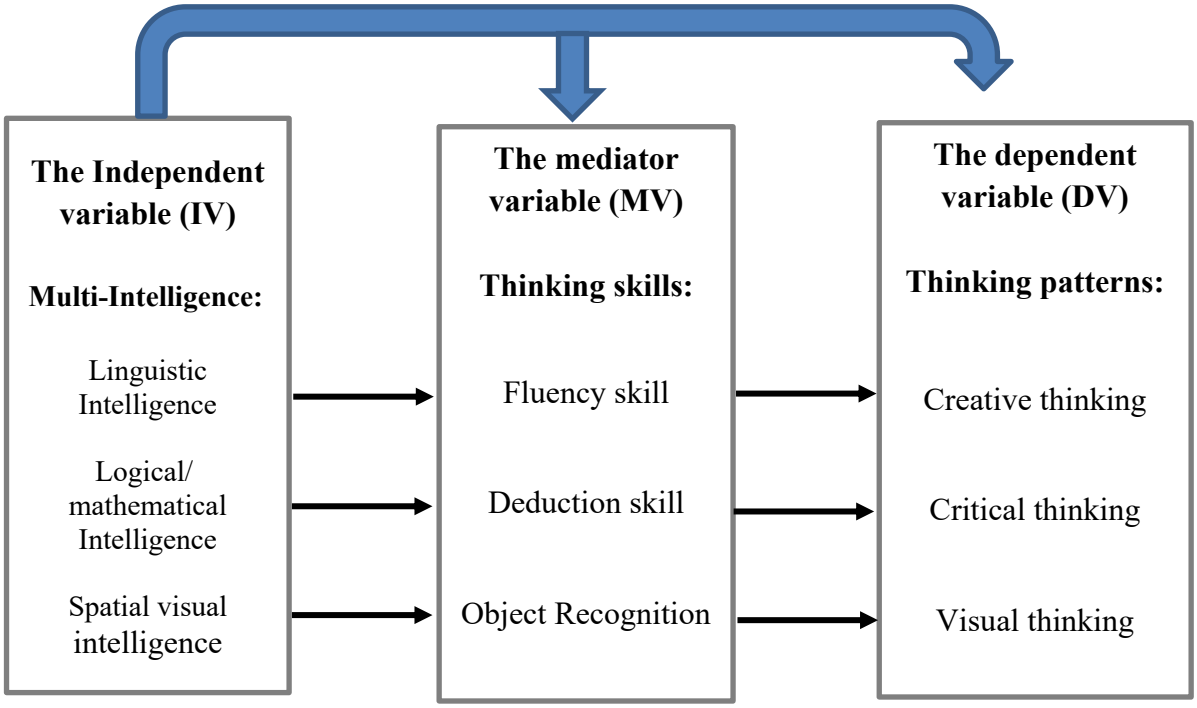


Figure 1.1 Conceptual framework of the study

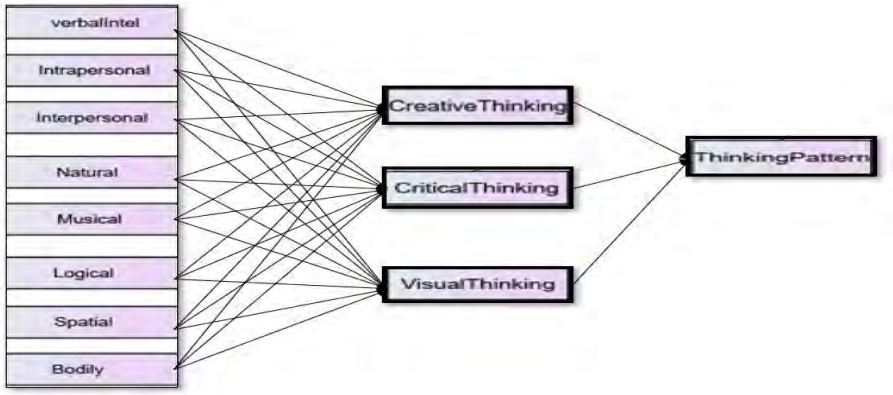


Figure 1.2 Model of the study

1.8 Significance of the Study

The significance of the study in scientific and practical aspects can be summarized as follows:

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Practical significance: Provide feedback to those who train teachers and prepare professional development programs at the actual practice level for the development of multiple intelligences, thinking skills and thinking patterns, which will help them to rethink of some teachers' training and preparation programs. Moreover, it helps workers in teaching and education field to provide training programs, guidance and mentoring for secondary school students. Also, it assists decision-makers in developing policies and strategies that contribute to the development of educational curricula in line with the abilities and needs of secondary school students.

Theoretical significance: This study may contribute to conduct other studies related to multiple intelligences, thinking skills and thinking patterns at other study grades/levels. To clarify the relationship between the variables of the study, including multiple intelligences (independent variable), thinking skills (mediator variable) and patterns of thinking (dependent variable) among grade 10th students. Also, to clarify the modelling of the relationship between multiple intelligences (independent variable), thinking skills (mediator variable) and patterns of thinking (dependent variable) among grade 10th students. This study may encourage other researchers to study this topic and its relation to some variables in other environments, curriculums and levels of study.

1.9 Study Limitations

The current study is determined by the following variables: multi-intelligences (IV), thinking skills (MV-mediator) and thinking patterns (DV), and is also determined by the nature of the sample used in the study, which is 'grade 10' students in private schools in Abu Dhabi-UAE. Time limitation: The study procedures began in year 2016 and will be completed during year 2020.

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Human limitation: Grade (10) students (males and females) in private schools in Abu Dhabi-UAE.

Spatial limitation: Private schools in Abu Dhabi / United Arab Emirates.

Objectivity: Exploring the relationship between multiple intelligences and thinking skills (deduction, discrimination of shapes and verbal fluency), and thinking patterns (visual, creative and critical) among Grade (10) students.

Determinants of the study: The results of the current study will be generalized according to a set of determinants related to the study instrument and the sample to be applied on as follows: What is provided to the instrument of the study has acceptable coefficients of validity and reliability, which will be calculated through the sample of the pilot study (not the study sample) but from the same population.

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1.10 Study Terminologies

The researcher believes that there are important terms mentioned in the current study, and need to be clarified and defined.

Intelligence: It is a latent mental ability to process data that can be activated in a cultural environment to solve problems or to create valuable products for a particular culture (Wafi, 2010).

Multiple Intelligences: Gardner (1983) defined it as a set of skills that enable an individual to solve the problems he/she encounters in life (Ar-Rubaie, 2011). On the other hand, Jaber (2003) defined it as differentiated mental skills that can be grown and developed, which Gardner had figured them out (mathematical, spatial, musical, interpersonal, intrapersonal, natural and linguistic intelligences).

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The operational definition of 'multiple Intelligences' is: The score that the examinee gets in the multiple intelligences' test used in the current study.

Thinking: It is defined as a complex knowledge process that involves information processing, based on the use of symbols, perceptions, language and concepts to reach certain outcomes (Rasha, 2017). Thinking is a mental treatment of sensory inputs that leads to the definition and judgment of things (Costa, 1985).

Thinking patterns: The mental processes of thinking can be classified into groups to distinguish each type from the other. Perhaps the multiple types of thinking are evidence of the increasing interest of researchers in studying it. According to some researchers, thinking is classified into correct and incorrect thinking patterns, as well as patterns based on analogous pairs, including (divergent and convergent thinking, inductive and deductive, innovative and critical, realistic and imaginative, formal and informal, creative and high level, logical and scientific, contemplative and successive, visual and analytical, and tangible and abstract thinking).

The operational definition of 'thinking patterns' in the study is: The score that the examinee gets in the thinking patterns' test used in the current study.

Critical thinking: It is the thinking that makes the learner subject the information to analysis, sort and test to determine a suitable level of information in order to distinguish between wrong and sound ideas (Atiyyah, 2015).

Thinking skills: Wilson defined them as mental processes performed by the brain to collect, store, or save information through analysis, planning and evaluation processes, reaching to conclusions and formulating decisions. Also, Atiyyah (2015) defined it as mental processes that intentionally process information and data to achieve different educational objectives, including remembering information, describing things, and stabilizing observations, predicting, classifying things, evaluating evidence, solving

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problems, and reaching results (Atiyyah, 2015). Thinking is the overall process by which the brain processes sensory inputs mentally to form ideas. However, thinking skills are specific mental processes that are used to deal with the information and data presented in a situation, such as problem identification skill, and setting assumptions …etc.

The operational definition of 'thinking skills' in the study is: The score that the examinee gets in the thinking skills' test used in the current study.

Secondary School Level:

It is the last stage of compulsory education received by all students, after passing the basic education stage of primary and middle/intermediate grades. It is the stage that determines the university major or specialization that the student will join after high school graduation, or the profession to be learned later. The so-called higher education or secondary schools often begins during the teenage years.

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1.11 Summary

This chapter provided a brief explanation of the study. It has included the background of the study, problem statement, research objectives, research questions, and research hypothesis. Also, it has explained the conceptual framework, the significance of the study, the limitation of the study, and operational definitions.

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CHAPTER 2

LITERATURE REVIEW

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2.1 Introduction

In this chapter, the concept of intelligence will be discussed and the most important related theories. Thinking and intelligences theory and the relationship between multiple intelligences and thinking along with its skills and patterns will be highlighted. Moreover, each intelligence pattern of the multiple intelligences and the role of the multiple intelligences theory will be discussed from the practical side. Also, this chapter will discuss the thinking and its definition and the related theories that have been researched, and the most important thinking patterns and skills will be studied.

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2.2 The Concept of Intelligence

Intelligence as a concept in educational psychology should be as in the researcher's opinion not exclusive on measuring linguistic and logical intelligence only. It should be in many and multiple intelligences covering all parts of human life. Previously intelligence was only measured on two parts: linguistic and logical only. If the student was skilled on these two skills he would get high marks in intelligence tests, while other students who were not highly skilled on them would get low marks on intelligence measurements.

Gardner (2004) identified intelligence as a vital psychological effort to deal with the information that an individual could encounter in a particular cultural environment, with the aim of solving problems or producing valuable output in one or more cultural contexts, depending on the requirements of the culture in which the person lives (Gardner, 2004). On the other hand, it was interpreted by Hussein (2003) as a mental ability that enables people to learn, remember, and use information in an appropriate manner (Hussein, 2003).

2.3 Theories of Intelligence

The scholars studied intelligence in all its sides. Therefore, they came up with different theories on how they studied it. Also, mental capabilities have been diversified which contain each theory on its own; some theories discussed many capabilities of intelligence and others discussed many capabilities that include intelligence. Thus, the

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theories that discussed intelligence and studied it from various sides were diversified and differentiated. The differences between the theories come back to the differences in the number of mental capabilities that shape the intelligence of the individual (the student).

Al-Zayyat (1995) explained that there are many theories that attempted to provide practical explanations of the mental activity in terms of its determinants, components and factors. The concept of intelligence differed in its formation from unilateral to bilateral and to multidimensional. We will review some of the most important theories that interpreted the concept of intelligence, including:

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2.3.1 One Factor Theory

Intelligence is one of the characteristic dimensions of personality that is evident with the growth of an individual and defined intelligence as the ability to guide thoughts or ability to act against situations, as well as the ability to directly adapt to new attitudes with self-criticism and reform. Also, the perspective of the one factor theory did not provide a convincing explanation of mental activity and its components and determinants and it did not undergo sufficient systematic or procedural experimentation. (Al-Zayyat, 1995)

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2.3.2 Two-Factor Theory

This theory is one of the theories that studied intelligence from different sides. Spearman is considered the father and author of this theory and this theory is considered very important and critical for studying intelligence and the capabilities that consist of it.

Al-Arbis (2013) mentioned that Spearman pointed out that intelligence can be influenced by two factors, the first factor is 'the general factor' which combines both mental and cognitive abilities and this indicates the common abilities in the mental tasks performance, and second, 'the specific factor' which consists of several different factors, while each factor is limited to a manifestation of mental and cognitive activities. Moreover, 'the general factor' is a fixed capacity for the individual and all the abilities associated with him/her and its degree differs from one person to another and its high degree will increase the success of a person in life. On the other hand, one of the characteristics of 'the specific factor' is that it differs from one mental process to another because of the lack of correlation between two mental processes. Also, these specific factors are numerous and thus, two mental phenomena or processes cannot be combined in one specific factor (Al-Arbis, 2013).

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2.3.3 Cattell's Theory

This theory is considered, according to the researcher, one of the theories that do not lean to an ethnicity or a gender over the other, it is one of the theories that is considered unbiased for a culture over another or a gender over the other, it does not rely on the linguistic sides like previous theories. No matter what their languages or their cultures, students will still achieve high marks if they answer Cattel intelligence test that measure the mental capabilities whereas learners will get low marks if they do not answer the test questions that measure their mental abilities. The researcher previously applied the Cattel intelligence test in one of his studies on a public school students sample and that the test was not affected by the culture, race, or gender of the student (the learner).

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Abu Hatab (1980) pointed out that (Raymond Cattel) has indicated two factors of intelligence called fluid and crystallized intelligence. Fluid intelligence is not related to culture and deteriorates with aging and it is measured by cognitive, understanding and reasoning tests. In addition, it does not rely heavily on educational experiences. However, it recognizes the relationships adopted in new environments. On the other hand, crystallized intelligence is measured by numerical and linguistic skills and the use of synonyms. Experience and schooling greatly influence this crystallized intelligence and its development and it does not deteriorate with aging. (Abu Hatab, 1980)

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2.3.4 Multi-Factor Theory

Thorndike's Theory;

Thorndike theory is considered one of the theories that defined intelligence consist of many mental capabilities not specified mental capabilities. It considers intelligence not limited to two capabilities which are, linguistic and logical intelligence, but Thorndike rather considered intelligence as wider and more general. Thorndike is considered the father and author of this theory, he tried to study intelligence in different sides and mentioned that intelligence consists of many capabilities, and learners have these capabilities that collectively shape up intelligence.

Nashwati (1996) mentioned that Thorndike has defined the intelligence as a large number of separate independent capabilities, which is known as the Multi-factor theory. Intelligence depends on the number of connections or neural connections an individual has, which connects the stimuli and responses, and also explained that Thorndike distinguished the types of intelligences based on the problem or the situation as the following types:

1. Abstract intelligence (Theoretical): It is the ability an individual use in understanding meanings and symbols of verbal words and numbers.
2. Mechanical intelligence (Practical): Consists of the capacities in which the individual handles perceived objects and situations.
3. Social intelligence

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Thorndike did not neglect the social intelligence as did many other theories. He rather focused on it and considered it not any less important from the other mental capabilities. Understanding the feelings and sentiments of other people and accepting them as they are, is just as important as the other mental capabilities that shape up intelligence, when the learner understands the feelings and sentiments of others and accepting them as they are shows a high level of social intelligence. The capable learner can express his feelings and sentiments to others in a big way and that shows a high level of social intelligence unlike the learners who keep their feelings and sentiments hidden and do not express them to their colleagues, and we as teachers and educators must teach and train the learners on expressing their feelings and sentiments to others from their youth and to not feel shy from expressing what they feel. It is the abilities required to communicate with people, understand them and this includes the emotional balance and the ability to influence and respond to the feelings of others. (Nashwati, 1996)

2.3.5 Thurston's Theory

Abu Shakra and Ghabari (2010) pointed out that Thurston showed that the axis of intelligence consists of seven mental abilities as follows:

1. Verbal comprehension ability: This mental ability is to understand the meanings of words, linguistic expression, ideas and definitions.
2. Verbal fluency ability: This ability is involved in the fluent use of words.

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3. Numerical ability: Mental activity characterized by the ease, rapid and accuracy of arithmetic computation.
2. Spatial visualization ability: Visual perception of spatial relations and movement of flat and stereoscopic shapes.
3. Memory ability: Mental task characterized by direct recall of words, numbers and shapes.
4. Perceptual speed ability: The mental ability, which is characterized by rapid recognition and proofreading of the details.
5. The ability to infer: inference is classified into two types:
    a. Inductive reasoning: A mental ability to use reasoning from the specific to the general.
    b. Deductive reasoning: A mental ability to deduce the individual parts and cases from the generalized results, and the independence of mental abilities, i.e., the correlation coefficients are zero. (Abu Shakra and Ghabari, 2010)

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2.3.6 Guilford's Theory

Guilford is considered one of the scholars who researched intelligence and its theories and worked on adding new mental skills over the common ones from the old intelligence theories. He stated that there are more than a hundred mental skill included in the intelligence of the learner (individual). Thus, intelligence tests must measure learners' intelligence from its different sides, so that they measure all the mental skills

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that the learners have, and this will give a more comprehensive and precise idea over the learner's intelligence.

Abu Jado (2004) found that Guilford's theory is one of the most comprehensive, multi- capacities of intelligence theories, with a total of 120 different intellectual abilities. It is assumed that mental activity is determined by three dimensions:

a. Content dimension: It involves five dimensions: auditory, visual, symbolic, semantic and behavioral contents.
b. Operations dimension: It contains five operations: cognition, memory, divergent production, convergent production, and evaluation.
c. Products dimension: It includes relations, classes, systems and implications.

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Intelligence is information processing, a qualitative energy that reflects the adequacy of one's mental functions. (Abu Jado, 2004)

2.3.7 Sternberg's Theory

This theory is considered one of the theories that studied intelligence, but Sternberg restricted intelligence in three components.

Nofal (2007) explained that there are three basic aspects of intelligence contained in Sternberg's theory (analytical, creative and practical). The first aspect is measured by the usual tests of intelligence. Sternberg emphasizes on the importance of

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maintaining a balance between analytical, creative and practical intelligences. The nature of intelligence is based on linking abilities. Human intelligence is an interactive process used in various aspects of life, because the individual constantly tries to understand the environment in which he lives. Therefore, the tests measure only a small part of the mind skills of individuals, and not all the skills of the human mind. (Nofal, 2007)

After reviewing the theories of intelligence, the researcher inferred that these theories vary with each other from each other's point of view and vision of intelligence from a different angle. Theories of intelligence have evolved and changed with the passage of time, so that they become integrated with each other in dealing with and studying intelligence in depth. The perspective of the one factor theory did not provide a convincing explanation of mental activity and its components and determinants and it did not undergo sufficient systematic or procedural experimentation. Then, Spearman pointed out that intelligence can be influenced by two factors, the first factor is ‘the general factor’ which combines both mental and cognitive abilities and this indicates the common abilities in the mental tasks performance, and second, ‘the specific factor’ which consists of several different factors. After that, Sternberg's theory explained that there are three basic aspects of intelligence contained i.e. analytical, creative and practical. Then, Thorndike has defined the intelligence as a large number of separate independent capabilities, which is known as the Multi-factor theory. However, Guilford stated that there are more than a hundred mental skill included in the intelligence of the learner (individual). Thus, intelligence tests must measure learners’ intelligence from its different sides. Guilford’s theory is one of the most comprehensive, multi- capacities

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of intelligence theories, with a total of 120 different intellectual abilities. These theories will continue to change and update in the future according to studies, experiments and research that will deal with intelligence in all its aspects.

Theories of intelligence vary in scope. Each theory formed an amendment and development of the intelligent theories that preceded it. Also, each theory was supported by some researchers, and criticized by others who observed some deficiencies and weaknesses in the theories. However, these theories remain strong support and scientific evidence to be cited in related scientific and human research and disciplines (Al-Khafaf, 2011).

The two-factors theory (by Spearman) indicated two main factors, which are (the general factor and the specific factor). The general factor combines all activities of mental and cognitive abilities, while the specific factor is limited to a manifestation of the phenomenon measured by the test and the correlation indicates the conjugative expression that the test measures. However, this theory uses small size of the experimental sample (64) students. Likewise, the lack of tests used, which is limited to five tests only. Also, the multiple factors are not similar or close, as well as the difference in the general factor from one experiment or test to another, and the difference is according to the characteristics of individuals (Al-Hashemi, 2013).

While the primary abilities' theory (by Thurston) indicated that the factors express abilities are completely independent of each other, that means no statistically significant correlation exist. The theory indicated seven independent factors called

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primary abilities. These primary abilities do not mean the absence of correlation while it means the presence of a low correlation. The primary ability is the basics on which cognitive activity and the complex abilities are based, that means there are correlation coefficients designed between the parts of the test, where Thurston identified deficiencies in the concept of mental age, which was adopted by the scientist (Binet) in determining the standard scores as it allows the child to be compared with his colleagues in age. It also avoids the use of mental age with adults. However, Guilford's Structure of Intellect theory is based on three dimensions, which are comprising operations, contents, and products. Guilford also indicated that thinking includes (knowledge, production and evaluation) While intelligence refers to short-term intelligence and long-term intelligence. This model is one of the clearest theoretical models in contemporary psychology and it is also distinguished in that it is summarized in its clear logic and taxonomic foundations that depend on events and the most accurate classification models. The theory has contributed to the development of factor analysis research so that it gives the researcher a frame of reference which supports large degree of logic by many empirical evidence. (Askool, 2009)

However, there are some criticisms, including that many researchers' studies' results have not been consistent with the results of Guilford's research, including (Adkins) in inference, (Bottrum) in closure and (Fouad Abu Hatab) in critical thinking. Besides, the uncertainty of the extent of overlapping mental abilities which is regulated by Guilford's Structure of Intellect theory, as it did not apply comprehensive tests for the various categories of tripartite dimensions, as well as for its lack of evidence of external validity (i.e. the extent to which the Guilford tests measure) to determine the

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factors of thinking in real life and professional and educational issues, and it is the closest model of intelligence to experimental psychology. (Al-Maloul, 2016)

Moreover, Cattell's theory showed that there are two factors: the general fluid ability, and the second is the general crystallized-ability. According to Cattell, intelligence mainly refers to the mental competence that is not verbal and free from cultural factors, such as the ability to perceiving visual shapes and forms, perceive sequences, relational matrices, and form analyzes. But the crystallized intelligence (general ability) are the various skills and knowledge acquired from culture, such as tests of numerical abilities, information, mechanical skills, and vocabulary. (Hussein, 2012)

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2.4 The Relationship between Intelligence and Thinking

There is a relationship between intelligence generally and multiple-intelligence in particular and thinking along with its skills and patterns. That is what many researchers and psychologists in their studies and researches showed, no researcher or student can deny that relationship. Intelligence does its role through thinking and affects it, and through intelligence thinking skills can be updated, growing thinking skills needs high intelligence from the individual. The more intelligence is practiced by the learner through applying thinking skills the more thinking patterns are updated Batdal (Karaduman & Cihan, 2018).

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Al-Sorour (2000) has shown that thinking and intelligence are connected to each other and are fundamental to the learning process. Intelligence depends either on genes or early education or a combination of both. In addition, thinking is the skill practiced by intelligence through experience-based activities. This is the true relationship between intelligence and thinking. (Al-Sorour, 2000)

The prevailing belief among psychologists, including Spearman, was that intelligence is inherited and that the superiority in a field means that the person is inevitably superior in all other fields, and this belief perceived the intelligence as a main attribute of the brain, and that this main attribute is inherited and all thinking abilities are derived from. Moreover, Al-kathiri and Al-Nathir (2000) demonstrated that Binet has designed a tool to measure various functions of intelligence, such as attention, observation, excellence, memory, and imagination, to conclude that intelligence is not a single general ability, but rather a multitude of abilities that contribute to its development. That is, thinking is the tool used by intelligence to deal with information and experience and to employ and utilize them to the maximum extents, possibilities and capabilities (Al-Sorour, 2000).

Abu-Zainah (2012) pointed out that logical intelligence and visual intelligence are closely related to mathematical thinking. To illustrate, there is a relationship between mathematical intelligence and all patterns of mathematical thinking, because the owner of this intelligence has the ability to use numbers and reasoning effectively and includes sensitivity to patterns, relationships, logical and abstract issues, and the ability to think logically. In addition, this intelligence includes sensitivity to logical

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models and relationships to the need to integrate intelligence theories into mathematics teaching since childhood. (Abu-Zainah, 2012)

If a child grows up in a musical family with musical instruments, his or her musical intelligence is likely to grow and mature, and if you grow up in a large family, you may have time to develop promising aspects of your intelligence, including interpersonal intelligence.

2.5 Definition by Theory

The multiple-intelligence theory has principles including that the weakness of one side (traits) of the intelligences types does not mean general weakness in intelligence, but only limited on that specific trait that the learner suffers from, because the learner's intelligence in light of this theory has different various relational levels for every type of intelligence. For example, a public speaker can give a speech to an audience and persuade them but may not be able to play the piano or sing or play a musical instrument. Also, a musician can play musical instruments but not be able to give a public speech to an audience (Alqatanani, 2017).

Petracco (2006), Morgan (1996), Mounir Moussa (2007) and Jaber Abdel-Hamid (2003) mentioned that the classification of intelligences expresses certain characteristics, but does not mean that individuals can be classified on the basis that the person possesses certain traits and no other traits. Each individual has all the

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intelligences but they vary in different levels from one person to another. For example, a weakness in the ability to speak or write in an individual does not necessarily mean he/she is weak in linguistic intelligence, but he/she may have another intelligence that is used as an input to develop his/her linguistic intelligence. The theory of multiple intelligences assumes that there is no educational method or educational strategy that can be offered to all students at all times due to the different levels of multiple intelligences each one of them has, using specific strategies may be highly successful with a group of students or less successful with other groups to address the individual differences among students.

Thus, it is recommended that a wide range of instructional strategies be used to match students 'intelligences to effective learning and to deepen understanding. The teacher can identify students' intelligences and accordingly use appropriate activities as instructional interventions that fit those intelligences of his/her students in secondary schools. (Petracco, 2006, Morgan 1996, Mounir Moussa, 2007 & Jaber Abdel-Hamid 2003)

2.6 The Concept of Multiple Intelligences

The concept of multiple-intelligence theory is considered very important. This theory changed looking at intelligence generally and introduced another understanding for intelligence. It has also rejected the single general intelligence idea and showed the existence of multiple intelligences that the learner has, which is considered as the mental

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capabilities that learners have and can use in their everyday lives (Winarti, Yuanita & Nur, 2019).

Ezzeddin and Al-Awadhi (2006) and Baraedah (2012) have identified the theory of multiple intelligences as a theory developed by Gardner, which enables educators to find teaching methods that help learners master the subjects and create an exciting classroom environment, including activities and assessment tools that respond to eight types of intelligences, which are linguistic, logical, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal (Ezzeddin & Al-Awadhi, 2006 & Baraedah, 2012). The researcher thinks that the number of multiple intelligences can be increased in the future and not be only limited to the eight intelligences stated earlier. Continuing research will work on discovering and reaching for other new multiple intelligences that cover all the sides of the learners' lives.

Al-Samaili and Al-Zahrani (2013) believe that the theory of multiple intelligences is one of the important educational theories reached to by Gardner and published in his book "Frames of Mind". Since then, the theory has evolved from theoretical to practical aspect. The researchers work in each field to use them experimentally and practically to make maximum use of the development of family members and school students. (Al-Samaili & Al-Zahrani, 2013)

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2.7 Historical Roots and the Emergence of the Multiple Intelligences Theory

The origin of the multiple intelligences theory has begun in 1979, when Van Leer Foundation asked Harvard University to conduct a research on the evaluation of scientific knowledge and mental abilities of individuals and to demonstrate their effectiveness in different life situations. Thus, many researchers have carried out exhaustive research for many years, including Gerald S. lesser who is a psychologist, Gardner (a specialist in cognitive psychology), Scheffler and Robert La Vine who are specialists in social anthropology, and Merry White who is specialized in education in the Japanese society. The research and studies included the cognitive and mental fields and the exploration of the extent to which this potential was activated practically in reality. They conducted research in human history, science, philosophy, natural sciences and humanities. Also, they conducted many periodic scientific meetings to discuss human development issues in different cultures.

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2.8 Foundations and Principles of the Theory of Multiple Intelligences

According to Rayyan (2013), intelligence is not a single type, but multiple and various types which work independently and their levels vary within an individual. In addition, the intelligences vary in growth and development, both intrapersonal and interpersonal.

1. Types of intelligences are all vital and dynamic.

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2. The multiple intelligences can be identified.by their distinctions, descriptions and definitions
3. Multiple intelligences can be developed and raised if individuals have motivation and if appropriate training and encouragement is found for their development.
4. The levels of multiple intelligences differ from one person to another. Moreover, each person has a unique combination of these intelligences which can contribute to the development of another type of these intelligences. Furthermore, the mental and cognitive capacities as well as the sub-capacities and skills behind each type of the multiple intelligences can be measured and evaluated. (Rayyan, 2013)

In addition, Jaber (2003) explained that intelligences work in a complex way. The ways in which an individual expresses his or her own multiple kinds of intelligence are different. Also, the multiple intelligences may change with the change of information about the theory itself, and most people can develop all types of intelligence to reach an appropriate level of efficiency as all intelligences work together in complex ways. Multiple intelligences are not directly recognizable, but we are inferred to them through our behaviors and reactions to internal and external influences. There are things in which we show great abilities to demonstrate our intelligence in a particular field (Jaber, 2003).

Gardner (1993) has developed a set of foundations that supported and demonstrated the validity of this theory, which became the basis upon which the theory was based. These foundations are the ability to isolate intelligence as a result of brain

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damage, the possibility that any type of intelligence maintains a kind of relative independence if the brain is damaged. Moreover, Jaber (2003) spoke about:

1. The existence of extraordinary children, such as the miracle child.
2. The existence of individuals with different competencies confirms the possibility of observing human intelligence in its isolated and independent forms. Although it is related to genetic factors and neurological areas of the brain, it emphasizes the existence of specific intelligence. For example, a child with damage to the left frontal lobe, the so called ‘Broca's area’, affects the child's ability to speak, read and write, but he/she might be able to sing, dance and meditate.
3. A distinguished development history and a set of clear tools to determine experience. Each activity depends on an intelligence that has a developmental path, and this activity has time for its inception in early childhood and a peak time during the individual's life. (Jaber, 2003)
4. A support from psychometric results: Tests that measure certain intelligence are closely related to another type of intelligence and are less related to other intelligences, such as the Wechsler test, which measures the intelligence of children, and gives an indication of the availability of some types of intelligence in individuals.
5. A central process that can be characterized and defined: Each type of intelligence needs a set of central actions and processes that can be performed by various activities towards that intelligence. For example, musical intelligence needs components that are sensitive to sounds and the ability to distinguish rhythms. Similarly, the rest of multiple intelligences.

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In addition, Nofal (2007) and Al-Shami (2008) indicated that encoding is in a symbolic system is the ability to encode with one of the aspects that distinguishes humans from other creatures. Each type of intelligence has unique symbolic drifts that distinguish it from other intelligences. For example, mathematical intelligence contains a set of spoken and written symbols in different languages, as well as spatial intelligence, including a set of symbols used by engineers and designers. In addition, the evolutionary history, each type of intelligence has historical roots. For example, spatial intelligence originates from drawings and fossils found in caves. Also, the best evidence of the existence of musical intelligence is the old musical instruments found. (Nofal, 2007 & Al-Shami, 2008)

2.9 Criteria for the Formation of Intelligence Skills

Wafi (2010) noted that Gardner has set several criteria for the formation of intelligence skills, including:

a) The ability to create important and influential productions or to devise new ways and means to raise and resolve issues.

b) The ability to solve problems and confront situations with attention to quality, not quantity, to examine the method used in solving problems.

c) The ability to create new issues and situations that add something new or new information (Armstrong, 2006).

d) The capability of encoding in symbolic system.

e) A development history and a set of clearly defined tools. These criteria came from developmental psychology, logical analysis and traditional psychology research.

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f) Support from psychometric results: It is the standard measures of human capacity, some people get high rate of linguistic intelligence, but might get low rates in the images and figures parts. (Wafi, 2010)

Jaber (2003) pointed out that Gardner has relied on some criteria to support his theory, which are the possibility of isolating intelligence as a result of brain damage, the presence of extraordinary children, such as the miracle child, a distinct developmental history and a set of clearly defined and experiential tools, evolutionary history, support of psychometric results, support from experimental psychological tasks, a definable core process or set of processes and procedures, the capability of coding in a symbolic system (Jaber, 2003).

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Table 2.1

Illustrates the difference between right and left brain teachers

Right-brain teachers	Left-brain teachers
1. Prefer to teach using hands in the lecture.	1. Prefer teaching using lecture and discussion.
2. Enter art, pictures and music in their lessons.	2. Place charts on the board and like to paste tables.
	3. Giving students questions and solving them independently.

Table 2.2

Illustrates the difference between right and left brain students

Right-brain students	Left-brain students
1. Prefer to work collectively.	1. Prefer to work alone.
2. Like to do art projects, industrial arts, design and planning.	2. Like to read independently.
	3. Prefer to be in a quiet class.

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2.10 The Importance of the Theory of Multiple Intelligences in Education

Ar-Rubaie (2013) mentioned that this theory is one of the theories that have a great role in the educational aspect, as it focused on things that were overlooked by other theories. Many talents were overlooked because of the reliance on individual assessment and intelligence tests. However, this theory helps to uncover individual abilities and differences. The educational importance of the theory of multiple intelligences is illustrated as follows. The researcher showed that this theory has a logical side (practical) which is not indispensable in the educational ground because it covers many of the sides related to the learners' studying and practical times. This makes the learner varies his educational choices so that they can cover many of the multiple intelligences, which will be as educational episodes that the student will learn from and in the end make for a bridge to the student's goals.

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This theory is based on the processes that the mind follows in order to solve the problem. It attempts to describe how individuals use their multiple intelligences to solve a problem and it helps teachers expand their strategies to reach as many learners as possible. Also, it has no specific rules, except for the requirements proposed by the cognitive components of each type of intelligence. It proposes solutions that enable teachers to design new curricula and to handle and present content differently (Ar-Rubaie, 2013).

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The multiple-intelligence theory is useful to the teaching aspects of the teachers. When teachers exploit this theory in all its sides, it makes them enjoy the teaching job especially if they use the theory right, it makes the classroom environment an attractive and fun environment for the students. Making corners (areas) inside the classroom so that each type of multiple intelligences has a corner (area) inside the classroom, this will make the students go to the corner which from there they will know and apply that multiple intelligence they desire. For example, students that desire and love linguistic intelligence go to the linguistic corner and practice all kinds of activities that are related to linguistic intelligence such as, reading stories and tales, synonyms and grammar and writing stories and novels, they can also interview other students in journalistic style and so on and so forth, same with other multiple intelligences corners.

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Furthermore, Hussein (2003) explained that helping teachers to improve their performance in the education process and the possibility of adopting multiple intelligences as an input in teaching styles will take into consideration the nature of the learners in the classroom. Moreover, this theory stems from the learners' interests and takes into account their preferences and abilities. It also guides all individuals to the job that suits their abilities and tendencies, improves students' achievement levels and raises their levels of interest towards educational content. Gardner believes that when providing information through multiple intelligences, it produces several things, including that it reaches as many learners as possible; students realize that they are more likely to express themselves and increase the ability of learners to present what they understood from the taught lessons in multiple ways (Hussein, 2003).

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2.11 Types of Multiple Intelligences

Linguistic/verbal intelligence.

The linguistic intelligence comes at the beginning of multiple intelligences in the theory discussed because it is the most used and easiest for individuals. Individuals who are skilled in this intelligence have strong speech charisma and are brave to stand in front of large audiences and give strong speeches, as the strong words and expressions make the speaker (student) enjoy great linguistic intelligence. A lot of celebrities enjoy linguistic intelligence like Martin Luther King, Barack Obama, Gamal Abdul-Nasser, Hitler and others. When the students are accustomed to reading stories, novels, books, magazines and newspapers, they will vastly enhance their linguistic and mental intelligence, which will most likely make them talented writers, authors, public speakers in their future. The family must provide a small library in the house that includes books, novels and newspapers to make them available for all family members, which makes them attracted to this library, and consequently, they will be used to practicing reading, and consequently developing their linguistic intelligence abilities significantly.

According to Al-Khafaf (2010), linguistic intelligence (verbal) is the intelligence of words and is shown through storytelling, ease of dealing with language, speech and sense of words. The gifted person with this intelligence has a high ability to memorize numbers, names and objects.

Characteristics of the gifted student in linguistic intelligence (verbal):

- Write better than those of his or her age.
- Enjoy reading books.

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- Has a high ability to communicate with others.
- Has a strong memory to save names of people, places and dates.
- Skillful in storytelling and jokes making.
- Has a great deal of vocabulary and terminology.
- Enjoy word games, arranging events and spelling skills. (Al-Khattab & Al-Hammadi, 2018)

Logical-Intelligence:

Logical intelligence comes at the second place after linguistic intelligence in the eight intelligences specified by Gardner's theory. This intelligence includes a big proportion of students, it requires much understanding and knowledge for the students to be good in this skill.

Is the intelligence of numbers and dealing with them effectively and with high capacity? It focuses on scientific thinking, problem solving, inductive and deductive ability, critical thinking skills, classifications and relations between things, guessing, reasoning, organizing ideas, sequence, analysis of events and providing proofs, arguments and evidence of things and the relationships that bind these things.

Characteristics of the gifted student in logical intelligence:

- Asking questions and inquiries about how things work.
- Enjoy mathematics and good in mental arithmetic.
- Has a great ability to classify things and deal with logical puzzles.

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- Has a great sense of causes and results compared to classmates.
- Enjoy chess, strategic and mathematical computer games and advanced mathematics skills.
- Like to perform experiments that show and require higher thinking skills. (Al-Khafaf, 2010)

Spatial/visual intelligence:

This type of intelligence comes in third place after linguistic and logical intelligences. It requires a huge capability in imagination and understanding the relationship between spaces, coloring pictures, and video games especially 3D ones. Many students like this kind of intelligence, as it makes them enjoy and be creative when practicing applications related to this intelligence. Thus, teachers can spend students' interest for this type of intelligence by engaging them in activities in the teaching process so that students can benefit from it to the maximum benefit that is expected of it.

It is the intelligence of picture, the ability to perceive the visual world accurately and to visualize the relative place of objects in the vacuum, and the formation of mental images and using imaginations in solving problems. This requires sensitivity to pictures, colors, lines, shapes, space, and relationships. It also requires the ability to think about the picture, awareness, shapes, structures and models, and the owner of this intelligence has the ability to mental imaginative thinking through images, sketches, visual perception, working with puzzles, reading maps accurately, color coordination, decoration, sculpture, drawing and coloring.

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Characteristics of gifted students in visual intelligence: Najm (2007) has shown that it is a student who:

- Reads maps and charts well.
- Takes over daydreaming more than classmates.
- Enjoys artistic activities, drawing shapes, producing visual reports, watching movies and visual reviews.
- Interested in pictures more than words.
- Likes to play with notebooks, build 3D structures, and do puzzles, mazes and visual activities.
- Creative in making models and shapes more than classmates.

Bodily-Kinesthetic intelligence:

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This kind of intelligence is preferred by male students over the females because male students love practicing sport activities more than female students. The natural body ability of male students is more suitable for sports and more dangerous games than the females. However, this does not mean that female students cannot practice sports but that they can practice the soft and simple ones not the dangerous and tough ones that require a lot of physical work.

It is the intelligence of body and moves, i.e., the synergy between mind and body, where the person uses his/her body and moves to express his/her thoughts and feelings, and this is not limited to athletes and practitioners of the sports' hobbies only, but also includes the actors who make their bodies and moves fit with the roles they perform. It requires speed, strength, flexibility, synergy, body knowledge, physical

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sensation, well body moves, sense of things, and imitation of the behavior of others. (Najm, 2007)

Characteristics of gifted students in bodily -kinesthetic intelligence:

- Participate in one or more sports' games.
- Tend to move a lot when sitting in one place for a long time.
- Show amazing consistency in crafts and professions, such as carpentry and sewing.
- Enjoy working with handicrafts, such as clay, thread and cubes.
- Show sensory reactions in looking and working.
- Have dramatic ways in expressing things (Hasan, 2002)

Primary school teachers can rely and focus on students using their senses most of the time. For example, teaching alphabets through cutting papers to shape these alphabets then coloring them with different colors. This will make the students attracted to them and learn them quicker and their learning will stay for a long time. Also, they can shape them through clay and toothpaste or via playing with sand, they can also learn via Lego to make different useful shapes that achieve educational goals.

Intrapersonal (Self) intelligence: Is the deductive intelligence, knowledge and contemplation of human abilities, Perceive the inner world of the soul, able to focus on inner thoughts, high self-confidence, aware of motivational factors, love to work individually, self-analytical reflection, and give strong opinions while discussing a controversial issue.

Characteristics of gifted students in intrapersonal (self) intelligence:

- Strong will and tendency towards independence.
- Possessing a realistic sense of their abilities, strengths and weaknesses.
- Have a distinctive style of living and learning.

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- Have interests and hobbies that they do not talk much about.
- Prefer to work individually instead of working with others.
- Able to learn and benefit from failures and successes in life.
- Enjoy high self-respect and self-esteem.
- Have a good sense or show accuracy of what they feel.

Social/Interpersonal intelligence.

Developing social intelligence is important for the students as it is vital to their lives whether inside the school or outside it. This can be achieved through engaging the students in activities, festivals and competitions so that they can enhance their individual personalities that are able to make beneficial decisions individually without intimidation and fearing consequences.

It is based on positive communication and interaction with others, such as peer participation in various social activities, discussion of topics and events, collaborative work through group work and participation in group projects and research.

Naturalistic/environmental intelligence.

This intelligence comes in a latter rank in multiple intelligences. Not many people have it in comparison to other multiple intelligences. The environment, nature and desire of learning its different sides need the availability of many equipment and instruments and studying all-natural phenomena that happen in the environment, and wanting animal possession, and planting different types of plants and trees and taking care of them.

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These activities are based on the exploration of objects in the natural environment such as plants, animals, birds and rocks. Moreover, students plant ornamental plants in small basins in the classroom or school garden and encourage them to classify the garden plants by type and color. (Abdel-Aziz, 2012)

2.12 The Role of the Multiple Intelligences Theory in Teaching and Learning

1. Re-tests to other fields such as visual arts and sports arts, moving from extracurricular activities and neglect to the rank of intelligences just like the language and mathematics.

2. Raise a wave of optimism that there are eight opportunities for the student to progress and growth and that if he/she fails to one type of intelligence, he/she can be successful in other intelligence types.

3. The idea of the overall growth of the student is confirmed by the development of all intelligences as much as possible.

4. The walls of the school has been expanded, not only limited to language and mathematics education (linguistic and logical intelligence), but have become more diverse and responsive to the different needs of learners.

5. Suggested more realistic, credible, diverse and inclusive ways of teaching and learning.

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2.13 Practical Applications for the Multiple Intelligences

The strong intelligence capabilities of the students must be used to train their weak capabilities, a student who is weak in math concepts may understand them better if they are embodied musically, and students who are weak in language arts skills can express things through drawing, and the following must be done:

a) Help students discover how to use their multiple intelligences in the taught lesson.

b) Teaching students the practical applications needed to enhance and improve the weaknesses in their intelligence abilities and give them the opportunity to use their intelligences in the classroom.

c) Create strategies to help them translate their knowledge into forms of intelligence and conduct special events for students to discover their multiple intelligences and help them perform exercises to learn how to activate each type of intelligence. (Jayaseely, 2020)

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2.14 Visual Thinking

This kind of thinking is one of the kinds that once the individual uses, it will help the student a lot of problems and troubles that will face him during his life. At first glance it may look difficult to apply it on real life, but if the individual continues to use it in all his life, he will turn a lot of verbal information to images and shapes showing his verbal

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skills and turning that to image memory, which will ease on individuals to memorize information and keep that information for a long time in memory.

Piaget defined it as a mental ability directly linked to visual sensory aspects, and it occurs when there is a mutual consistency between what the learner sees as forms, drawings and relationships, and then, the connection of objects and mental outcomes happens based on the vision and drawing shown. Also, Wileman (1998) believes that it is the skill to imagine and present an idea or information using images and drawings instead of the stuffing of words we use to communicate with others.

On the other hand, Campbell (1995) defined it as thinking based on forms, graphics, and images presented in the situation and the real relationships involved. In addition, Afanah (2001) stated that it is a mental ability directly related to the visual sensory aspects and occurred when there is mutual consistency between what the learner sees, whether shapes or drawings, and the connections and mental outcomes that happens based on the vision and drawing presented.

2.14.1 Characteristics of Visual Thinking

Visual thinking is one of the thinking patterns that educational institutions are interested in its development among students because of its many advantages, including:

1. It carries a lot of meanings and needs words to be expressed.

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2. Ease of saving and recalling information; it is scientifically proven that a person remembers 20% of what he reads, 30% of what he hears, 40% of what he sees and 50% of what he says.
3. It is a universal language understood by the human being no matter how different the language is, and develop the student's ability to think and recognize the relationships and links involved.
4. It increases the commitment among students and supports the exchange of ideas.
5. It deepens thinking and develops problem solving skills among students.
6. The means used in visual thinking are safe, inexpensive and facilitate the management of the educational situation
7. It develops the various processes of knowledge, such as observation, analysis, interpretation and deduction, and it helps the teacher to deliver information to students in more accessible ways and makes information more durable and more used in different life situations.
8. It is suitable for all grades and reflects the learner's cognitive output.
9. It is a refinery that purifies the brain of the learner, which was suspended by impurities in front of this accumulation of knowledge and works to keep the impact of information in memory for a longer period.
10. It spreads the vitality and increases the enthusiasm of learners to participate and employ the information and skills obtained in achieving the desired success. (Afanah, 2001)

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2.14.2 The Disadvantages of Visual Thinking

It is not suitable for blind people, and works to accustom the mind to look for pictures or forms, not to think abstractly. Also, the lack of awareness of those involved in the educational process regarding this pattern of thinking as well as the lack of experts in the production of tools of visual thinking, the high cost of producing educational programs for its development and the inability of the curriculum to develop it.

2.14.3 Visual Thinking Methods

1. **Imaginary thinking through reading a book:**

   Marian and Peter (1999) defined imagination as a mental process based on the construction of new mental configurations that are organized in images of things that the person has no previous experiences. It is unleashing of ideas without considering the logical and realistic connections and is the highest level of creativity and very rare where it achieves a completely new assumption. According to Cost (2000), imagination is a mental activity that contributes to the achievement of goals, including facilitating the representation of information effectively, transforming abstract ideas into sensory thoughts, improving memory by retaining experience for long periods of time, helping to link information and create new meanings for the learned ideas.

2. **Thinking through writing or drawing:**

   Writing is linked to thinking because it illustrates the ideas of others. If students want to write efficiently and skillfully, then they must think clearly and efficiently.

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Similarly, if they want to write strongly with strong imagination, they must think and imagine strongly. The process of writing goes like this, think then write, and write while you think. The student expresses his/her ideas and analyzes the ideas of others through writing. Oxley (1993) suggested that writing evokes a clarification through a language characterized by the beauty of form and emotional effect. However, Lory (1993) perceived writing as expressing feelings and sensations in the form of stories or writing short contents; writing enables the student to express his/her thoughts and feelings, and writing is an optical coding of the spoken language through forms linked to each other and linked to visual visualization processes of shapes and visual elements within the human brain. On the other hand, Wandersee (1987) argued that drawing plays a key role in facilitating the identification of students' conceptual structures and assembling the parts of knowledge students possess. Drawing is an organizational thinking tool that stimulates thinking. It is the easiest way to input and retrieve information in the brain. The drawing depends on how the mind reads the information and helps to link the ideas and easily retrieve them. Biktimrov (2006) pointed out that drawings are an optical scheme of concepts and ideas and their relationships, and drawings are a network of related concepts containing words and symbols, and the information in the scheme falls according to their levels from the most comprehensive to the least comprehensive, such as radiological thinking in all directions.

3. Thinking through the objects around us:

As visual education continues, the recording of information continues to be modified and other forms of visual perception will be grown, including:

1. The process of collecting and structuring information in an appropriate manner.
2. The process of representing information and linking it with previous information.

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3. The response which may be visible or invisible and more than 75% of human knowledge reaches him/her through the eyesight. Thus, the application of artificial intelligence in the field of vision has begun. Visual thinking is a pattern of thinking that arises as a result of the stimulation of the mind by visual stimuli. That is to understand one or more relationships that help solve the problem or get closer to solving it. (Ruzouqi & Abdel-Karim, 2015)

2.14.4 Visual Thinking Tools

Vision-based thinking is also called spatial thinking, which is comprehensive and the right side of the brain is responsible for its functions, including installation, intuition, initiation, generation of ideas and innovation, and is usually influenced by the visual language, whereas hearing-based thinking is sequential thinking, written sequentially and the left side of the brain is responsible for its functions, including analysis, organization, reasoning, and deduction, and is influenced by verbal language. (Austega site, 2003)

Bennett and Maier (1996) believe that the use of visual thinking in the educational process is important because it is considered a strategy to understand the scientific contents; the presentation of images, drawings and shapes facilitate learners understanding and improve their performance, because presenting one image is better than showing a thousand of words. Navak (1998) argued that visual thinking is important and demonstrate higher levels of thinking, because the learner views the subject comprehensively.

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Visual thinking includes components, such as thinking tools, modeling method and mental attitude of inquiry. Thinking tools are symbols that are schematically linked to mental connections to produce an innovative pattern of information and form of knowledge about an idea and are divided into:

1. Brain storming schemes which are linked and integrated with the main idea.
2. The task-specific organizer is a visual tool used to display information and support a specific presentation.
3. Thinking process maps which visual tools are known as basic thinking processes and designed to embody thinking patterns, including thinking maps and mind maps (Hyerle, 1996).

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Costa (1991) explains that visual tools are an educational application of visual thinking, because students see their thinking and develop their abilities for innovation and methodology, and recognize the above-cognitive patterns and apply these patterns to classroom challenges. In addition, Al-Shafi'i (2006) pointed out that visual tools encourage the learner to form mental perceptions of the surrounding world which leads to enthusiasm and joy of learning. The Idon group indicated that visual tools work on visual arousal and brainstorming in geometric shapes and maps, which leads to better teaching and thinking, and accelerate thinking in life and educational situations, including decision-making, project management, problem solving and creative thinking. (Al-Shafi'i, 2006)

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In the view of Hosni (2009), modern digital tools of visual thinking help to develop visual thinking, in terms of capturing ideas, organizing information and express the various processes through diagrams (Hosni, 2009).

Shehatah (2014) classified visual thinking tools as:

1. Pictures
2. Diagrams
3. Symbols

First: Pictures

The picture is more expressive than speech. From a picture a goal can be achieved and get the attention of the students, as colors attract the student to learn. Many curriculum textbooks include many pictures and drawings as they support and enhance the educational content. So teachers should use and exploit the picture element when explaining the lesson to the students. In our daily lives we see colors fill up the streets and shopping stores to attract customers.

Benkard (2003) says that the picture is a set of relationships that are transmitted in a certain medium from sender to recipient by following a set of codes, and the recipient of this set of relationships starts to dictate it according to the appropriate codes.

Attributes and functions of picture:

1. Information is transmitted in the form of audio-visual images which saves time and effort.

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2. It nourishes the mental thinking of the learner and develops his/her mental abilities for storage, remembering and logical thinking.
3. The precise picture reduces the paths of reading because a single picture is better than a thousand words.
4. Helps the learner's mental abilities in deduction, judgment, evaluation and connectivity, as well as recalling things that are absent from his/her mind, and works to create mental images in the representation of things, which helps to speed up learning.
5. Refrain from getting things, not subject to time and space limits.
6. Allows the learner to discuss and interact to access information and facts and stimulate mental processes by the work of mental images which is called the eyes of mind.
7. Making the learning process clearer and more effective and sustained by communication between learners and teachers. (Shehatah, 2014)

Second: diagrams

The diagrams achieve many educational goals inside the class. Explaining a lot of ideas and meanings through diagrams will save time and effort on students. Also, it will help the students keep the information for a long time and they can use what have been learned in their everyday lives.

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The collection of images, shapes and graphics is based on visual representation, helps the student understand the text through deep reading and conclusion, it also helps in the process of communicating and expressing ideas, events, phenomena, laws, theories, rules and relationships by highlighting certain elements, and facilitates the mental perception, visual thinking and the formation of mental visual concepts, which supports the effectiveness of education, including:

1. Image-related drawings: Objections are easy to distinguish or the idea and use of these objects as silhouettes to write a profile of the object using printed clips.
2. Graphics related to the concept: Details of an object, which is easy to distinguish and identify.
3. Arbitrary drawings: abstract symbols through which we see the links between ideas which is called arbitrary schemes and include geometric forms and web maps.

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Third: Symbols

Symbols are all what expresses a thing or replaces it when it is absent, which are ideas and data that involve certain meanings, and used by the human when he/she thinks, through which he/she can infer objects and meanings and are considered indirect means of learning. The clarity of meaning depends on the extent to which a person possesses sensory experiences related to these symbols.

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Habib (1996) added that there are concepts and principles of thinking tools, including:

1. Simplifying the environmental stimuli surrounding the student to increase awareness and understanding.
2. Determine the method of counteracting the stimuli when renewed and organized.
3. The use of concepts in the learning process. (Habib, 1996)

Al-Farra (2006) differentiated between visual knowledge, thinking, education and communication as follows:

1. Visual knowledge: Expression of thinking, learning and self-expression through images.
2. Visual thinking: Mental images and the endoscopy of the contained symbols, lines, shapes and colors.
3. Visual education: Learning through visual stimuli and design of optics that help in learning.
4. Visual communication: The use of visual symbols to express ideas and to convey meanings, and the reading of images sometimes are called (Image poetry).

Al Hadidi explained that the readiness for visual learning can be developed through:

1. Shape recognition: Identify single objects and classify them on a black background and add internal details.
2. Symbolic representation: Recognition of abstract letters and symbols for different forms.
3. Arrange, classify, and recognize images of things and organize things in certain categories.

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4. Symbolic representation of ideas and the identification of different words and sentences. (Al-Farra, 2006)

In order to increase the effectiveness of visual education, activities must be diversified in a developmental sequence, including:

1. Activities to note differences and similarities in shapes, symbols, sizes, conditions and internal details.
2. Activities on the consistency of forms, objects and symbols of the same category or different categories.
3. Activities to arrange things, symbols, sizes, events and experiences.
4. Activities to distinguish the missing parts in shapes and symbols.
5. Activities that link and collect objects, symbols and shapes within their major categories.
6. Activities that require the integration of the clear elements of shapes, objects and symbols into an integrated whole.

2.14.5 Visual Thinking Processes

1. **Eyesight**
2. **Imagination**

Allah (SWT) said: {And Allah has extracted you from the wombs of your mothers not knowing a thing, and He made for you hearing and vision and intellect that perhaps you would be grateful} (Surat An-Nahl, verse 78)

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Allah (SWT) also said: {Those are the ones over whose hearts and hearing and vision Allah has sealed, and it is those who are the heedless} (Surat An-Nahl, verse 108). Imagination is important and necessary in the life of the student. Imagining things makes it easy on the student to understand things. Moreover, imagination works on strengthening memory and mental capabilities of the student. We need to train our kids and students on practicing imagination in their everyday lives. Explaining some ideas, concepts and terms via imagination attracts the students to learning and makes it seem like playing. So the students enjoy the educational process and make the learning of value and benefit and continue for a long time in the students' lives. It may seem difficult at first, but with the practice and continuation of the learner in carrying out imagination makes it an easy and useful process for the learner over time.

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The sense of sight is a bridge crossing into the vision, which represents the entrance to the brain, which is the human window on the world of visualizations around them. It is a process of integrated interaction, where a person sees, perceives and understands things. Vision is one of the most important means that makes the person in touch with the external influences surrounding him/her. The functional goals can be achieved through the use of symbols.

Imagination

Imagination is an important mental ability for the human. Not all people can do it or hone it in a way that makes it the helper of the student in his life. Students imagining

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pictures, sketches, diagrams, incidents and situations make them easily remember them in a big way when desired.

Imagination is “the ability to remember and recall mental images, which have already been created and stored in the mind, in case of their absence” (Silverman, 2005). Moreover, Osberg (2002) defined it as “the ability to innovate and renew mental images within the mind”. Also, Worren defined it as “higher mental processes, which create new relationships between past experiences, so that they are organized in images and forms of experience that the person has not experienced before”.

Acting is the main engine of all creative processes, which is one of the higher mental processes. It is an intellectual activity that attracted the attention of cognitive psychologists and is related to other mental activities, such as attention, perception, remembering and thinking. Furthermore, it is a valuable learning tool and a thinking skill that every student must be trained to enhance it. Also, it is a unique and enjoyable experience and a very important skill to solve problems. The power of imagination is that it provides the product of thinking in the right hemisphere of the brain and provides us with sources on both sides of the brain. When we ask students to think of a name, they respond with information from the left hemisphere of the brain. But, if you ask them to become a name and tell you how they feel, they will invoke the insight from the right hemisphere of the brain.

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Williams (1983) pointed out that the strenuous attempt hampers the flow of images, and the student or learner can create the conditions that allow imaginative images of the left hemisphere to be easily accessible.

Functions of Imagination

Imagination makes for many and various tasks whose benefits and importance will be amplified when students keep practicing and using it until it becomes a part of their lives and everyday practices.

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According to Shehatah (2014), the most important functions of imagination are:

1. A powerful way to create a positive image and get rid of negative thoughts.
2. The activation of mental processes, where the person feels his/her achievement with self-realization.
3. Makes information easy to be stored and maintained for a long time and facilitates the process of linking information.
4. Makes classes more enjoyable and comfortable and increases students' achievement of scientific material.
5. Enrichment of imagination helps to acquire new knowledge and develop the visual, spatial and linguistic intelligences of students.

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6. Imagination is a mental exercise to improve and develop skills and achieve relaxation of the body and brain, which takes a starting point on the world of innovation and excellence.
7. Visualization is essential to thinking, it is an important process in the processes of thinking, learning subjects and understanding abstract scientific concepts.
8. Create non-written practices, such as graphical models, conceptual mappings, graphics, images and a language of communication.
9. Increasing participation and motivation, as well as presenting different viewpoints and assisting students in representation.
10. Reproductive imagination: Restoration of the individual sensory images that were the subject of thinking.
11. Innovation imagination: The ability to install and produce images that do not exist in reality and are characterized by novelty and interest. (Shehatah, 2014)

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2.14.6 Theories of Mental Imagination

There are a lot of theories that studied and researched imagination and tried studying it in many different aspects. Some of these theories will be discussed, which include:

Dual-coding theory

This theory was proposed by Allan Paivio. It is also known as dual representation. There are two systems for the visualization and processing of information, but they are

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interrelated. The first system is known as verbal coding. It is specialized to process and represent verbal information arranged in a specialized sequence. The second system is the non-verbal coding, which is conceptual or analytical coding, Paivio (1971) concluded that symbols of images are remembered faster than verbal symbols, because abstract words are ambiguous and difficult.

Cognitive Activity Theory

This theory states that mental images are a direct automatic process, which does not include representations of images, and the brain picks up static information from the environment with what the individual expects to see in a given context. These processes are generated on the basis of prediction, which results in mental perceptions by comparing information from the external environment with the diagrams already in place.

2.14.7 Visual Thinking Skills

The processes in which the eye works, so that the learner can use his/her eyes to reach everything that they see, through the power of observation, and an explanation of the components of what he/she sees.

These skills encourage the learners to visualize scientific information by combining their visual perceptions with their cognitive experiences. The most important visual thinking skills are:

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1. Visual recognition skill: The ability to recognize the visual shape displayed and distinguish it from other shapes. This shape is in the form of symbols, images, graphs and sketched issues.
2. Recognition of Spatial Relations: Ability to recognize objects in space, and study of two and three-dimensional shapes.
3. Formal Visual analysis: This skill focuses on fine details and splits the visual form to its basic components.
4. Formal Visual Interpretation: Refers to the interpretation of all visual form molecules, including symbols and signals that illustrate information.
5. Deduction of meaning: To reach scientific concepts and principles through the form presented, taking into account the previous steps.

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2.14.8 Terms of Visual Thinking

1. Visual Figure: Visual activities that can be done through educational strategies, including structured steps to facilitate the learners' understanding.
2. Visual Shape: A schematic image of concepts, ideas, phrases, discussions and valuable ideas.
3. Visual Perception: The ability to interpret the stimuli, and recognize the shapes, differences and similarities, which are important abilities to read, form stability is the basis in the recognition of the letters and the overall picture of the word.
4. Visual Closure: The ability to recognize a complete whole when given incomplete information or a partial picture.

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5. Visual Word Recognition: Recognize the words without fragmentation of its components through the shape, length, the number of points and letters.
6. Visual memory: The ability to retrieve modern visual experiences, such as recall letters, numbers, forms and written language.
7. Visual Art Decoration: the use of visual aids to help identify characters, sites, times and events, and also helps to raise the imagination of the individual.
8. Visual Spatial Intelligence: The ability to perceive the visual place, and visual thinking through images, graphics, drawings, shapes and perception of spatial relationships. The teacher should use the tree of concepts and mental maps, and models and visit museums, mapping, computer software, graphical representations and presentations of visual tapes and engineering designs (Ruzouqi and Abdel-Karim, 2015).

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2.14.9 Significance of Visual Thinking

Allah (SWT) said: {And Allah has extracted you from the wombs of your mothers not knowing a thing, and He made for you hearing and vision and intellect that perhaps you would be grateful} (Surat An-Nahl, verse 78). Allah (SWT) also said: {And it is He who produced for you hearing and vision and hearts; little are you grateful} (Surat Al-Mu'minun, verse 78).

It is necessary to review the usefulness and importance of visual thinking when activated by students in their daily lives, including:

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1. Increases the student's ability in communicating with others with self-confidence.
2. Increases mental capacity, because visual thinking opens the way for the practice of different types of critical and innovative thinking.
3. Helps the learner to obtain, represent and interpret information. Visual thinking occurs when vision, imagination and drawing are integrated into an active interaction.
4. It has a role in increasing the motivation for learning because it depends on visual language and thinking together, it is one of the flexible methods and the process of support for effective thinking, and it also provides us with an easy way to expand our thinking
5. Include learning strategies for teachers and learners based on active learner-centered learning through the use of questions to discuss and create a safe atmosphere for discussion and justification of ideas.
6. Visual Thinking Strategy, which is a base for development that is used to manage discussions and question strategies through the teacher and learner to achieve goals, develop observation and active participation, develop communication skills and develop creative thinking among learners.

(Diezman, 1997) suggested that visual thinking works to develop spatial relationships of shapes, to reveal relative relationships and to develop inference skills. While (Neimiroysky and Nobel, 1997) pointed out that visual thinking opens the way for the practice of different types of creative and critical thinking, and acquiring scientific skills through providing the steps to acquire each skill of scientific thinking skills that are important in the student's scientific life.

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In addition, (Hyerle, 2000) has presented 10,000 pictures to a group of students in his study. A month later, a large portion of the pictures were displayed in addition to new unseen images. The results showed the students more than 90% of the images that were previously presented to them. This shows the strong reinforcement of the visual mind when dealing with thinking skills. The visual system is responsible for sending 80-90% of the information received by the brain, and the brain can absorb approximately 36.000 images per minute. Therefore, multiple methods of audio, visual and kinesthetic learning tools must be used.

Abu Al-Nasr (2004) indicated that the results of the studies confirmed that the human is learning by the sense of sight (83%), and that the person remembers (20%) of what he/she reads, (30%) of what he/she hears, (40%) of what he/she sees, and (15%) of what he/she speaks (Abu Al-Nasr, 2004). However, the study of (Gribs, 1996) demonstrated that the most thought processes come from our understanding of the world around us, through sight, and the visual system is the first sensory organ that provides the basis and composition of our cognitive processes.

2.14.10 Methods of Developing Visual Thinking

1. **Infographics:**

Salamah (1998) defined it as all drawings whether colored or uncolored, which the teacher uses to illustrate an idea. They are visual symbols that express ideas, relationships and facts through lines, drawings and words in a concise way aimed at

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helping the learner to learn better. These drawings come in different forms and types, and have proven to have a clear impact on increasing the educational outcomes of many students and in many aspects of their lives (Salamah, 1998).

Significance of infographics:

Ruzouqi and Abdel-Karim (2015) showed the significance of infographics in the following:

1. It makes the individual understands things that he/she sees better than if he/she read or heard about them, and provide information in visual form.
2. It raises the attention of the learner and gives him/her enough opportunity to deductive thinking with installation of information and makes a comparison between the parts.
3. It helps learners remember information by retrieving images, tracking ideas displayed and increasing the output of education for students.

Conditions of infographics:

There are many conditions that must be provided in infographics to achieve the desired goals from them. The researcher think that these diagrams must not be random and without goals but must achieve the goals that they are provided for. This means infographics have to have some nice colors to attract students and make them focus on their content.

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It must be correlated to the objectives and content of the lesson, suitable for the reconstruction of students, simple, contains correct information, lack of congestion in the colors and parts, honest and realistic. (Ruzouqi & Abdel-Karim, 2015)

Guidelines for teachers when using infographics

1. Direct the focus of learners to the parts associated with the lesson and give time for learners to view the painting freely and adapt to it.
2. Ask the learners questions that help them read the infographics so that they can deduce their parts and rely on themselves to understand the true meaning of the infographics.
3. To close the gap between drawing and reality and remove the drawing after the completion of the educational process.
4. The teacher can help the students to read the infographics by asking them to describe the graphics and name the parts that they are made up of and compare those parts of the graphics with each other or compare a graphic with another graphic that the teacher brought to the classroom.

In the beginning, the teacher must be prepared and familiarized with the infographics sufficiently in order not to be surprised by any questions and to avoid being embarrassed as a result of any errors that may confuse him in front of his students.

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2. Graphs:

Definition: Converting abstract numbers into different forms that reflect the development of the given phenomenon, and the graphs vary according to the nature of the phenomenon.

It is a visual representation of data, information, figures and tables that include information, data in the form of lines, images, charts and bar graphs. Their functions are comparing, reasoning and perception of relationships and then, decision-making.

Advantages: Saves time and effort, clarifies the statistics and relationships, helps the learner to portray the proportions of numbers to each other, and helps in deducing information through these numbers and to make important decisions to help draw his/her life strategies.

In the researcher's opinion, teachers using graphs makes the students save the information for a long time and make them use this information in other parts of their academic and practicing lives because of the easiness in saving this information in their memories and recalling it back.

Stages:

1. Introduction: Includes the content of the document.
2. Describing (reading) the graph: Describing the phenomenon as represented by the graph.

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- Interpretation of the phenomenon: Highlighting the factors controlling the evolution of the phenomenon.
- Conclusion: To extract facts from the phenomenon and to express personal opinion about it.

3. **Tables**

Tables are considered one of the important educational resources in teacher's and student's lives and have many advantages and benefits. We see them in many writings, MSc and PhD thesis and articles that include statistical, social or economic analyses. They are means to explain and simplify data and information and make it easy for the reader to understand and link the relationship between all given data and information.

Shehatah (2014) reviewed the meaning of the tables as a method of presenting a wide range of quantitative information in a concise manner, and we have to deal with them accurately to achieve the greatest benefit.

Conditions of using tables:

A lot of conditions must be provided in tables, which will work on increasing the students understanding and deepening their knowledge. This makes them analyze and criticize the information and not just hear and get it. The availability of clarifying tables in textbooks and curriculum brings many benefits to the students and makes it easy on them to understand information and helps teachers deliver information easily to the

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students and make them enjoy and anticipate receiving this information. The conditions that must be provided in tables must be the adjustments for increasing the benefits hoped from and not specified and restricted to them solely.

To give an idea of the table's content in general, to allow students to provide explanations based on what they have learned, to guide students to follow numbers and lines, to ask students to identify minimum and highest rates, follow lines and associated vibrations and relate them to relevant events and provide explanations, conclusions and predictions, to provide ideas about the future of the phenomenon raised based on what they have learned, whether individual or collective work, even if not accurate, because it develops the ability of visual thinking among students (Shehatah, 2014).

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4. **Artistic Activities**

A group of practices from the students' aesthetic vision of the surrounding environment, where they present vivid and formative characteristics that reflect the needs and tendencies of the students, demonstrate their abilities and experiences gained in the fields of arts and development of their mental abilities and train students on practical skills that develop visual observation, discover the abilities of the gifted students and the opportunity to show their talents and develop the different and diverse patterns of thinking that cover all aspects of the student's educational and practical life.

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Objectives of artistic activities.

The artistic activities are considered some of the means that work on enhancing thinking and its skills for the students. They are considered some of the benefiting and attractive tools for the students, they include colors, drawings, shapes, artistic curios and wall posters that make the students pay attention. The students are raised on loving drawings and practiced artistic activities though simple. Also, they considered them creativity and innovation, they are like small projects that express their dreams.

Discovering outstanding talents, working on refining, developing and sponsoring them, and linking the technical activities with other subjects, where students learn about the materials and tools needed for the art works, and train the students in the ways of their formation and uses to highlight and develop the students' mental abilities to innovate and be creative. Also, students should be trained in the areas they like and tend to, such as drawing and photographing. These are tools for the development of visual thinking and means for students to express their ideas and thoughts as well as express their feelings through inspiration, intimation, action and movement.

5. **Mental Maps**:

The mental map is regarded as one of the means that work on developing thinking skills. Teachers draw a map (clarifying sketch) including information and data that clarify the main ideas of the subject that the teacher wants to explain and simplify to the students.

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It is one of the illustrative means that facilitates the delivery of information and works to maintain it for a longer period of time and to recall it more easily .Mental maps need trained and skilled teachers in teaching them who know the right way to teach them and how to use it in the right time to achieve the educational objectives hoped from them.

According to (William and Mary, 2006) definition, it is a visual language in which thinking skills are integrated, which helps to meditate and think systematically and form a neural network of thinking in which the mind drives and constantly builds on what it perceives. However, (Hyerle, 2004) has mentioned that a mental map is a common visual language for all learners and teachers at all levels and visual materials. It is a typical tool for integrating previous and subsequent lessons with each other and a method of organizing information to facilitate learner retrieval, interpretation and analysis of information (William & mary, 2006).

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Significance of mental maps:

(Hyere, 2004) explained the significance of mental maps in the following:

1. Simplify information and help learners remember, organize, address and apply them in new life situations.
2. Help learners in writing skills, such as the design of thinking schemes and the development of life skills, because mental maps address the mental processes, such as observation and description, application and processing information, interpretation of data, problem solving and decision-making.
3. Provide a common language between teachers and learners that develops individual and collective education as well as reflective thinking and creativity.

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4. Visual tools for building knowledge, which encourage thinking, in what we know, what we do not know, what we should know and how we know it.
5. Students sharing their different thoughts with their colleagues.
6. Enables students to see their thinking, i.e. recognizing the processes of metacognition (Hyere, 2004).

It supports the interactive teaching and learning, metacognition and higher level of thinking and learning skills. The use of thinking maps helps to represent cognitive patterns that link prior experience and knowledge by content knowledge and cognitive construction of abstract concepts and practical outcomes of thinking as well as facilitating a set of healthy mind habits. (Marzano, 2000) has mentioned nine educational strategies that positively influence students' education and achievement as follows:

1. Identifying similarities and differences.
2. Summarizing and taking notes.
3. Reinforcing effort.
4. Homework and practice.
5. Cooperative learning.
6. Generating and testing hypotheses.
7. Activating prior knowledge.
8. Setting goals and providing feedback.

(Holzman, 2004) noted that the use of thinking maps enables teachers to produce many strategies in different subjects and educational grades, thus, helping students to build

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fluency in using thinking maps in all life situations that they may encounter or experience.

6. **Video Cassettes:**

The video games work on simulating real life on a virtual platform. They help students on making a miniature image to incidents and accidents, which makes the student aware of what is happening around him. The colors, action and interaction between them attracts the student and makes him interact with what is going on, which increases his focus and attention in a big manner especially 3D scenes, they make the student live the incidents and activities as if he is part of them. However, video games should not be the highest property or the end goal for learning, but they should be a simple clarifying way. When using them excessively in education process, it makes the students rely on them too much and neglect other educational means.

Defined as a set of consecutive images that is displayed in the same rate of speed as they are seen in reality.

Advantages:

1. Makes the learner feels that he/she is part of the event, and adds a sense of realism and this leads to the development of visual thinking.
2. The repetition of the kinesthetic reality, especially when the event is rare, which increases the visual perception.

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3. Increases the ability to imagine through various methods to deal with the content of the close and far shots.
4. Presentation of the scientific material at any time according to the class period.
5. Control the display by pausing and playing as well as pointing to important points, which attracts the attention of learners.
6. Confirmation of the important phases of action and photographing them in a short time and then, present them to the learners (Al-Farra, 2006).

7. Computer Activities:

The computer has become an integral and essential part in the educational process. The student regards the computer as an important part of his every day and educational life as he spends a long time from his day in front of the computer and plays video games and educating programs. In the recent times, educational materials have been integrated inside computers, so that student can apply and study educational courses using his personal computer. Computers are interesting to the students and make the job convenient to the teachers. In UAE for example, most courses are put on computers in recent times, and every student has his personal computer and the teacher supervises the student to solve class exercises via his computer, and he can finish in the house too, and this strengthens independence concept for the students.

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It works to develop visual thinking through the possibilities available to them, which are:

1. Flexibility in information provision by providing a number of means for presenting information to the learner, through new visual stimuli and freedom of movement between different parts of the program.

2. Retention of information in the memory of the learner for a long time through the encryption and encoding of information in a number of different means of encryption.

3. Diversity: Provide a mixture of stimulants that activates and stimulates the senses of the learner.

4. Takes into account the individual differences between learners and moving forward according to the learner's speed of understanding and self-step.

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5. Using the simulation method which leads to the removal of obstacles in the tests carried out.

6. Stimulates and excites the learners and makes them interact positively and allows them to free control their attitudes and behaviors, and thus, getting rid of fear, shyness and boredom.

7. Display the educational material in the form of pictures and graphics, and provide information very quickly with linking the theoretical science to practice.

8. Present educational patterns that are difficult to be displayed through traditional methods, and create intellectual environments that stimulate students to discover topics that are not in the curriculum. (Shehatah, 2014)

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8. Caricature (Cartoons)

All images or drawings include a creative idea in its content or method of presentation, and educational positions are enriched by conditions, and many of the questions are raised around it that stimulate the thinking and enables the learner to translate and analyze the ideas and pictures drawn to reach the goals.

The significance and advantages to learners:

1. Attract attention and promote mind skills, develop personal tendencies, desires and creative abilities.

2. It has a great role in teaching students through the conversion of abstracts to senses and visualizes the ideas in a funny way, which is exciting and characterized by power and attraction, and carries more than one goal, and this justifies its use by the teacher within the objectives of the curriculum (Shehatah, 2014).

3. It is used as a modern means to help learners cope with the differences of knowledge, and to compare, build ideas and create a lively atmosphere within the classroom, and contribute to the development of thinking skills of learners, if it is addressed in class and raise creative and motivating questions with the formation of public opinion.

4. Formation of self-opinion and respect other opinions, and delivery of guidance for learners in an easy way that help in more stable information, which is a partial representation of reality.

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5. Can be used in many topics of study, in the form of stories that is loved by learners, and can be used as a method of preparation or a hub for the conduct of many discussions or within the educational activities associated with the curriculum.

6. (Sturm, 2002) stated that it is a form of art through which students learn the skills of reading and writing visually, it helps to clarify abstract concepts in tangible ways, stimulates the learner and his/her thinking, increases his participation and motivation.

7. (Lukehart, Michelle and Neumann, 2009) indicated that its use limits learners' anxiety and tension, promotes learning and helps to retain it, while (kandil, 2008) and (Balm, 2008) explained that its use leads to the participation of learners and creates a motivational environment for learning, where students learn perception and thinking skills, which increases their understanding of scientific concepts, especially in science subjects.

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8. It helps the student acquire information with joy, it solves many problems, clarifies the idea and delivers it to the targeted people, it is close to the understanding and perception of the reader, shortens the time, and also, it is limited to the important information without the marginal details that may distract the concentration and attention of the students.

2.14.11Visual Thinking Strategies

Definition:

The visual thinking strategies are considered some of the most important strategies in educational field. They significantly help in developing different thinking skills. A lot

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of studies were conducted on these educational strategies and a lot of researchers encouraged applying and using them on educational fields. Visual thinking is considered as the visual memory of the student which achieves many goals and educational outcomes that some of them will be discussed later. Students prefer visual things over textual or audio things because they are easier to learn and stay longer in the memory.

Ruzouqi and Abdel-Karim (2015) have defined it as a series of systemic actions, which concentrates on the development of a focused view of learners' education. It is based on experimental research on thinking methods and focuses on developing the learners' ability to direct the visual language from a visual form to verbal written language or system.

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Objectives:

1. Enhance self-confidence in students and confidence in dealing with ambiguity and develop communication skills and creative thinking.

2. Students benefit in their development of discussion methods, and expose them to situations that help them when exposed to similar situations in reality.

3. Developing the ability to observe and gain a comprehensive view of the subject.

4. Developing communication skills, such as expression and asking questions.

5. Creating interaction between students and developing the motivation among learners towards seeking and acquiring knowledge. (Ruzouqi & Abdel-Karim, 2015)

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Steps:

1. Ask students to look at the drawing, think about it and contribute notes and ideas.

2. Ask questions to students so that students remain interactive and to clarify the relationships between different elements.

3. Respond to the students' notes of observations and consider how they develop their thinking and transform isolated concepts into meaningful pieces of information.

4. Encourage students to think about all the processes that benefit in drawing conclusions, develop the skills of conversation and organize the information in sentences that summarize all what they have learned in ideas of originality and novelty.

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Hamadah (2006) and Al-Showaiki (2010) believe that visual thinking can be taught through:

1. Illustrating the visual shape and seeing the relationships in the shape presented to the students at the beginning of the lesson.

2. Raising the attention of learners in the visual shape, and making them look at it carefully.

3. Understanding the ambiguity or gaps through the visual shape, and making students understand the relations between the components, deduce new relationships and visual percept the similarities between different shapes.

4. Thinking visually and trying to use concepts, laws or evidences and organize the information to reach the conclusions of what the visual shape contains.

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5. Making them use their vision, imagination and drawing, in an active way and move in their thinking from an imagination to another of alternative solutions and express them with quick drawings to be compared and evaluated later. (Hamadah, 2006 & Shehatah, 2015)

2.15 Critical Thinking

Critical thinking is one of the thinking patters that receives higher attention and focus from researchers. Critical thinking follows educational steps in a right sequential way and leads the students to be skilled researchers who follow educational steps in a suitable manner from assumptions to collecting information and data and testing it on educational bases. After that, they may subject these assumptions to scientific testing and presenting them to professionals and experienced people to take their opinions on the gotten results. Finally, they will get the results of the educational sequential steps (Alqatanani, 2017).

The definitions of critical thinking are based on the theoretical differences and assumptions of researchers. These differences are positive because they lead to further research and studies. Thus, further knowledge generation.

Critical thinking was defined by (Watson and Glaser, 1980) as an ongoing attempt to test facts and opinions in the light of the evidences on which they are based. This includes logical search methods that help to determine the value of various evidences, arrive at logical results, test the validity of results, evaluate discussions objectively,

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formulate assumptions and interpret data. Also, (Beyer, 1985) defined it as a process of ascertaining the reliability of the facts to highlight its importance and the accuracy of its credibility in judging matters.

However, (The national council for excellence in critical thinking, 1987) has defined critical thinking as a coherent process of activity, skill in visualization, application, analysis, synthesis, and assessment of acquired information through observation, experience, reasoning, logic, evidence of belief and behavior. So, it is a reflection based on the holistic view of the molecules of subject matter, clarity, accuracy, consistency, sound evidence, rationale reasons, depth and clarity. In addition, the definition of (Mayer, 1993) defined critical thinking as a systematic and active process for understanding and evaluating discussions regarding the subject characteristics of two or more topics with evidence to support or disprove the assertion.

On the other hand, (Bailin et al., 1999) presented a concept of critical thinking based on studies of some researchers. This concept includes five basic elements of critical thinking:

1. Background knowledge.
2. “Operational knowledge” of the standards of good thinking.
3. Knowledge of critical concepts.
4. Effective heuristics.
5. Habits of mind.

(Nugnt and vitale, 2004) believe that critical thinking is a linear process which often follows a straight line with a beginning and an output in the end, while some processes are liner - like, such as:

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1. Problem solving: It involves finding alternatives, detecting overlapping alternatives, providing selected overlaps and reaching the final product that is a solution to the problem.
2. Decision making: This includes reviewing the information accurately and using the relative approach.
3. Diagnostic reasoning: It involves collecting and analyzing information, linking information to standards, identifying evidences of information that have been collected and reaching a final product, which is a conclusion.
4. Scientific method: Identifying the problems involved in the research, collecting information, and formulating hypotheses and testing them through experimentation to reach conclusions of acceptance or rejection to the hypothesis.
5. Enhanced operations: This includes collecting information, identifying evidences, diagnosing, setting goals, planning and helping students to evaluate and access true and real results.

2.15.1 Key Features of Critical Thinking

Shehatah (2014) indicated that the most important features of critical thinking are:

1. A positive thinking that leads to a positive interaction of the individual with the daily events, which increase the self-confidence of the student with positive self-esteem, deduction and drawing accurate conclusions.
2. Emotional and rational thinking, the emotional part is the essence of critical thinking, such as sense, intuition, emotional feeling and response, as there is an interactive relationship between the cognitive and emotional aspects. Critical thinking helps us to

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access our emotions to explore which is more appropriate to our thinking processes, which helps us to evaluate these emotions.

3. Critical thinking tests new ideas through analysis and scrutiny away from intolerance and appearances, as it focuses on the content.

4. It is one of the most liberal and objective thinking patterns. It rejects invalid myths and traditions.

5. Critical thinking is a process, not a result, and its manifestations vary according to the environment in which it occurs. It can be provoked by positive events because it is emotional and logical.

6. It is evaluative based on appropriate criteria and standards in the process of mental output.

7. It includes a set of thinking skills that can be used individually or in combination, without commitment to a certain order, with evaluation based on certain criteria to issue judgments on things or to reach a conclusion, generalization or decisions.

8. Examining beliefs and propositions in the light of supporting evidences, logical relationships, and the ability to interpret data and draw conclusions, using correct instructions and evaluate the validity of the evidences, judgments, and arguments. (Shehatah, 2014)

2.15.2 Levels of Critical Thinking

(Qatalami, 2000 & Al-Sayyed, 1995) and (Malonen, 2003) believe that critical thinking goes through several stages, including:

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1. Motivation: Influences the attraction of attention, the sensitivity of the individual and the contradiction of external events with the personal theory, and this sense of contradiction is the basis that creates critical thinking. The factors involved in the motivation are:

• Orientations: The desire and depth of the field of thinking and the identification of its stimuli.

• Energy expansion: The student's awareness of the contradiction between the external event and his/her own personal theory in interpreting and understanding events and resolving the contradiction requires more energy.

• Curiosity: The desire for knowledge and asking many questions about ambiguous subjects that needs to be explained and clarified.

• Balance effect: the balance between emotional responses, knowledge and the continuation in solving the contradiction which invloves risk behavior, such as the risk of asking questions to clarify things, which may end to a behavior that is not acceptable by others and this requires psychological characteristics and personal skills that makes it easy for a person to do it. (Qatalami, 2000 & Al-Sayyed, 1995)

2. Information seeking: It is the output of previous learning experiences, bringing the individual into a state of contradiction, and this requires some activities, including:

• Attention: Individuals, who are good in paying attention, are more likely to observe and listen well, because of the contrast between their views and the external events.

• Understanding concepts: Establishing relationships between concepts and events.

• Identifying discrepancy: It includes basic attempts to express contradiction, such as answering a particular question related to the reason of contradiction.

• Organizing knowledge: Includes collecting and organizing information in the right place.

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• Know the use of resources: These resources might be publications or humans. The person develops the skill of using and utilizing these resources in solving the contradiction.

3. Linking information:

• Making links: A basic process of the organization of information and framework of ideas.

• Identifying patterns: Identifying relationships between concepts and the event as well as the personality.

• Convergent thinking: Categorizing the many different pieces of information into small groups to help resolve the discrepancy.

• Applied knowledge: A practical application of the information collected to resolve the contradictions presented.

• Divergent thinking: Creating non-traditional relationships and innovative solutions to the contradictions.

4. Evaluation: It is determined through three tracks: The temporary solution of the contradiction, the evaluation of the product by analyzing it and checking its relevance in resolving the discrepancy or evaluating the process and accepting the solution.

5. Expression: The ability to review and critique the solution and modify it in the light of new information.

6. Integration: Integrating the personal view with the knowledge base of opinions, values and beliefs, where the individual feels a state of cognitive satisfaction, new contradictions become new challenges, and then, the process of critical thinking begins again.

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2.15.3 Criteria for Critical Thinking

They are the agreed standards by a group of specialists in critical thinking, and are mainly based on judging the quality of the student's thinking in dealing with a particular problem. These standards are measures for both, the student and the teacher, and should be paid attention and followed precisely when evaluating critical thinking.

Also, Jaber (2008) highlighted the most important criteria of critical thinking in the following points:

1. Clarity: It is the main input to the other criteria, and the teachers must train their students to clearly articulate the terms in their responses and to distinguish between reality and opinion.

2. Accuracy: The statements should be correct and verified, and the teachers should train their students to do so by asking some questions, such as what is the source of the information? How can it be verified?

3. Precision: Attaining the subject through the standards, and expressing it without adding or decreasing parts of it. Teachers can train their students by asking them some questions. For example, Can it be more specific or concise?

4. Relevance: There is a close link between the question, argument or the statement and the topic of discussion, such as do these ideas or questions give explanations of the problem? Or does it contain supporting contradictory evidence?

5. Depth: The intellectual processing of the problem is appropriate for the ramifications of the problem.

6. Elaboration: Discussing all aspects and parts of the problem in details.

7. Logic: The organization, sequencing and interconnection of ideas in a way that leads to a clear meaning and a consequence of acceptable arguments, including:

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1. Is there any contradiction between ideas?
2. Do the justifications lead to the result? (Jaber, 2008).

2.15.4 Significance of Critical Thinking

(Ammerican Philosoical Associating, 1990), (Neisler, 2001), (Huitt, 1998), (Bert and Hartley, 1993) and (Purden and William, 2001) have explained the significance of critical thinking in the following points:

1. Facing situations and problems with a flexible and objective mentality, and attaining the results after examining the facts and collecting evidences.
2. Critical thinking is one of the educational goals that should be developed among students to have a strong ability of criticism.
3. It has the most important and essential components of citizenship, because you must understand the information received.
4. It includes the process of originality, accuracy and validity of information provided, and requires reflection thinking and formulation of a judgment or a conclusion to differentiate between fact and opinion.
5. Cognitive engine, which is a deliberate process and a systematic rule because it is a cognitive engine that allows for solving problems, where the cognitive skills, such as interpretation, analysis, evaluation and conclusion are the focus of critical thinking. They interact with each other when making decisions or solving problems. It helps to make decisions in situations where there are no specific legal texts.

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6. Critical thinking encourages learners to practice a wide range of thinking skills, such as problem solving, creative thinking, accurate comparison and insight, analysis, research, reasoning, decision making, organization and communication.

7. Preparing individuals who have the ability to critique productive ideas and the proposed solutions to problems. The basis of critical thinking is philosophy.

8. Developing critical thinking skills can help the learner to feel others, understand their ways of thinking, distinguish between ideas and understand their relationships, and to classify, organize and use ideas in scientific issues.

9. Critical thinking is an educational necessity to protect students' minds from harmful cultural influences and to filter out the ideas and information they receive. Critical thinking is the filter that determines what the learner should accept or reject in the light of specific criteria.

10. Training students on intellectual flexibility, and studying the data around them, in a correct scientific way that leads to the development of their thinking.

11. The development of critical thinking skills helps the learner to predict events and the way they are sequenced based on his/her cognitive outcome, which leads to the acquisition of perception and understanding of the situation.

12. Developing critical thinking skills that attract learners to the classroom environment, which is characterized by an atmosphere of security, tolerance and acceptance, because of the principles and moral foundations on which critical thinking is based.

13. Improve the learner's thinking to rely on self-assessment and develop many intellectual features, which help for lifelong learning and the ability to solve future problems. Some of these features are intellectual humility, intellectual courage and intellectual clarity.

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14. Critical thinking leads to the observation of learners to their skills of thinking and control them to be more accurate and valid, which helps them to make decision apart from extremism in opinion and emotional submission.

2.15.5 Characteristics of Critical Thinking

(Brookfield, 1987), (Beyer, 1995), (Nasic, 2006) and (Saadah, 2014) mentioned the most important characteristics of critical thinking, which are:

1. Critical thinking is a positive activity that produces creativity. To illustrate, people who think critically know that they are creative and have the ability to change their lives.
2. Critical thinking is a process and not an output or outcome, it is scientifically responsible for the interpretation of events, and the doubt of global realities makes us rethink of some statistical results.
3. Critical thinking varies according to the contexts in which it occurs; critical thinking can be observed and inferred directly in the external actions of some people, while some other people use internal critical thinking and they express it through their writings or conversations with others.
4. Critical thinking can be influenced by positive and negative situations; whether the events are painful or pleasant, they will leave effects and traces on the person that will make him/her think critically about how the events run, where negative and positive events influence and stimulate their personalities.

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5. It is an emotional-rational thinking: Emotions are the center of critical thinking, and we have the ability to change our lives, which gives us a sense of confidence and reassurance.

6. It is a realistic thinking and requires the use of standards, such as accuracy and relevance, and the issuance of judgments in consistence with the standards of logic, the essence of critical thinking may play its role when facing problems. The essence of critical thinking may play its role when confronted with problems and real questions to reach judgments and determine assumptions (Saadah, 2014).

2.15.6 Teaching Critical Thinking

The critical thinking must be integrated into the curriculum, and that it must be taught in schools. Students must know the critical thinking steps because they benefit their practicing and learning lives and make them aware thinkers of what happens around them. The teaching strategies must include these critical thinking. Training students in the steps of critical thinking, such as making assumptions, collecting and experimenting data, and arriving at results makes them successful researchers and thinkers in the future (Alqatanani, 2017).

The educators introduced a number of critical thinking strategies and skills, which were supported, revised and developed (Atiyyah, 2013), including:

1. McFarland (1985) strategy:

Is the strategy of interrelated words, identify the views and their aims, provide examples that help teach the skills of distinguishing between relevant and irrelevant materials with

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providing a supporting educational climate. This strategy has two methods in teaching and training critical thinking, which are:

The first method: Aims to teach students and train them on the skill of distinguishing between the relevant material and the material that has nothing to do with the subject of the lesson, and then, reach a generalization that expresses the relationship of the correlation, and can be expressed orally or in writing for the higher grades and it presents a group of related words, and one word that has nothing to do with the subject, and the remaining words are expressed in a generalized sentence in which the logic of interdependence is clarified, the sentence is relevant with the subject and students are encouraged to think in right logical ways.

The second method: Is the defence of points of view strategy and it aims to provide education and training in the development of arguments relevant to the subject by collecting information, selecting points of view with choice of supporting statements, and the teacher is leading students' discussions, it comes from many basis including: to define the subject accurately and develop the points of view and choose a particular point of view through the preparation of evidence, and arrange the words in favor of the viewpoint and summarize in terms that all students see and read and determine their views accordingly (Atiyyah, 2015).

2. O'Reilly strategy:

Al-Khawaldah (2002) explained that this strategy is suitable for high school students. It makes the student a critical thinker by making him/her sceptical of what he/she reads and listens to, and presenting discussions about what the students think, and then,

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showing the weaknesses of this discussion. It specializes in training on evidence determination skill. Teaching goes through this strategy according to the following steps:

The teacher presents a specific incident and asks the student to act it. Then, the teacher's dialogue with the students by asking questions about the incident. After that, the students practice the skill of evidence determination by asking questions, evaluating the evidence, analyzing it and ask questions among themselves. Under the supervision of the teacher, the students can be directed and helped to practice this skill using a guiding reference, such as O'Reilly manual "Critical Thinking Guide". (Al-Khawaldah, 2002)

3. Smith (1983) strategy:

It is based on processing information that emphasizes understanding and reasoning. There are several criteria for evaluating the validity of sources of information, including the skill of judging the validity of information sources and the ability to account for and explain the answer arising from a number of questions.

The steps of teaching critical thinking skills using this strategy are:

1. Introduction of the lesson: Design a certain situation to raise the attention of students.

2. Presentation of the lesson: Clear and specific criteria are set for the purpose of evaluating the sources of information and writing them on the board.

3. Skill training: Students are trained to apply the proposed standards to make judgments about the validity of information sources, and to encourage students to use the standards and support their responses.

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4. Conclusion of the lesson: Discussing directions about information and its impact on effective citizenship. The teacher tells students that people have different directions towards sources of information and must use reliable sources.

4. Beyer (1985) strategy:

1. Direct method: It is called the deductive method, and includes (Introducing the skill, explaining it, demonstrating it, reviewing the steps to apply the skill, applying the skill and final review of it).

2. Indirect method: It is called the inductive method, and includes five steps (Introducing the skill, students implementing it, knowing what is going on in the minds of students, applying the skill on new information and reviewing the skill).

To achieve better learning of critical thinking skills, it is better to rotate between direct and indirect methods. It must follow specific principles, provide sufficient examples of the skills for the students, expand the skills and practice them under guidance and with a variety of methods. There are five stages that teachers should teach their students, which are:

1. Give students an opportunity to select examples of skill, focusing on their cognitive outcomes.

2. Configure and explain the skill elements step by step, and in detail in one lesson.

3. Training for skill components that can be reviewed in new lessons.

4. Provide additional opportunities to apply the skill with educational feedback, so that students can create, apply and employ a skill.

5. Introduce the skill in two types of strategies, the first is inductive and the second is the direct strategy (deductive). (Beyer, 1985)

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5. Zaitoun (2003) strategy:

It is called (direct strategy for teaching thinking skills) and is suitable for training on different thinking skills, and is taught through the following stages:

1. Introducing the skill: Preparing and motivating the students, writing the skill on the board, teaching the students its concept, and defining it in terms of the situation where the skill is used and the benefits desired.
2. Demonstrate how the skill is performed by an example: The teacher shows how to implement the skill and perform the task step by step through examples.
3. Explain the steps of the skill performance: Write the skill steps sequentially and give the justification for each step.
4. Review the steps of the skill performance: Conduct a discussion with the students to review these steps and rules to ensure that students understand the steps of the skill performance.
5. Practicing the skill: Assign students to perform a task or activity related to the skill of thinking, similar to the task or activity done by the teacher in the previous stage, and discuss with the students the solutions they found.
6. Independent practice (skill application): It aims to raise the students' level of skill performance and develop their abilities to use it in new life situations.
7. Final review: includes a comprehensive review by students to the thinking skill they have learned, and a presentation of the appropriate areas to use it.

6. The strategy developed by (Paul, Binker, Jensen, and Kreklau, 1990)

They have developed a list of 35 dimensions for critical thought:

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A. Affective Strategies:

Developing intellectual courage, good faith or integrity, perseverance and humility, as well as exploring thoughts underlying feelings and feelings underlying thoughts, exercising fair-mindedness, developing egocentricity or sociocentricity, and thinking independently.

B. Cognitive Strategies - Macro-Abilities:

Transferring insights to new contexts, questioning deeply, and generating solutions, reading critically, evaluating actions, evaluating the credibility of sources of information, listening critically and reasoning dialogically like comparing perspectives and interpretations.

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C. Cognitive Strategies--Micro-Skills:

Such as comparing ideals with actual practice, thinking precisely, evaluating assumptions, making plausible inferences and predictions, recognizing contradictions, noting significant similarities and differences, and exploring implications and consequences.

7. Critical Challenges Strategy:

Bailin, Case, Coombs , Daniels, Paul, Ennis , Lipman are the initiators of this idea, which is a modern method that uses challenges or critical tests, and helps students get the tools needed to solve the difficult situations and what they should do about the life situations they may face.

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2.15.7 Approaches of Critical Thinking

Critical thinking can be taught in different ways and methods. Teachers must include critical thinking in their teaching methods and not teach in the traditional or old-fashioned way of teaching because information change from time to time but teaching students in new ways will teach the students the thinking skills that will help them in the future. There are multiple ways and strategies that teachers can follow in teaching their students (Alqatanani, 2017).

Afanah (2001) and Al-Sayyed (1995) explained the approaches of critical thinking as follows:

1. **The first approach**: Teaching critical thinking in the content of different subjects: It is based on the principle of integrating critical thinking into the curriculum. The focus is on teaching critical thinking through the subject. This can be done in many ways, including lectures, laboratories, homework and exams. Ennis explained that this trend is done in two ways:

1) Infusion: Teaching critical thinking to students in curriculum subjects with the correct focus on the principles of critical thinking and its skills, i.e. the teacher focuses on teaching students critical thinking abilities when teaching the different content elements of the subjects.

2) Immersion: The teacher provides the learning elements of the education content of the subject in an environment of thinking in general and critical thinking in particular, without drawing attention to the criteria that characterize the types of thinking prevailing in the academic environment, The supporters of this approach defend their point of view based on the following points:

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a. Critical thinking skills contribute to helping students overcome difficulties in learning the content of subjects, especially reading, writing and math skills.

b. Make learning and educational materials enjoyable, because of the deep understanding of the education content and increase its relevance to everyday life.

c. Motivate students by using thought processes to reach the correct understanding, and then, make appropriate and correct decisions. (Afanah, 2001 & Al-Sayyed, 1995)

This approach requires: To analyze the objectives of the curriculum, identify the skills required, evaluate the cognitive needs of learners with the objectives of the curriculum and build a framework of the proposed thinking skills according to the needs of learners and curriculum requirements. However, all these tasks require qualified teachers to perform, which in turn will motivate learners to use the thinking processes in different subjects, and provide a deep understanding of the educational content and a bigger ability of recognizing and applying it. Some of this approach's biggest supporters are (Beyer, Paul and Chamber). Also, Schafersman (1991) stated that teaching critical thinking of the curriculum has many forms, which were explained by Atiyyah (2013) in the following:

1. Lectures: It is used as a way to stimulate the thinking of students by asking questions that stimulate their thinking.

2. Laboratories: Through conducting scientific experiments, this is a great way to develop critical thinking as well as scientific approach.

3. Homework: Reading books and research as well as critical reading to know the strengths and weaknesses, and know the perspectives on different topics.

4. Math quantitative exercises: Enables learning problem solving skills through continuous practice in solving computation problems.

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5. Worksheets: The best way to develop critical thinking is to give the opportunity to write freely, because writing organizes ideas, evaluates data in a logical manner and presents the results in a convincing way. Good writing is an example of good critical thinking.

6. Exams: The questions based on comparison and the discovery of similarities and differences develop the ability to infer and deduct as a way to develop critical thinking. (Atiyyah, 2013)

2. The second approach: Teaching critical thinking as an independent subject of the curriculum: Teaching critical thinking through special programs as a skill or public ability, and is taught in the form of independent skills of the content of the study subjects. This includes examples of solving social and political problems and concerns of students, the proponents of this approach defend their opinion based on the following points:

1. The learning content is determined by a limited time: that is, time will restrict participants from the application of critical thinking skills if these skills are not integrated into the study subjects.

2. Teaching critical thinking motivates and stimulates students by recognizing the subject they are studying.

3. Teaching thinking as an independent material is more useful, especially in the absence of teachers who improve the teaching of critical skills through the subjects.

4. Training on critical thinking skills make students feel their thinking processes, which makes them appreciate the skills of thinking and use them in real life situations.

5. Making the process of critical thinking more accurate through training programs that are renewed in the form of activities and exercises not related to the subjects.

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3. The compromise approach:

Saadah (2014) noted that this compromise approach is calling for teaching critical thinking through the curriculum, but as an independent subject like other subjects, which combines the first and second approaches together in order to benefit from their advantages and features, and achieve this fusion of information with the different forms of thinking skills. Thus, combining the comprehension of the lesson with the proficiency of the skill, where the lesson time is spent in mastering thinking skills and learning the content. This approach goes through several practices, which are, the teacher shows the importance of thinking skill then, uses the thinking maps, the curriculum content will be shaped in the mold of thinking skills to lead the students towards thinking while they are learning. After that, the teacher asks the students questions to make them aware of their meditations. The teacher then strengthens the thinking strategies by providing opportunities for the students to engage independently in other situations that require the same thinking process. This approach is supported by (Schollerger).

Some of the disadvantages of this approach are: Difficulty and need for qualified teachers with curriculum content and thinking skills, because thinking skills have an exaggerated importance over the scientific course lessons. Also, the curriculum may become crowded and distract attention.

Some of the advantages are:

1. Separation between educational content and thinking skills, artificial and incorrect separation, because the curriculum must be based on integration and deep processing of

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educational content, and this requires greater mental effort and a network of interconnections between the components of the scientific material, leading to more effective and lasting education.

2. Scientific knowledge needs thinking skills, where the two sides of the integration between thinking skills and informative knowledge of the content is similar to the two sides of scissors. Thinking skills need organization, comparison and collection of information to be sorted and create a new system.

3. The transfer of the impact of learning thinking skills through the curriculum content compensates the difficulty of this method.

4. Teaching thinking skills through the curriculum content is shortening two steps in one step, instead of teaching skills and then explaining how to apply them in the curriculum.

5. The acquisition of thinking skills gives greater attention to content, where priority must be set and time must be managed and saved to create balance. (Saadah, 2014)

2.15.8 Critical Thinking Skills

Critical thinking is one of the important and well-known thinking patterns. It includes sequential and organized skills or steps which shape critical thinking. Most researchers agreed on these steps (skills) as they are the scientific steps, which the learner follows, so that its application to it is like scientific research in studying the problem and finding the final solution to it.

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(Watson and Glaser, 1991) and (Beyer, 1985) have identified critical thinking skills as follows:

1. Hypotheses prediction skill: A capability for examining incidents or facts judged in light of available data or evidence, and the distinction between allegations/claims and facts in identifying central issues.

2. Inductive thinking skill: It aims to reach conclusions or generalizations beyond the available evidences, and it is an important way to solve problems.

3. Expository skill: The ability to draw a certain result of the facts proposed with certainty, it includes deductive thinking, arriving at new information based on hypotheses, and the deductive evidence gets the form of symbolic or linguistic structure.

4. Evaluation of discussions: the ability of the learner to distinguish between the strengths and weaknesses in judging an issue, and provide a standard to judge the quality of life.

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5. Deductive skill: The student's ability to distinguish between degrees of probability or error of a result due to the degree of its relevance to certain facts and distinct between information and the real reasons, and also determine the strength of proof. This helps the student be able to increase the information available to him/her on issues under discussion and analyze the relationship between things and the judge the deductive skill after applying it several times.

6. Inference skill: The student's ability to draw the relationship between the facts given to judge the extent of the correlation of a result derived from those facts, and connecting the elements by links and relationships, if the assumptions are true, then the inference must be true too. (Facione, 2004) reported that the consensus of the panel of experts assembled on six skills on the cognitive side (Interpretation, analysis, evaluation, inference, explanation, self-regulation) and seven skills on the emotional side that

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prompts the learner to use critical thinking, which are (Desire to search, open-mind, tendency for analysis, systemic organizing, cognitive maturity, self-confidence in the ability to think critically). (Watson & Glaser, 1991, Beyer, 1985)

2.15.9 Logical Thinking Skills:

Obaidat and Abu Al-Sameed (2015) noted that logical thinking skills include:

1. Information collection: It is done through logical and accurate observation, doubt, questioning and deep looking, it includes the following skills:

a) Observation: Information is obtained through the senses.

b) Questioning: Creating and raising questions help in obtaining new information.

2. Information conservation: The ability to store data, or so-called (coding) and also remember and recall information when needed.

3. Information organization: a) Comparison: Note the similarities and differences between things. b) Classification: Place objects in groups according to common characteristics. c) Arrangement: Place things in context and order according to a given benchmark.

4. Information analysis: Such as identifying relationships and components and the ability to distinguish between opinions and facts, causes and results, main and marginal ideas, and evidence and proof.

5. Information production: A basic skill that comes as the ability to expect, predict and formulate assumptions, including: a) Research, experimentation, prediction, creativity and induction. b) Deduction: Thinking beyond the available information to fill the gaps and holes in them. c) Prediction: Using old information to add meaning to new

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information and linking it to the existing knowledge structure. d) Extensibility and development of basic ideas and information given, and enriching them with details and additions that leads to new results. e) Representation: Add a new meaning to information by changing its image, such as representing it by symbols or charts and graphs.

6. Information Evaluation: The ability to make decision and judge the validity of information and then the accuracy of sources, and identify the errors of generalizing. It also includes a) The development of benchmarks: The adoption of standards to issue judgments and decisions b) Proof: Evidence of the validity or accuracy of allegations c) Identify errors: The detection of weakness in the logical inferences and the information related to the situation or subject matter, and the distinction between opinions and facts.

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The following are some of logical thinking skills, which are:

1. Scheduling and organizing facts and using reasoning skills.
2. The use of symbols and logical solution to some problems.
3. Analysis of data and information, and discovery of relationships and organizational graphic.
4. Imposing hypotheses, conducting experiments and finding models. (Obaidat & Abu Al-Sameed, 2015)

2.15.10 Scientific Thinking Skills

Topin and Capie (1981) defined it as a mental skill used to gather and analyze information in order to solve the problems facing the individual. The learner can use

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them to form answers to questions and look at points of view to interpret and describe information. Also, (Yunus,1996) defined it as the skills the teacher perform during training and teaching, through mental activity in trying to solve a problem by identifying it, collecting data related to it, set appropriate assumptions and choose the most appropriate methods to solve the problem through specific steps. In addition, (Oudah, 2006) defined it as the mental performances of students, which are accurate and fast, during practicing the dissolution of various activities and exercises. It is also a set of mental abilities and processes that the student must have to carry out scientific processes to achieve a goal. These include (information gathering, remembering, organizing, analyzing, integrating, generating, concentrating, and evaluating).

1. **First: Observation**: Allah (SWT) said: {So let man observe from what he was created} (Surat At-Tariq, verse 5). Allah (SWT) also said: {Then do they not look at the camels - how they are created, and at the sky - how it is raised, and at the mountains - how they are erected, and at the earth - how it is spread out} (Surat Al-Ghashiyah, verses 17-20). The scientific observation is the first skill in acquiring scientific knowledge, through which the rest of the skills are developed. Observation was urged by the Qur'an in many Qur'anic verses.

Marzano (1996) defined observation as the acquisition of information through one or more senses, these senses are used to collect new information, and these senses can focus or not on a particular pattern of information. While (Al-Huwaidi, 2005) defined it as the ability of the student to use his/her senses in covering the topics and facts involved in situations accurately.

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It is the ability of the learner to use one or more senses to reach scientific knowledge and collect information. In addition, it is a process of thinking that involves watching and monitoring, and is coupled with the existence of a cause or goal that requires attention, and is influenced by the observing person's experience, because knowledge requires conscious observation and interpretation to reach accurate results.

There are some conditions that must be provided in observation, including: (1) it must be organized, disciplined and precise in quantity, quality, objectivity and comprehensiveness. (2) Recording the observation immediately and representing a sufficient number of cases. (3) The difference must be clear between observation and deduction, because observation leads to knowing things, phenomena and events, while deduction explains these phenomena and events. (4) To rely on the appropriate devices to observe phenomena and events and to take into account the differences between similar objects during the observation precisely to reach a distinctive description. (Marzano, 1996)

Objectives of observation: (1) to benefit from the research process, because it is essential for the rest of the skills. (2) Developing the use of senses effectively. (3) Knowing some of the causes and changes occurring in the phenomenon. (4) Knowing the relations between things. (5) Training the student on it, must be controlled and intended to discover the reasons and the laws of phenomena.

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2. Second: Regulation Skill

1) Comparison: Atiyyah (2007) defined it as the ability of the learner to identify similarities and differences between information and objects or ideas as well as to identify differences between objects, ideas and information and distinguish between them, which is one of the basic thinking skills that depends on observation, classification, information management and knowledge development. It requires the ability to interpret, analyze, infer, link, and come out with generalizations that can be applied to other phenomena. Also, it aims to develop the divergent thinking skills, thinking about physical and abstract things and critical thinking.

2) Classifying: Atiyyah (2007) defines it as a process that aims to place things in groups according to a specific system in our minds, and is necessary for the learner in order to efficiently absorb the large amount of information and knowledge, and to distinguish and compare between phenomena, to reach a precise classification and thus, be able to identify the similarities and differences. To carry out the classification process, the following steps must be taken: a) Identifying goals and reviewing and examining data b) Selecting objects and phenomena similar to each other in one or more characteristics c) Searching for the common denominator and the related vocabulary and put them under one heading d) Forming other groups with classifying some headings and separating their interpretations to be more precise, or integrate them and place the different ones into separate groups. (Atiyyah, 2007)

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The classification process aims to facilitate study, predicting it with some of its characteristics and classifying things according to their characteristics and general functions, and to make recalling of information easy.

3) Ranking: Marzano (1996) defined it as setting the characteristics to a particular criterion, which is directly related to classification and could be considered a special case of classification skill, or the ability of the learner to order the characteristics of the concept according to a particular criterion or attribute.

4) Representation: The ability of the learner to use information by changing its form to show the important relationships between specific elements to represent the concept, objects, information and ideas with drawings, shapes, models and hierarchical maps (conceptual maps and sensory objects).

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3. Third: Obstetric Skills

1. Heuristics: Al-Huwaidi (2005) defined it as the student's ability to understand the relations between the parts or examples to reach the whole, and to use the whole in observing parts or examples.

2. Forecasting: Al-Lulu (1997) sees it as a mental process that can be trained and practiced by analyzing the information and observations of the student. Training the learner to predict gives him/her the ability to control phenomena and deal with them easily.

Moreover, Al-Huwaidi (2005) defined it as a pattern of thinking that requires giving the best estimate based on the information available to the individual and aims at the expected result. Therefore, the prediction is the student extrapolates to future changes

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that happen to the phenomenon or the event in light of current observations or previous experiences associated with that phenomenon or event.

3. Expansion (depth): It was defined by Marzano (1996) as more details, explanation, examples and other information that are related to previous knowledge to improve understanding. Also, it is known as the ability of the learner to add more details and information related to the problem in terms of understanding, applying concepts, generalizations in new situations and solving the problem in light of previous knowledge. (Al-Huwaidi, 2005)

4. Forth: Integration Skills:

It is the learner's ability to integrate previous information with subsequent (new) information to acquire new knowledge.

i. Summarizing: The ability to synthesize information efficiently into a coherent statement. This requires at least three activities, collecting and selecting important information, consolidating important information and expressing key ideas briefly and clearly after deleting irrelevant aspects.

ii. Reconstruction: The ability of the learner to change existing knowledge structures by adding new information to previous information to acquire new knowledge structures.

5. Fifth: Analysis Skills

Qatami (2000) explained that analysis skills include all of the following:

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1. Determination of features (characteristics): The learner's ability to form general components for several things, or the ability to devise a comprehensive description. This requires the student to know and then clarify the parts and analyze the components, which requires focus on the details and structure of things and ideas.
2. Identification of errors: The learner's ability to detect errors in arithmetic operations, information and behaviors, to identify and correct these errors.

6. Sixth: Deducting: The student's mental ability to reach partial results, due to the existing observations. Training the student to deduct helps to explain the observations obtained through scientific experiments, and find the reasons for the occurrence of these observations. Zaitoon (1993) defined 'deduction' as moving from general to specific, and its goals include drawing one result or more from a group of observations, and reinforce it with more observations. Then, test it through further observations and experiences to accept or reject it based on personal observations. It also aims to distinguish between observation and deduction. (Qatami, 2000)

7. Seventh: Measuring: Jood (1995) defines it as training students to use measurement tools, scales and dissection tools, compare between things using specific units, and identify similarities and differences between objects and events.

8. Eighth: Experimentation: Testing the hypothesis validity through using materials and tools, and controlling the variables. It includes most of the processes of science, such as collecting information, and developing, controlling and differentiating hypotheses, and then, experimenting them. Practicing experimentation helps the student to reach scientific facts, because it treats the student like a researcher, and let the

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students reach knowledge that makes them respect their abilities and energies, it also increases self-confidence and respect for science and scientists.

9. Ninth: Isolation of variables: Determining the independent and dependent variables which are used in the experimentation. Developing the student's ability to distinguish between variables helps him/her to control many of the factors that influence the phenomenon. Jood (1995) explains that the purpose of distinguishing between variables is to allow the observer to reach certain logical results based on previous influences.

10. Tenth: Interpreting data: A mental skill that needs intelligence. It includes interpreting the data and information which were collected, observed and classified by the student, as well as interpreting the results and data which were concluded in light of the student's information.

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11. Eleventh: Evaluation skills: The ability of the learner to make judgments to the degree of suitability for the ideas and information presented.

i. Creating standards and benchmarks: the process of establishing standards to judge the value of ideas and their logic, as well as the ability of the learner to rely on standards in the issuance of judgments and decisions.

ii. Verification: The ability of the learner to verify the validity of the judgments and the hypotheses by providing evidences of their validity, including observation, classification and comparison, and setting the information in tables. Then, the researcher can determine the credibility of the hypothesis of the study, and this requires more training in using the information to explain phenomena (Jood, 1995).

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12. Twelfth: Building models: The top of the student's ability to construct a mental or sensory representation of an idea or event. It may be used to describe the interrelationships of ideas and events. Moreover, it is a very sophisticated process, and an evidence of the teacher's creativity in teaching his/her students, as well as his/her ability to make them generate ideas, which influences the students through the embodiment of ideas in a way that brings them to creativity.

2.15.11 Pestalozzi Model of Teaching Thinking:

Qatami (2000) stated that the individual begins to think from the outside and then moves to the inside; a child thinks about what surrounds him/her, because what surround them are subject to the tools of the mind, then, move to thinking using these tools and the child uses his/her senses effectively. Al-Shaibani (1971) stated that this theory has two main principles:

1. The meaning and objectives of education should be consistent with natural laws.
2. Education is a fundamental pillar in the reform and change of society.

Qatami (2000) argues that practicing enhances students' thinking skills and increases their mental levels, when the top students are asked to teach other students to get to results and discussing them with each other. Also, Dussault says that the method of teaching thinking aims to simplify the learning subject and make it appropriate to the nature and level of students' thinking, and reliance on sensory materials is the basis for starting mental education and training to think, because through the direct sense of

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things, the formation of ideas happens and thus, it develops the student language outcome.

Pestalozzi thinks that the willingness to think grows with training and experience, and that the greatest goal in educating student is to reach his/her focus attention, and training the student to think right and think about family matters. Training the student on housework and caring of the house affairs is an important requirement to achieve this. (Qatami, 2000)

The approaches of teaching thinking by Pestalozzi are based on the following principles. First, the need to start sensory perceptions and moving from concrete to abstract, from simple to abstract, from general to specific and from the known to the unknown. Second, the effects of thinking education by Pestalozzi: Remove the obstacles that may hinder the growth of the student, and stimulate the learner to train his strengths, where the teacher provide him/her with the appropriate opportunities, and the spontaneity and self-activity are the necessary conditions for the student's self-learning to get strength and independence (Ahmed, 2011). The teacher should make the learning process move in consistence with the system in which the student's mental development goes i.e. moving with gradual steps (Boyed, 1964).

Methods that contribute to teaching and training of thinking:

1. Students should be taught how to speak before learning how to read, because speaking is the main thinking tool, by which the idea can be transferred.
2. Students should be taught drawing before writing.
3. Use physical materials to teach principles.

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4. The association of mental learning and manual work.

5. Taking into account natural growth in the study of language, we start with names then, adjectives and then, sentences.

Pestalozzi's assumptions in teaching of thinking: Pestalozzi believes that thinking has strength, and this strength can be taught to students, and can be activated by creating physical and sensory conditions, as well as life and realistic experiences.

1. The process of teaching thinking depends on the personal experiences of the individual.

2. Linking the experiences of the individual with the language spoken helps in the development of thinking among students.

3. The teaching of thinking starts with simple and surrounding things, and then, it progresses with a simple logical progression.

4. The time of thinking is where the student uses his/her abilities and makes use of his/her thinking styles, without criticism from the teacher and others. Thus, the student exercises his/her individuality of thinking.

5. Spontaneity and self-activity are necessary conditions and factors to teach students.

6. Thinking is self-growth that starts with senses and then turns to sensory perceptions, and recorded as thoughts. This initial knowledge is the basis of all knowledge.

Pestalozzi gave a great value to religious thinking, and considered it as a fundamental foundation for the development and training of students' thinking. Through the control of moral behavior, students' thinking can be trained, developed, and accelerated by different events. It allows individuals to verbalize and express their feelings and emotions, make decisions and solve problems (Shehatah, 2014).

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2.15.12 Froebel Model of Teaching Thinking:

Jarwan (2014) explained that natural thinking is not limited to environmental conditions, the environment and nature are variables of multi-phenomena, and each phenomenon requires a window of thinking to be understood. Froebel assumed that language is the habit of thinking, if you learned a language of a community, then, you actually learned their ways of thinking, and added new mental processes to yourself. The language reflects the clothes, culture and customs, all these open windows of children to think about these multiple and renewable factors.

Factors that influenced Froebel's theory: His interaction and connection to nature, as well as religious influences and scientific, philosophical and educational studies, in addition to his long teaching and educational experience.

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Froebel's educational and psychological assumptions:

Education is a natural process in which the individual is adapted to nature. Man is connected to everything and he expresses his connections through his actions. A community consists of a group of individuals with an affiliations relationship. Froebel believes that memory is the most important and strong link between the individual and the surrounding environment, these links grow through stages consecutively and they form links with the environment. Moreover, Froebel shows the importance of playing; he considered it as a link in which the individual tests his abilities. The process of education is governed by two laws: First, the law of antagonism (the link to reconcile between two different elements or factors by creating a link, like antagonism between the spirit and material, and man and women). Second is the law of association, which

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is the growth process in which the individual overcomes the differences by creating a kind of link between the things that seem opposite to the individual. (Jarwan, 2014)

Froebel's assumptions in teaching of thinking:

1. Drawing works to teach the student thinking: It reflects will, develops his/her innovative readiness and gains real information.
2. The questions raised by students express the desire to discover phenomena and open multiple paths for thinking.
3. Mathematics is the product of free thinking, and material phenomena indicate and confirm that.
4. Taking care of curiosity, because it contributes to raise the level of thinking, by self-discovery of the truth through observation.
5. The environment that allows the individual to move and work positively contributes to the growth and development of his/her thinking.
6. The teacher is responsible for directing students to become creative, through a curriculum that includes bonuses and educational games that raise students' attention and love for the study subjects and enjoyment, and the impact of learning is then, transferred to all life situations that the learner is exposed to in his/her life.

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2.16 Creative Thinking

2.16.1 Definition of Creative Thinking

Creativity literally means creation or formation and construction of something new that does not mimic anything. Allah (SWT) said in the Qur'an: {The Originator of the heavens and the earth} (Surat Al-Baqarah, verse 117).

The idiomatic definition: There are many definitions of it (Atiyyah, 2015; Al-Hadaabi, Al-Jaji and Muzaffar, 2011; Al-Bulushi, 2010; Al-Rashidi and Al-Khalidi, 2015) including:

Harris (1998) definition is the ability to imagine, or invent new things by synthesizing ideas and modifying or changing them. Olson (1999) defined creativity as a mental process in which new ideas are generated and ideas are modified in prior knowledge to create new solutions to problems. Also, Guilford defined it as thinking in an open format whose output has a unique feature, which is the variety of produced answers that are not determined by the information provided to the individual. However, Jarwan (2002) noted that creativity is a comprehensive and complex mental process aimed at finding original solutions to problems in human life.

Ghanem (2007) interpreted creativity as a multi-faceted mental activity involving new and original output of value from individuals or groups. Also, Qatami et al (1996) definition of creativity is a cognitive process with successive stages of production, which is to produce multiple solutions characterized by diversity and novelty in a supportive and harmonious environment. While Obaidat and Abu Al-

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Semeed (2007) see it as a thinking that does not follow familiar or common methods, rules and patterns. In addition, Torrance (1993) stated that creativity is the process of sensitization of problems and awareness of vulnerabilities, gaps, inconsistencies, lack of information, seeking solutions, formulation, testing, reformulation or modification of hypotheses, transfer or delivery of results to others (Obaidat & Abu Al-Semeed, 2007).

2.16.2 Personal Traits (Qualities) of the Creative Person

Saadah (2003) explained that the creative person is characterized by traits and characteristics that distinguish him/her from other people, whether psychologically, cognitively or personally, and we note these characteristics as follows:

Accepts information without bias, prepared to take up ideas that are not well studied, strong will and determination, avoid routine and mimicry of others, have a high persuasive skills and takes responsibility, and is characterized by optimism and hyper sensitivity and is flexible, have the ability to make quick decisions and have good listening skills and hearing others for collection of information, and willingness to ignore or exceed existing rules and policies.

1. Independence: Does not follow what others say or do, and make his/her own life path in terms of the philosophy and ideas he/she believes in, and patterns of behavior translated on the ground.
2. Broad imagination: Through which the person seeks excitement and solutions that are not familiar.

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3. Bearing ambiguity: Does not give up to problems or ambiguous situations, and enjoys high capacity of patience and tolerance in order to reach more accurate solutions or more appropriate to the nature of the problem and the possibility of applying them in reality.

4. Curiosity: Where the person tends to ask questions, and wonders about a lot of things to increase personal knowledge and benefit from them in the various problems and life situations faced by him/her.

5. Open-minded: Accepts the opinions of others and listens to them with interest in order to understand and analyze them, and know whether they are consistent with a particular issue, a specific problem or situation.

6. Ability to manage the various discussion panels that revolve around different life themes or processes. (Saadah, 2003)

7. Tendency to challenge difficult situations and uncertainties without surrender to them in order to seek suitable solutions that may benefit the person and others.

8. Flexibility in different situations to prepare for the best solutions.

9. Big verbal fluency, which helps the person to respond to many queries, and try to convince others of his/her point of view and address the issues that require fluency to talk about and clarify them.

10. The ability to generate new ideas from old ideas, opinions and situations.

11. Looking at the problems as an interesting work, because it stimulates thinking and engage the creative person in proposing temporary hypotheses or experimental solutions for a period of time, and then, look for the evidence and cognitive data necessary to examine hypotheses, and get to appropriate solutions and applying them in educational situations.

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Al-Bulushi also pointed out that some of the creative person's traits are:

1. The tendency to self-confidence and faith in what he/she does, even if it provoked criticism of others.

2. In-depth view of the phenomena and patterns of human behavior with analysis and interpretation of them.

3. The ability to predict the results of the issues and problems that he/she deals with, or researches them in light of familiarity with its aspects and access to many evidence and data that support such a trend.

4. Tends to compete instead of bargaining, and wants to try and experiment instead of agreeing to the views of others. (Al-Bulushi, 2010)

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2.16.3 Levels of Creative Thinking:

Atiyyah (2015) and Ghanem (2004) explained that creative thinking has levels that vary in terms of depth among people:

1. Expressive creativity level: It is a foundation on which the other levels are based and it is necessary for their emergence. Also, it appears independently without the need for skill, originality or output quality and perhaps the best example of this level is the expression of spontaneous drawings of children expressing their thoughts.

2. Productive creativity level: A level that, if reached by the individual, shows a tendency to improve the method of performance according to specific rules leading to the emergence of integrated products.

3. Inventive creativity level: This is represented in the individual's ability to invent and discover, this level is deeper than the previous two levels, and invention is considered

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the most apparent quality of the individual. It is the work of the inventors and discoverers who show their genius using innovative materials and methods and the realization of new relationships between things or parts that were separated before.

4. Regenerative creativity level: A level that requires an amendment to the general principles governing a field in science, literature or arts. When a person reaches this level, he would be able to renew and modify the general principles governing the field of the thinking subject, which leads to improve previous existing things and methods using skills relevant and suitable to them.

5. Imaginative or emergent creativity level: It is the level that requires an original creative thought to appear among available ideas. This level is achieved by the creative person when he/she is able to show a principle or generate a new rule that was previously unknown. (Atiyyah, 2015 & Ghanem, 2004)

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2.16.4 The Importance of Creative Thinking

1. It makes the student effective in the community and able to diligence, and increases the effectiveness and efficiency of mental function of learners in addressing issues.
2. Frees the individual from dependence, imitation and monotony in thinking.
3. Develops fluency and elaboration in thinking, and provides original alternatives and unprecedented solutions to problems and issues.
4. Addressing issues from various aspects, and creating an accurate image leading to comprehensive solutions.
5. Creative thinking is one of the thinking components with the highest capacity which is a complex and continuous thinking that deals with difficult tasks.

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6. Develops self-confidence, independence and self-reliance in the individual.

7. Creative thinking is an urgent need imposed by The Creator (Allah SWT) to meditate and think of the universe, the soul, signs of Allah (SWT) and the lessons included.

8. Increases the individual's ability to tolerate ambiguity, seek out what is missing, or create a new vision of extraordinary value about the situation.

9. A key input to the process of scientific and technological progress pursued by countries of the world in various aspects of life.

2.16.5 Characteristics of Creative Thinking

1. A complex thinking that is not confined to one side, and has no single path, meaning that it is not a linear thinking.

2. Fluent thinking and the ability to generate as many ideas as possible in a short time.

3. Flexible thinking with the ability to change the state of mind, by changing the situation and change the trend of ideas depending on the situation.

4. Divergent thinking with original outputs and lack of repetition in different contexts.

5. Its center is in the right hemisphere of the brain, where it does the divergent thinking production, intellectual processes, and processes that require the abilities of conceptual, intuitive and spatial thinking.

6. Its results cannot be predicted and it does not abide by the rules of mental logic.

7. It is acquired by training and practicing, not limited to a certain number of individuals, which means it is not limited to talented and gifted individuals alone. (Atiyyah, 2015)

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8. It is a comprehensive thinking able to add and increase to the idea, and is based on many skills such as fluency, flexibility, originality and elaboration.

9. Free unrestricted thinking based on imagination, and it enables the individual to link ideas to achieve the outcomes of the treatment method of different situations. (Atiyyah, 2015)

10. The ability to deal with a set of ideas, and enables the student to build knowledge himself, and makes the learner integrated with the content of learning persistently and effectively.

11. Running the mind of the learner in a faster and more efficient manner.

2.16.6 Stages of Creative Thinking

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Al-Atoum et al. (2007) noted that the creative person passes through many stages of his mental activity, which addresses the thinking issue and these stages as seen by (Walls and Marksbery)

1. Preparation stage:

It is the psychological preparation for the thinking process in a certain issue that stimulates the individual and pushes him/her to think about it. In this stage, the whole background is formed (the creativity), and this stage includes (the psychological preparation for the thought realization, the cognitive preparation of collecting information, the identification of difficulties and the need to solve, and the collection of available data and information that help in thinking processes, and the organization and utilization of available information).

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2. Incubation stage:

At this stage, the ideas or information related to the issue or problem are organized, and ideas that are not related to the subject are eliminated, and information and experiences are synthesized from the padding that may delay the solution. It is characterized by the great effort exerted by the creative learner to solve the problem. The importance of this stage gives the mind an opportunity to get rid of wrong thoughts and impurities, and removes the individual's anxiety and unconscious fear of doing the work. (Al-Atoum et al, 2007)

3. Inspiration or illumination stage:

It is a stage of labor for the new idea and creative flash or the stage of generating new idea in the mind of the thinker or creative person which exists when the cover is revealed to show the unusual solutions. This stage includes (many original solutions to the raised problem or issue, critical and objective analysis of the proposed solutions, choose the best solution among the proposed solutions).

4. Investigation (verification) stage:

It represents the last stage of the creative process, where the desired final results are obtained; the value of the work is shown to others. This stage includes (the original solution test, the declaration of the solution value and the follow-up and evaluation process to take account of the variables and their consequences).

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2.16.7 Steps of the Creativity Process:

Al-Mufleh (2005) explained that the creative process goes through many steps, including:

1. Stimulation: It means something that stimulates the individual, this may be a question posed by the individual himself when faced with a problem, or a situation that requires a response or answer, which may be raised by others. This stimulus should be powerful in order to activate the mind of the individual in the process of creative thinking, and make him/her feel a challenge worthy of thinking and seek for a solution.
2. Exploration: It means searching for new solutions or alternatives to the raised issue before the decision is taken. This step should be given sufficient time to collect information and ideas that give a complete picture of the issue, and this research may take several forms such as experimentation, reading and consulting others of similar experiences. (Al-Mufleh, 2005)
3. Planning: It includes identifying the dimensions of the problem and the information related to it and analyzing it to shape the individual's awareness of what he/she thinks about.
4. Activity: It means converting the idea produced into work to excrement it and verifies its validity or search for an alternative.
5. Review: The evaluation of the idea to know the level of effort and success achieved and then, work to improve it to achieve the goal or purpose of the process of thinking. (Al-Mufleh, 2005)

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2.16.8 Factors Contributing to the Development of Creative Thinking

Al-Surour (2000) explained that there are a number of factors that can help in the development of creative thinking and abilities of learners, which are:

1. Qualified teachers who are able to take care of creativity and creative minds and follow-up their students in and out of school, and communicate with their families to follow the development of their creativity.

2. Provide an educational environment that encourages creativity, which contains all the supplies of libraries, laboratories, computers, technologies and means of presentation.

3. Provide curricula with modern contents that are flexible and work on a comprehensive development of the personality of the learner, and is able to develop his/her imagination and enable him/her to develop hypotheses and discovery methods, so as to stimulate the mind and encourage research and experimentation.

4. Relying on assessment methods that emphasizes measuring creative abilities for learners and these measures are characterized by stability, objectivity, comprehensiveness and discrimination, that is, measuring the higher thinking levels of the students to whom creative thinking skills belong.

5. Conducting workshops and training courses for creativity which are equipped with all the means and techniques required for the processes of creativity.

6. Engaging creative students in activities and events that are characterized by depth and diversity and are under the supervision of those who have sufficient experience in creativity and care of creative minds.

7. Providing optional courses that respond to the students' creative tendencies and guide their path of choosing future career.

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8. Providing programs enrichment in support of the content of the subjects that enrich the learning material in a way that contributes to the formation and development of creative abilities among learners.
9. Issue a special magazine or newspapers that include creative students' activities and achievements. (Al-Surour, 2000)

2.16.9 Creative Thinking Skills

Dojani (2003) demonstrated that psychologists and researchers of creative thinking perceive that the practice of creativity has sentimental tendencies as well as mental skills. Emotional orientations should be available along with cognitive skills and creative thinking, and it has components and skills that distinguish it from other types of thinking. The researchers almost unanimously agreed of the classification and components of creativity, some call them creativity skills, which include four fundamental skills of creative thinking (fluency, flexibility, originality and elaboration). Where Feldhusen (1984) and Torrance (1965) determined them by five skills, which are:

1. First: Fluency Skill

Al-Khalili (2000) defined it as a person's ability to produce multiple ideas and proposals on a given topic or problem. (Dojani, 2003)

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Also, Qatami (2000) defined it as the multiplicity of ideas that can be recalled or the speed at which uses, needs and benefits are recalled for specific things, meaning the liquidity of ideas, their flow, and the ease of generating them.

According to Saadah (2014), fluency is defined from the researchers' and students' perspectives. From the researchers' point of view, (it is the mental skill used to generate a freely flow thought in light of a number of ideas related to the problem), while students believe that (it is the skill that makes students' ideas flow freely in order to reach many new ideas as soon as possible). (Saadah, 2014)

Fluency is an essential component of divergent thinking that is at the core of creative thinking. Abu-Hatab (1982) believes that fluency is the divergent solution to problems, which comes under the conditions of lacking information. Fluency is determined entirely by the number of responses issued by the examinee.

Fluency is measured by several ways and methods, including:

1. The speed of thinking in giving words in a single format.
2. Classification of ideas according to specific requirements.
3. Ability to give many words related to a certain idea.
4. Ability to arrange words in as many sentences and phrases as possible that carry meanings. (Abu-Hatab, 1982)

Types of fluency:

By (Al-Rashidi & Al-Khalidi, 2015, Al-Mutairi, 2014, Al-Bulushi, 2010, Atiyyah, 2015, Razouqi & Abdul-karim, 2015)

1. Verbal fluency / Fluency of words:

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Al-Huwaidi (2004) defined it as the ability of the student to produce as many words as possible with specific characteristics, which means the speed of thinking in giving words and terms and generating them in a specific form.

Also, Abu-Jado (2007) considered it to be used in spoken language or expression units and is measured by the speed of generation or production of words under certain conditions in their construction or composition.

2. Ideational fluency:

Guilford defined it as the ability to produce as many ideas as possible at a specific time.

Also, Al-Harithi (1999) defined it as the rate of generating a quantity of ideas at a given time. In addition, Torrance explained that there are some guidelines for the development of intellectual fluency (aids, incentives, and competition): creating competition between students leads to the production of the highest number of high-quality ideas. (Abu-Jado, 2007)

3. Figural fluency:

Jarwan (2000) defined it as the ability to quickly draw a number of examples, preferences, or adjustments in response to situational or visual stimuli.

Categorizing examples and information in the form of figures and encouraging students to make schedules that include similar things, handicrafts, professions, and academic disciplines.

4. Expressive fluency:

It is the ability to express ideas easily, and the possibility to translate them in words or images to express them in a connected way.

It is the ability to formulate ideas in useful phrases and the ability to think fast in sequent, permanent and appropriate words of a situation in a particular topic.

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5. Associational fluency:

It is called interrelated fluency because it expresses the divergent production of relationships' meanings in the Guilford formation model, and it refers to the ability to produce as many relationships, correlations, or ramifications as possible in the sense of an idea, such as producing or writing the largest number of synonyms to a set of given words. Moreover, the associational fluency means producing a number of words that meet certain conditions in meaning and require the creation of specific meanings of words. For example, expressing a relationship, such as similarity, contrary, or from part to the whole, as well as providing words related to a certain term under certain conditions in terms of meaning, and it depends on understanding words or certain characteristics. (Jarwan, 2000)

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2. Second: Flexibility

Rayyan (2006) defined it as the ability to produce different kinds of ideas that transform one's thinking to different angles, or use a set of strategies. Roshca (1989) defined it as a knowledge-based center that reproduces rapid and appropriate transmission of information, systems and knowledge in accordance with the requirements of emerging situations. Also, Guilford (1967) defined it as the ability to quickly produce ideas which belong to different types of ideas that are related to a particular situation. In addition, Qatami and Nayefah (1991) and Shehab (2000) see that it is the person's ability to change the state of mind and ideas to suit the complexity of the situation. Flexibility here reflects the opposite of the so-called mental rigidity and inertia.

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There are some classroom activities that help in the process of flexibility:

1. The teacher uses open - ended questions.

2. Assigning students duties that require the mention of unusual uses of things, classifying these things and their uses into different categories, types and groups based on certain characteristics.

3. Training students to compare differences between two types of vocabulary, encouraging students to identify as many different types of variances as possible with classifying responses to categories, such as location, climate, language, …etc. (Qatami & Nayefah, 1991, Shehab, 2000).

Flexibility has two types, which are:

4. Spontaneous flexibility: The ability to answer as many different and varied responses as possible to a specific situation determined by the test. These responses are characterized by diversity and spontaneity.

5. Adaptive flexibility: Al-Titi (2004) defined it as finding a solution to a problem or confronting any situation in light of feedback from that situation.

The ability of the individual to change the mental direction quickly to meet the changing problems, and this reflects the mental adaption, because the flexible person adapts to situations and circumstances and he/she is contrary to the person who is mentally sclerotic to situations and problems.

Al-Kanani (1988) defines it as the ability to change the mindset to achieve special and imposed requirements in a new situation.

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3. Third: Originality

Al-Zayyat (1995) pointed out that originality expresses the divergent production of meanings transformations and appears in new and uncommon production that is characterized by novelty and rarity.

Al-Harithi (2001) defined it as an extraordinary new response that originates from a person.

Hussein (2002) believed that it is the ability to produce original responses that are a little repetitive in the statistical sense within the group to which the individual belongs. The less widespread the idea is, the more original it becomes.

Originality is a skill that differs from the skills of fluency and flexibility in that:

1. It does not depend on the amount of creative ideas proposed but on the quality, value and novelty of such ideas.

2. It does not include an attempt to distance from the repetition of the person's perceptions or ideas as in the skill of flexibility, but it rather includes the exclusion of repeating what others do. Thus, the skill of originality is distinguished from the skill of flexibility (Atiyyah, 2015).

Zaitoon (1987) stated that originality can be measured by:

1. The amount of uncommon responses, which are acceptable responses to specific provocative problems or situations.

2. Choose titles for some short stories, where the person is asked to mention titles as funny or strange as he/she can at a specific time, with the possibility of replacing the story with a certain picture or shape.

Torrance has shown some classroom activities that may help in the process of originality, including:

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Through the brainstorming process, teachers reach activities that encourage students to postpone judgment on responses until they have completed their production process in order to obtain unique responses and encourage the production of unique and original ideas. Students use metaphors and image processes while comparing similar and different objects and describe topics more dynamically (Zaitoon, 1987).

4. Fourth: Elaboration

Saadah (2006) defined it as the skill that is used to load the idea or the mental process, to exaggerate the simple idea or the normal response, and to make it more useful and precise, by expressing its meaning in detail, elaboration and clarification (Saadah, 2006).

Al-Kanani (1990) described the students who are interested in elaboration as being able to take up an idea or work and elaborate its details. Many creative ideas were implemented on the ground because of the addition of those details that facilitated the application of creative ideas. Moreover, elaboration enables students to improve, develop and organize their ideas.

There are some classroom activities that contribute to the process of elaboration, including:

Solving problems with specific conditions that allow successive mental developments leading to final solutions to the original and major problems, writing conclusions for topics with unknown conclusions, and artistic activities that allow students to create images or designs from simple lines (Al-Kanani, 1995).

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5. Fifth: Sensitivity to Problems

Al-Huwaidi (2004) defined it as an individual's ability to sense or find problems, discover them, identify missing information, and raise appropriate questions about the problem. Moreover, Jarwan (1999) stated that sensitivity to problems includes awareness of problems, needs or weaknesses in the environment or situation. In addition, Qatami (2000) defined sensitivity to problem as the individual's observation of many problems in the situation he/she is facing, and knowing the mistakes, deficiencies and shortcomings. The student needs to raise the level of awareness and perception to master this skill.

Sensitivity to problems is considered one of the creativity components. It is intended to increase the level of awareness of the problems, needs or weaknesses in the situation or environment in which the person lives, and to recognize the mistakes, deficiencies and shortcomings, and sensing problems which is the awareness of the existence of problems and it falls under three stages (affiliation that creates the sensor of the problem, the discovery that emerges from the skill of sensitivity to problems and the solution that results from creativity and talent); without affiliation, there will not be a sensor, and without sensitivity, there will not be exploration and awareness of the problem, and without creativity and talent, there will not be a correct solution to the problem. (Ruzouqi & Abdel-Karim, 2015)

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2.16.10 Conditions of Creative Thinking

It was explained by Al-Atoum et al. (2007) as follows:

1. Interest and stimulation: the individual's sense of a motivation to think about finding solutions to the problems.

2. A specific goal sought by the individual to achieve because the goal is what guides the path of thinking and forms the axis around which the process of thinking revolves and defines its features.

3. Sufficient knowledge: the existence of sufficient knowledge on the subject by research, reading, stimulation and follow-up.

4. Strategy of thinking and the development of multiple plans and alternatives, evaluate and arrange them according to their preference and importance to reach the solutions that the individual seeks to achieve.

5. Choose the most appropriate alternative and plan among what was proposed after eliminating the inappropriate or ineffective alternatives.

6. Creative imagination: It is one of the most important conditions for creative thinking, describing visualization or mental imagination as a cornerstone of creative thinking, as imagination helps the individual in the development of a final perception of the desired results.

7. Boldness and adventure: It is not to fear failure, and not to put obstacles, sometimes innovation seems impossible or not useful at the beginning.

8. Accepting criticism and admitting error, because the creative person is an objective thinker who is not adamant or bigoted towards a certain idea.

9. Training as it is an acquired thinking even though it is influenced by other factors, such as intelligence and heredity. It is an intellectual skill and every skill is acquired

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through practice, training and continuity. There are methods of training in creative thinking, such as positive thinking and developing the ability to generate ideas. For example, figurative thinking, imagination, learning by likening and analyzing cognitions. (Al-Atoum et al., 2007)

2.16.11 Creative Thinking Theories

Ruzouqi and Abdel-Karim (2015) as well as Atiyyah (2015) mentioned that there are many theories that explained creativity and creative thinking, and they received attention of many theoreticians from various theoretical schools. The civilizations that used creativity have risen to the highest levels, unlike other civilizations. Without creativity and creative people, human life descends into abyss and desolation. Thus, we will look into the most important theories that discussed creative thinking:

1. Geschtal Theory of Creative Thinking

The authors of this theory believe that creative thinking begins with a problem that the individual faces that is incomplete or deficient, and when thinking about solving it, everything is considered, examined within the overall framework, they see that it is insightful thinking, where the individual reaches the solution suddenly, and then, moves away from the problem and reaching the so-called flash insight. Looking at the problem for the first time will be different from the other times, the more we look at the problem, the more we will receive new information from reordering factors and components, which makes us change our opinion and see things we did not notice before. In the final

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stage, re-building the field is done to restore consistency to it (Atiyyah, 2015, Ruzouqi & Abdul-karim, 2015).

There are laws governing the relationship between the parts and the whole, including:

- Law of fullness: that is, the total is greater than the sum of its parts, and that man becomes aware of the whole before he realizes the parts.
- Proximity law: The relatively close things look like one set.
- Law of Similarity: Similar things look like a single set.
- Law of One Destiny: Moving objects in the same way look like a single set.
- Law of continuity: means things arranged in such a way that they take a certain method of continuity that overwhelms things that change in their direction. (Saleh, 1988)
- Law of closure: The missing things seems like they are complete and treated as if they were indeed complete.

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Roshka (1989) showed that the solution suddenly appears on the basis of intuition and understanding of the situation, not on the basis of logic, and that some solutions come by coincidence and others by creativity.

Creativity is the ability to look at the components of the field, and the realization of relationships. Then, vision happens that comes suddenly as a solution to the problems, creative solutions require intuition and understanding of the problem, as well as fertile interaction between imagination and spontaneity (intuitive knowledge) and between mental processes i.e. abstraction and analysis (mental knowledge), and creative processes occur through this interaction.

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2. Association Theory

According to Thorndike, people become creative because of the rewards and incentives they receive from their creative work. The association theory defines creativity as combining the elements associated with certain configurations to meet needs or to achieve some benefits, and as the elements of the new configuration are asymmetric and heterogeneous, the level of creativity increases.

Al-Sarraf (1999) mentioned some of the factors behind individual differences in terms of creative thinking abilities, including:

1. The need for associative elements: An individual who lacks the necessary elements for new configurations cannot produce creative output.
2. Organization of associations: Individuals differ among themselves in the general organization due to the associations between them, and this organization affects in the speed and extent of the possibility of an individual to reach the creative solution.
3. Number of associations: The greater the number of associations, the greater the likelihood of an individual reaching creative solutions.

Also, Midnyk also believes that creative formation occurs through three methods as follows:

1. Serendipity: It occurs when associations between elements appear by accidental environmental stimuli, so associations appear between elements that were not previously interconnected.
2. Similarity: It is between the elements associated to each other or similarities in the stimuli that provoke them.

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3. Mediation: The correlative elements may be affected by each other via mediation or intercession of other familiar elements.

Therefore, according to this theory, creativity can be developed by providing reinforcements to individuals (Al-Sarraf, 1999).

3. Humanistic Theory

The adopters of this theory, including (Maslow), believe that all individuals have the ability to innovate and that this ability is subject to the influence of the social climate in which they live. There are creative people who are self-fulfilling and other creative people with special talents. Moreover, creative people live their reality more than those who live in the world of stereotypical theories and beliefs, and creative people are more self-expressive, more natural, spontaneous and less articulate. Furthermore, there are two types of creativity: the first type is the one that leads to the production of new things which depends on talent and hard work, while the second type is the creation of self-realization. On the other hand, Rogers believes that the creative process is an authentic production that grows in the person's individuality, materials, events and life circumstances, because creativity cannot be achieved without producing something that can be observed and that this product must be authentic, creativity from his point of view depends on two conditions, which are mental integrity and mental freedom. In addition, he considered creativity as a new production that stems from the interaction between the individual and the different experiences he acquired. However, there is a weakness in this theory, in which that it gives creativity a romantic look and that it

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fulfills individual's humanity more than it is a particular mentality leads to a certain output. (Qatami, 2000)

4. Factor Theory

In the interpretation of creativity, Guilford relied on his theory of mental formation, in which he defined the dimensions of mental activity as follows:

The type of mental process, the type of content or purport that occupies the mind and the type of outputs obtained from that process.

He showed that these dimensions include the following mental processes:

Knowledge which means the individual knowing what belongs to the situation in the field of his/her experience, memory which means storing information and experiences in the long-term memory and recall them when needed, evaluation which means the issuance of judgments in light of the person's experience and knowledge, and production which means finding solutions to the problem facing the individual, which are two types:

1. Convergent production: It means the production of correct information, or specifically pre-determined and agreed upon.
2. Divergent production: It means producing diverse information that is not subject to prior agreement on the scales of error and right which confirms its originality. (Al-Sultani, 1984)

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5. Cognitive Theory

This theory determines the mental processes, brain functions, and the relationship between them and the personality variables, and deals with what happens in the human mind when he/she creates or solves the problems, and this theory comes from the following suggestions:

1. Interest in the study of cognitive processes that can be inferred, such as thinking, intelligence, values, awareness and expectation.
2. Cognitive processes are the ones that govern the human perception of the world and the environment around him without diminishing the role of the environment in human growth, consciousness and mental uplift. In addition, Piaget believes that the influence of the environment on humans is governed by their consciousness of it, and this consciousness goes through different progressive stages, and thus, human perception of the environment is linked to his/her growth and progress. This theory emphasized that creative thinking is a cerebral process that follows a series of mental processes, such as attention, perception, awareness, organization, classification and integration, and then getting a new form of solution, this chain must be linked to learning experiences (Jarwan, 2014).

6. Psychoanalysis Theory

Freud, the founder of this theory, believes that creativity is the expression of defensive tricks called (transcendence or sublimation), and through these defensive tricks, the individual expresses his potentials in a form that is accepted by society. Creativity arises as a result of psychological conflict at the beginning of the person's life (as a defensive

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trick) to counteract the libido energy which society does not accept to express. According to Freud, creativity is the creative person move away from the familiar reality to an imaginary life, and he has linked creativity and other behaviors with the set of motives driven by the unconscious. If the person could not express with full freedom about his/her desires and tendencies, those desires must proceed in other ways or be compensated. (Ruzouqi & Abdel-Karim, 2015)

Moreover, Chris provided another explanation for the creative process from the psychoanalysis point of view. He believes that the basic psychological process of creativity is a recoil process in the service of ego. Creative work emanates primarily from unconscious content, including memories, delusions and instinctive stimuli. Ego plays the role of directing these contents towards the problem that the creative person tries to find a solution for, even if these contents tried to direct themselves, and thus, the unconscious or ego do not try to overcome it.

Furthermore, Younk sees that the creative node of the individual develops unconsciously at first, and continues to evolve until it comes to the consciousness at a certain moment, while Adler sees that creativity occurs by a feeling of deficiency because when the individual feels an organic shortage that rush towards confronting it bravely to make up for that shortfall.

Hence, the theory of psychoanalysis has concentrated on the emotional and motivational aspects for creativity, but its focus was less on the cognitive and learning aspects. The concept of creativity in light of this theory emphasizes the role played by the contents and motives that lie outside the area of individual awareness in the

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creativity process, and this is an exaggerated explanation far from logic and reality in which the person lives (Atiyyah, 2015).

Intelligence theories dealt with all aspects of intelligence, and there are supporters and others against them. The theories have also dealt with deficiencies and weaknesses in some of these theories, but these theories remain a strong support and evidence. For example, the two factor-theory showed two main factors (i.e. general and specific). However, its shortcomings are the small size of the sample and the lack of tests that were conducted on the samples of related studies. Moreover, Thurston's Group Factor Theory expresses completely independent capabilities while there was no any statistically significant correlation. But the theory indicated seven factors, and it moved away from the use of mental age with adults. In Guilford's Structure of Intellect (SI) theory, intelligence is viewed as comprising operations, contents, and products. It is one of the most ambitious models in contemporary psychology and its basis of classification that depends on classification models. This theory contributed to the development of factor analysis research so that it gives the researcher a frame of reference supported by many empirical evidence. However, the results of this theory do not match with the results of the research of Guilford's theory, and this theory did not apply comprehensive tests for the various structures of the theory. On the other hand, Cattell's theory showed two factors (i.e. fluid ability and crystallized ability). intelligence refers to a mental competence that is non-verbal and free from cultural factors, such as tests of numerical abilities, mechanical skills, and vocabulary.

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2.16.12 Constraints to Applying Creative Thinking

Diab (2005) explained that the obstacles are all what surrounds the student, including factors, circumstances or reasons that hinder creative thinking of the student, so we need to identify those causes and constraints, and the most prominent reasons are:

1. Fear of failure and lack of self-confidence and hesitation in decision-making.
2. Fear of unknown; avoid frustration and lack of resources.
3. Lack of courage and extreme caution in exposure to a situation.
4. Fast adherence to familiar things and admiration to them, and adherence to traditions and customs. (Diab, 2005)

Obaidat and Abu-Al-Sameed (2005) added the following constraints:

1. Ignorance, avoidance of work and fear of mockery, criticism, ridicule and embarrassment.
2. Negative education and killing the spirit of creativity in the individual.
3. Lack of flexibility and adherence to stereotypes, and excessive enthusiasm for things.
4. Consider a single point of view only.
5. Lack of desire to learn and to acquire the necessary expertise that helps the learner in all stages of his life in different circumstances and problems (Obaidat & Abu-Al-Sameed, 2005).

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Roshka (1989) and Jodi dones (1993) summarized the constraints of creative thinking as follows:

1. Permanent reliance on the recital method of communication to deliver information and ignoring other media, such as research and panel discussions.
2. The teacher forcing students to adhere to his way of thinking and expression.
3. The teachers' orientation to reward students who show obedience, submission and conformity.
4. Some teachers do not accept different opinions of students than theirs, and the disappearance of innovation and originality in the teaching process.
5. Forcing the students to do what they do not like, away from their tendencies.
6. Preference of the teacher to the smart student, and lack of preference for the innovative student, and attention to the students getting the rapid and correct solutions.

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Al-Sorour (2006) reported some of the views on the constraints or obstacles of creative thinking:

1. Environmental constraints: Such as noise, lack of space, lack of support for new ideas and lack of material support.
2. Cultural constraints: The customs and traditions and the community rejection of creative ideas before their application, and not promoting creative work.
3. Cognitive visual constraints: The inability of the individual to see things and issues from all aspects.
4. Expressive constraints: The inability to communicate and deliver ideas to others due to the inability of speaking in a particular foreign language or the absence of modern assistive devices.
5. Intellectual constraints: It is manifested by the use of inflexible or incorrect ideas.

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6. Cognitive constraints: It is to look at things and problems in traditional stereotypical ways.

7. Emotional constraints: It is related to fear of making mistakes, bearing risk or inability to distinguish between truth and fiction. (Al-Sorour, 2006)

8. Time (historical era): There are historical achievements that were not appreciated when their creators did them, but their societies appreciated them after their deaths, and time here has a role of influence on creativity.

9. Conscious and unconscious constraints: When the creative person fears to show new ideas to avoid society punishment, so these ideas remain locked and do not appear to the public and thus, there is a nervous struggle between conscious and unconscious.

10. Other constraints: lack of information and background on creativity, discouraging individuals on productivity, ridicule and mockery, and lack of appreciation to knowledge and work. (Abdel-Kabeer, 2008)

Also, Jarwan (2014), Obadah (2001), and Abdel-Hamid (2005) mentioned that there are other obstacles, such as:

A. Personal Constraints: Such as lack of self-confidence, excessive enthusiasm, stereotypical thinking, lack of flexibility, lack of encouragement and motivation, lack of time investment and excessive preoccupation with routine work.

B. Family Obstacles: Such as lack of emotional security or students having unpleasant and bad experiences affect the composition of the brain and low economic level of the family.

C. Constraints of creative thinking in educational institutions: It has been divided into two types, which are:

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1. The Teacher: There are behaviors that hinder the intellectual process (like not having consultation principle, lack of adventure and risk spirit, the discouragement of new ideas and be confined only to the content of the textbook, arousing ridicule of students on the mistaken student, provide ready solutions for problems and narrowing areas of criticism).

2. The Curriculum: It is limited to theoretical information that measures only the linguistic and logical (mathematical) aspects and omits other aspects that will develop the personality of the learner, such as training him on how to solve the problems facing him in different life situations, and training him on scientific research skills like searching for information and facts, as well as criticism, issuance of judgments and decision-making skills, and do not fill the students' minds with large amount of useless information.

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2.17 Previous Studies

Also, Abdi and Rostami (2012) have studied the effect of multiple intelligences- based instruction on students' creative thinking ability at 5th grade in a primary school. The purpose of this study was to examine the effect of multiple intelligences- based instruction on students' creative thinking ability at 5th grade in primary school. This research was a quasi-experimental study with non-equivalent groups, which includes pre and post-test design with the control group. The study was conducted with 30 experimental and 29 control group students at 5th grade in primary school in Kermanshah. Torrance's Creative Thinking Test was given to both groups as pre-tests

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and posttests. During the instruction, the experimental group received multiple intelligences based on learning science activities while the control group utilized traditionally designed science instruction by the same teacher over a period of 8 weeks. Results which were analyzed by covariance indicated that multiple intelligences- based instruction significantly stimulated students' creative thinking ability. Hence, it was concluded that strategies founded on MI theory were more effective in improving students' creative thinking ability than traditional teaching.

Foong, Shariffudin and Mislan (2012) conducted a study on the relationship between multiple intelligences, personality traits and critical thinking skills among high achievers in Malaysia. This paper examines the Multiple Intelligences pattern, personality traits and critical thinking skills among the high achievers. The population involved were high achievers from all over Malaysia comprising of 1268 students selected at random from secondary schools enrolling high achievers such as boarding schools, Mara Science College, as well as religious schools nationwide. These data include the frequency, percentage and level of achievement and relationship for aspects of personality types, multiple intelligences and critical thinking skills of the high achievers. The Multiple Intelligences Inventory was modified and validated according to the research needs. The results showed that high achievers possess the following intelligences: Intrapersonal> Existential> Bodily/Kinesthetic> Logical/Mathematical > Visual/Spatial> Interpersonal > Verbal/Linguistic> Naturalist> Musical/Rhythmic. The personality traits of the high achievers are in the order EN>ES>IS>IN. Whilst their critical thinking skills are in the order of EA>DE>RA>IF>IT. The results also displayed

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some significant correlations between multiple intelligences, personality traits and critical thinking skills of high achievers.

Zobisch, Platine, and Swanson (2015) conducted a study on the theory of multiple intelligences and critical thinking. The study aimed to investigate whether using MI techniques could increase mastery of critical thinking to know if perception of an instructor's use of MI techniques enhance critical thinking mastery as measured by scores on a standard test. The mixed method was selected to allow the researcher to use two different data collection approaches to confirm, cross-validate, or corroborate findings within a single study. Researchers used questionnaires and focus groups as the means to offset the weaknesses associated with using a single method with the strengths of using multiple methods. The sample group was a convenience sample and consisted of students enrolled in critical thinking courses during the 2004 fall term at the nontraditional adult education institution in the central United States. The design of this study incorporated two assessments of student perceptions of instructors' use of MI techniques, and an assessment of student critical thinking mastery. The study collected data on two constructs:

- Measurement of student comprehension of the critical thinking concepts taught in the course using a standard exam developed through the nontraditional adult education institution.
- The variable measured from the focus group discussion was the number of examples provided for each MI technique.

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Relationships are measured by correlations. Pearson's product movement correlation was used on interval level data. The significance of the correlations was tested using the correlation t test. The significance level was chosen as alpha equals .05. Findings revealed that the correlation between individual recall and final exam scores was not significant, while the correlation between group recall and average final exam scores was significant at the 0.05 level. The focus group discussions revealed student ability to recall specific examples of instructor use of MI techniques. Students could identify, remember, and relate MI techniques to their experiences in class. The study concluded that employable individuals who have graduated from colleges and universities must be inquisitive, challenging problem solvers. Graduates must be able to take the knowledge that they learned and apply this to new knowledge and reasoning skills in the new work environments they will encounter. Also, it is necessary for educators to apply Gardner's (1983, 1993a) theory of multiple intelligences to enhance the learning experience of the students. To continue to remain employable, critical thinking skills must be taught and applied to real-world experiences.

Yi, Sulaiman and Baki (2015) have conducted a study about the role of multiple intelligences and creativity in students' learning style to examine the relationship between creativity and intelligence. This study adopted a descriptive survey method where a set of questionnaires was used for the purpose of data collection in determining the relationship between the two variables. A total of 1040 randomly selected students which consisted of both male and female students were involved in the study. The research findings showed that overall, there was a significant and positive relationship between multiple intelligences and creativity (r=0.648). Research findings also showed

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that students from both gender possessed high intelligence in common domains, namely interpersonal (M=3.795, SD=0.61), followed by intrapersonal (M=3.656, SD=0.628) and musical (M=3.648, SD=0.863) as well as similar characteristics of creativity in two constructs (imagination and fantasy, and playfulness). This study concluded that it is important to identify students' intelligence profile as well as their creativity level according to domains. This is to aid students learning, providing them with the optimum learning environment through their preferred learning medium and help them to achieve their fullest potential in their respective talented areas.

Alhamuddin and Bukhori (2016) also conducted a study investigating the effect of multiple intelligence-based instruction on critical thinking of full day Islamic elementary schools' students. This research aims to know the impact of multiple intelligences based instruction on students' critical thinking skills. The research was conducted at Al-Amanah and Buahati Islamic Elementary Schools by using a quantitative approach with case study method. The study has collected data through critical thinking tests and was analyzed by using independent sample t-test to examine the impact of instruction on students' critical thinking skills. The results showed that the implementation of multiple intelligences based instruction had significant effect on students' critical thinking skills. From the finding, some recommendations are given as follows: 1) The teacher's role is not only for transferring knowledge based on his/her competencies but also students' characteristics reflecting their instruction styles; and 2) for further researcher, it is suggested to investigate this issues more specifically and comprehensively.

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Moreover, Widiana and Jampel (2016) have conducted a study about improving students' creative thinking and achievement through the implementation of multiple intelligence approach with mind mapping. This classroom action research aimed to improve the students' creative thinking and achievement in learning science. It conducted through the implementation of multiple-intelligences with mind mapping approach and describing the students' responses. The subjects of this research were the fifth grade students of SD 8 Tianyar Barat, Kubu, and Karangasam. The objects of this research were multiple-intelligence, achievement in science and students' response. The research was conducted in two cycles and every cycle consisted of planning, action implementation, observation, and reflection. The data of students' creative thinking were collected by performance test; the data of students' achievement in learning science were collected through questionnaire. After the data were collected, then they were analyzed descriptively and quantitatively. The results of the study showed that (1) the implementation of multiple-intelligence approach improved the students' creative thinking and achievement in learning science. The improvement in the students' creative thinking from cycle I to cycle II is 16.56%. (2) The improvement of the students' achievement in learning science from cycle I to cycle II is11.46%. (3) The students' response to the implementation of multiple-intelligence with mind mapping fell into category positive. The students felt happy in learning science through the implementation of multiple-intelligences with mind mapping.

Previous studies proved that teaching based on multiple-intelligence has a great effect on students' learning and creative skills. Also, it helps to increase students' motivation to learn different subjects. However, there is a lack of studies investigating

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the relationship between multiple-intelligence and thinking patterns where most studies focused on creative thinking skills and few others on critical thinking skills. Moreover, most studies found experimental studies and very few studies used structural equation modeling (SEM). Hence, the current study aims to investigate and is willing to prove that teaching based on the multiple-intelligence theory is more effective in improving students' creative thinking skills and patterns than traditional teaching using SEM technique.

2.18 Summary

In summary, this literature has presented the theory of multiple-intelligence and highlighted creative thinking in education. It has explained the concepts, theories, conditions, and stages of multiple-intelligence and creative thinking. The skills and characteristics of creative thinking were also presented in details. In addition, a review of some previous studies on multiple-intelligence and creative thinking was shown in this chapter.

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CHAPTER 3

METHODOLOGY

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3.1 Introduction

This study aims to model the relationship between multiple-intelligence and thinking skills and its influence on developing thinking patterns among the 10th-grade students in private schools in Abu Dhabi. In this chapter, the researcher will present a description of the research methodology and its procedures that have been adopted to achieve the objectives of this study. It also includes a description of the study population and sample and the followed steps to prepare the research instruments. Then, the statistical techniques used in data analysis as well as the difficulties faced by the researcher in his study will be addressed.

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3.2 Research Design

All studies can fall under three main types of research, which are historical, descriptive, and experimental. The current study uses the descriptive approach. The descriptive approach explains and describes what is really happening, and is concerned with the conditions and relationships that exist, prevailing practices, current procedures and processes, beliefs, different viewpoints and individuals 'directions about an issue. Descriptive research goes beyond the simple collection and tabulation of data, it involves an element of analysis and interpretation of the meaning of what is described, and therefore the description and comparison or variation involving measurement, classification, analysis and interpretation are often combined (Al-Hoot, 2015, p. 72).

Descriptive research includes surveys and exploratory interrogations in different fields. The primary goal is to describe the current state of a phenomenon. Therefore, the researcher compares the differences between groups or the relationships between them and the variables in this type of research differ in type more than in the amount (Allam, 2001). It is characteristic for descriptive research that it is restricted to factual registration and that there is no quest for an explanation why reality is showing itself this way. In principle, descriptive research is not aiming at forming hypotheses or development of theory. Another characteristic of descriptive research is objectivity or neutrality. Descriptive research is about describing how reality is. In this regard descriptive research differs from prescriptive research that is primarily concerned with the question how the reality should be. Descriptive research is making inventories; prescriptive research is normative. Descriptive research is increasing in value when it does not limit itself to mere description, but also contains initiations to interpretation

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and evaluation of its findings. A more intensive co-operation between those who study and those who design could enlarge the application potential in the design process. This seems to apply particularly for the start of the study – the formulation of the problem and of the objective – and for the finalization of the study: the formulation of conclusion and recommendations, together with making the results accessible. (Nassaji, 2015)

The Structural Equation Modeling Method (SEM), which depends on a descriptive model of the relationships between different variables being studied, is one of the best descriptive statistical methods that can be used in analyzing the correlation coefficients between the variables to direct or indirect effects. In addition, the evaluation of the relative importance of the independent variables in determining or interpreting the total differences of the dependent variable becomes clear when it is studied within the framework of the structural equation modeling. (Sahrawi & Busalb, 2016)

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3.3 Study Procedures

According to the characteristics of the descriptive research design, the researcher has gone through some consecutive procedures to model the relationship between the variables in the current study. The steps start with determining the study population and then selecting the study sample which will be used for rationing, and the sample according to which the relationship between the variables in the current study will be modeled. Then, the research instruments were developed which includes three scales for three variables i.e. multiple-intelligence, thinking skills and thinking patterns. After that is data collection and analysis using the structure equation modeling (SEM) to

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arrive at a model that reflects the relationship between the variables. Figure 3.1 below summarizes the steps of the study procedure.

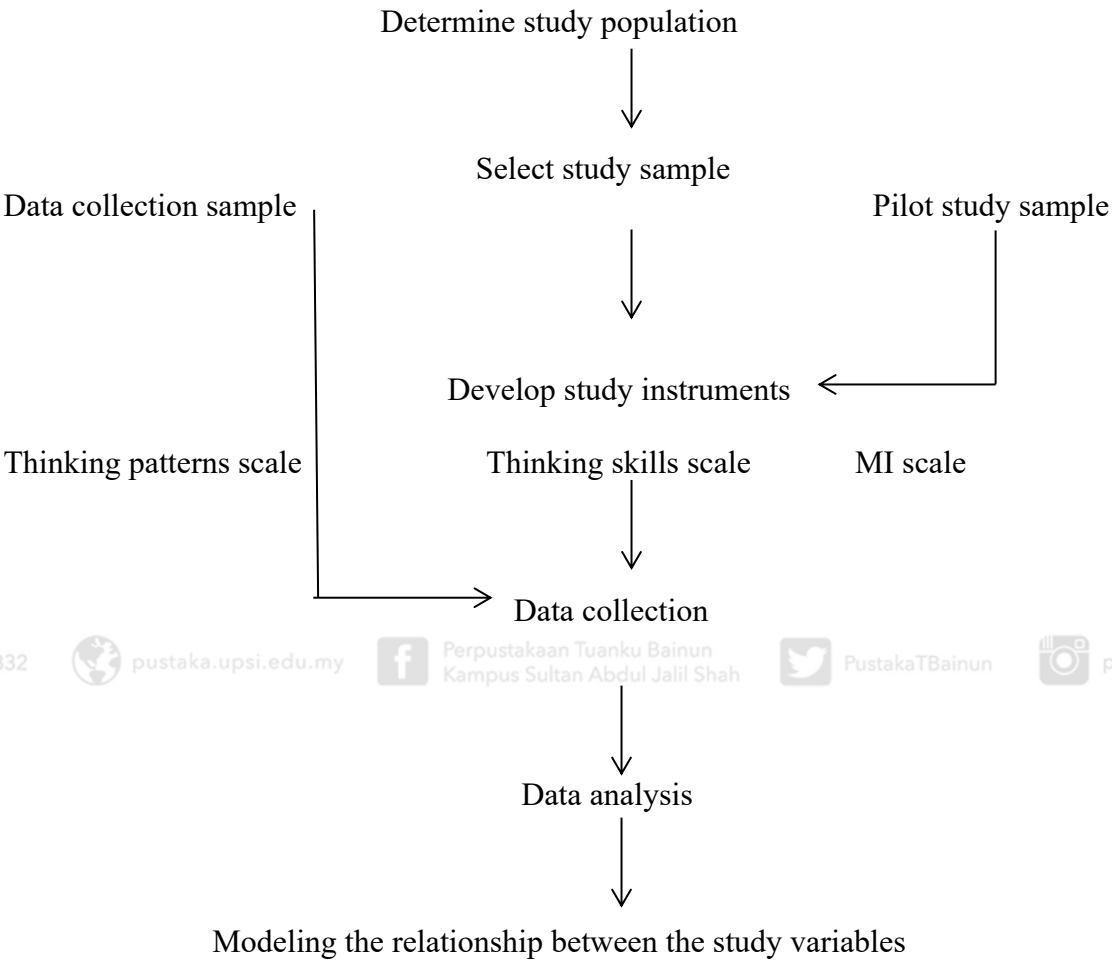


Figure 3.1 Summary of the study procedure steps

3.4 Validity

There are four types of validity as follows:

1. Construct validity: evaluates whether a measurement tool really represents the thing we are interested in measuring.

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2. Criterion validity: evaluates how closely the results of your test correspond to the results of a different test.

3. Face validity: considers how suitable the content of a test seems to be on the surface. It's similar to content validity, but face validity is a more informal and subjective assessment.

4. Content validity: assesses whether a test is representative of all aspects of the construct.

3.5 Reliability

The degree of consistency between two measures of the same thing.

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Reliability methods:

1. Split-half method: the test is done completely, then marked and divided into two equal halves, i.e. half division (odd division, even division) i.e. test procedure, then, calculate the correlation coefficient between individuals in both halves.

2. Equivalent Forms method: From a test concerned with measuring (a phenomenon or a characteristic related to the phenomenon), two forms are equivalent in terms of the representation of the variables or functions that are measured, that is, the proportions of the elements that measure the components in the two forms are the same, as well as the level of difficulty and the method of formulation. Also, the equivalence of the two forms in terms of length, method of procedure, marking and time allocated. Then, apply the two forms to the same group, and then the correlation coefficient is calculated between the scores of each of the two tests representing each of the two forms.

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3. Variation analysis method: Reliability is affected by variance of test scores in terms of increasing or decreasing individual differences.

4. Test-retest: The test is applied to the same individuals twice (from day to week), and the correlation coefficient is calculated between the first and second test's results.

5. Objectivity: This means that the test items are not affected by the subjectivity of the informant (the person who answered the test). Likewise, objectivity also means accuracy in the assessment of the examinee, that is, he gets the same score if the test is corrected by more than one examiner.

6. Standardization: It is intended to define the conditions for applying the test and the factors that can affect the results of the test and are represented by the test instructions, where they should be clear and specific, and to specify the duration for answering the test and how to answer. The Standardization of the test can be done by applying it to a wide sample which represent the characteristics of the population for which the test is developed.

7. Comprehensiveness: The test covers all aspects of the feature, phenomenon or characteristic that is to be measured.

8. Level of Difficulty: The test should not be too difficult so that no one could answer it, nor is it too easy for all students to answer, but rather medium level of difficulty so that it is not sensitive to individual differences.

3.6 Factor Analysis

It refers to a family of statistical methods that are used to reduce a large number of variables or data related to a particular phenomenon into fewer numbers of factors.

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It is also known as a multivariate statistical method used in data analysis or correlation matrices, of variables. Factor analysis aims to clarify the relationships between observed variables, and it results in a number of new or hypothesized variables called factors. Usually data are the individuals' scores of psychological, social, or educational variables. It is used to analyze a set of correlation coefficients between several variables and reduce them into a fewer number of factors and thus, helps to understand the structure of the correlation matrix or common variation (Abu Hashem, 2007).

3.6.1 Types of Factor Analysis

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There are two types of factor analysis

1. Exploratory Factor Analysis (EFA)

It is used to discover the factors to which the variables can be classified as these factors are categories of the observed variables and to identify the characteristics of the important relationships without a clear predetermined idea of how many factors there are. The purpose is to explore the structure, model and assumptions.

EFA requires some assumptions and conditions in the data to be analyzed and addressed. These assumptions and conditions can be divided into two parts:

1. General conditions before the analysis: the moderate distribution of the variables, the level of measurement of the variables from the categorical and relative level, the

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presence of linear relationships between the variables and the random sample is large and representative of the population and finally the independence of errors in each variable and the independence of the variables among each other.

2. Conditions during the factor analysis (methods of factor analysis and cycling).

2. Confirmatory Factor Analysis (CFA)

It is used in testing hypotheses that necessarily assume special patterns or factors of relationships in the data on which to classify the variables, where the researcher develops a model that is supposed to interpret and classify the data in light of relatively few measurements.

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3.6.2 Structural Equation Modeling (SEM)

Structural equation modeling is one of the most important statistical revolutions. It is called the new generation of statistics. SEM is distinguished from the traditional methods of statistics (correlation, regression, and variance analysis) with several features that are summarized as follows:

1. SEM depends on the confirmatory method, while traditional statistical methods depend on the descriptive method.

2. SEM takes into account the measurement error during data analysis, while the traditional methods do not take into account the errors of measurement during the analysis and they are unable to correct or evaluate the error.

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3. SEM depends on the apparent and latent variables, while traditional statistics depend on studying the apparent variables only.

4. SEM has the ability to model common and interrelated relationships between many variables and estimate direct and indirect effects, while traditional methods use only a number of variables (Al-Dossary, 2013).

3.7 Study Variables

To determine the variables of the study, the researcher reviewed previous studies related to the topic of the study. Some of the studies found in the previous literature are the studies conducted by Demerdash, 2006; Al-Rubaie, 2013; and Adel, 2012.

Accordingly, the researcher determined the following variables as follows: Multiple-intelligence (independent variable), thinking skills (mediator variable) and thinking patterns (dependent variable). In addition, the gender variable (male and female students) is the demographic variable.

3.8 Study Population

The study population consists of the tenth grade students in private schools in Abu Dhabi, UAE. The researcher used the records of the UAE Ministry of Education to obtain correct and accurate data, and some random schools were selected because of the large number of private schools in the Emirate of Abu Dhabi. According to the records of the Ministry of Education, is (12,300) male and female students.

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3.9 Study Sample

Table 3.1 below shows the distribution of the study sample in Abu Dhabi private schools.

Table 3.1

The Numbers of Tenth Grade Students in Abu Dhabi

School name	No. of males	No. of females	Total
Al-Rawafid	40	60	100
Al-Shuhub	0	35	35
Al-Mamurah	0	50	50
Al Bateen (Aldar Company)	60	50	110
Gling (ADNOC Corporation	100	55	155
Total	160	190	350

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The researcher was keen on selecting a secondary level to apply the study instruments for several reasons, including:

1. For their easy understanding of instructions in answering the tests and questionnaire.

2. Because this stage represents the gateway for students to join universities, and thus, they interact with different life situations and face multiple and varied problems.

3. The researcher was keen to apply the study to male and female students in order to gain extra benefit by identifying gender differences in the study variables, if any.

The researcher will select a random sample for the pilot study of male and female students in the center of Abu Dhabi, due to the presence of homogeneity among students in terms of economic and social levels. The researcher will define the objectives of the

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scales, tests and questionnaire for the members of the pilot study sample at the beginning of the academic year, read the instructions and explain what is included and how to answer, such as:

1. Read the questions well before answering each question to understand what is exactly required.

2. Do not start answering until you are allowed to do so, and do not write anything on the question paper.

3. These tests and questionnaires are not related to school grades or academic achievement.

The researcher believes that the pilot study experience may achieve some goals and objectives, including:

1. Ensuring the consistence of the content of scales, tests and questionnaire to the current study.

2. Paying attention to the inquiries and clarifications needed by students while answering the study instruments.

3. Determine the problems and difficulties that may arise during the application of the study instruments to the pilot study's sample, to avoid them while applying the study instruments to the actual (experimental) sample.

4. To know and estimate the duration time that the sample of pilot study will take, and this is useful in planning to control the time period during the application of the real experiment of the study.

After counting the names of private schools affiliated to the Emirate of Abu Dhabi, the researcher randomly selected some private schools, due to the difficulty of restricting all tenth grade students in all private schools in Abu Dhabi. Therefore, the study sample

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consisted of (350) students in total, where it included160 male students, and 190 female students.

3.10 Study Instruments

The main objective of this study is to model the relationship between the three variables of the study which are multiple intelligences (IV), thinking skills (MV), and thinking patterns (DV) among students of private schools in Abu Dhabi. Therefore, this study includes three scales to measure the variables. We will review the most important scales that we will use in this study.

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3.10.1 Multiple Intelligence Scale

The researcher made standardization for the scale on a sample of private school students represented by Al-Rwafid's school students as a pilot study sample. The researcher found that Gardner scale is best suited to measure multiple intelligences, where many studies have used this scale, including: (Adel, 2012; Al-Jawaldeh, Al-Qamesh, & Muqableh, 2006; Al-Qaisi, 2010; Baraida, 2012; Al-Shami, 2013; Rayyan, 2013; Armstrong, 2000; Mekenzie, 2000; Naill, 2006). The scale consists of eight types of intelligence which are, linguistic, logical, interpersonal, intrapersonal, musical, spatial, naturalistic and bodily-kinesthetic. The following table shows the relevance of the scale items to the intelligence type to which they belong:

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Table 3.2

The Relevance of the Scale Items to the Intelligence Type to which They Belong

Item No	Relevance to linguistic intelligence	Relevance to logical intelligence	Relevance to spatial intelligence	Relevance to bodily-kinesthetic intelligence	Relevance to naturalistic intelligence	Relevance to musical intelligence	Relevance to interpersonal intelligence	Relevance to intrapersonal intelligence
1	0.663	0.513-	0.713	0.223	0.050	0.760	0.025	0.16
2	0.222	0.556	0.444	0.298	0.795	0.272	0.609	0.182
3	0.751	0.643-	0.517	0.183	0.450-	0.521-	0.004	0.669-
4	0.327	0.461	0.122	0.521	0.539-	0.677	0.001	0.437-
5	0.650-	0.274	0.119	0.710	0.291	0.422	0.540	0.427
6	0.422	0.342	0.183	0.343	0.066	0.004	0.29	0.716
7	0.221	0.342	0.689	0.509	0.029	0.178	0.615	0.017
8	0.226	0.143	0.713	0.444-	0.028	0.044	0.506	0.401

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Five-point Likert scale was used i.e. 1) Strongly disagree; (2) Disagree; (3) Neutral; (4) Agree; (5) Strongly agree.

1. Psychometric Characteristics of the Test

The instrument of measurement in psychology described as a behavioral science can be defined as a group of items or situations that represent the ability, feature, or characteristic to be measured. It can be said that the instrument only represents a sample of the components of this ability or feature. Whenever this sample is able to represent the actual population from which it was taken. Then, it is a good and valid instrument and its results can be relied upon (Al-Hoot, 2015).

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The researcher has standardized the measuring instrument by extracting the psychometric characteristics to verify the validity and reliability of the scale, which makes the researcher reassured about the objectivity of the measuring instrument and its link to the subject of the measurement, and we will present some of the details below.

Scale Validity

A valid scale is a one that measures what is set to measure it. Validity also includes to what extent or degree this instrument can measure what it was intended to measure. It is reached through a specialized judgment on the degree of measurement of the measured feature. The test is given to more than one evaluator to conduct face validity, which is going through the content of each of the scale items, and judging the extent of its link to the general feature. The degree of face validity of the test can be evaluated by the compatibility between the estimates of the evaluators (Odeh, 1993).

To verify the content validity in the study instruments, the researcher presented it to a group of evaluators who are specialized in educational psychology and in the state of Malaysia, Jordan and UAE (i.e. Prof. Dr. Suppiah Nachiappan, Assoc. Prof. Dr. Mohamed Yousif, and Dr. Ali Bani Hamad). The evaluators were asked to provide their opinions and general observations on the items of the scale. After analyzing their opinions and observations, some items were retained and some were modified. They have agreed on the five-point likert scale to be used as it is, and all of them assessed that it is appropriate for the scale and the age group for which the scale will measure the feature they possess namely, multiple intelligence. After reviewing the opinions of the evaluators, the scale was modified and the final form consisting of (31 items), including eight intelligences.

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Internal Consistency

The internal consistency indicates the degree to which all items of the scale are involved in measuring a specific characteristic. When the test is homogeneous, each item measures the same general factors in the feature or ability as any other item. It is calculated by measuring the correlation coefficient of each unit or item with the scale (the test as a whole). Whenever the items are homogeneous in what they measure, the consistency and the connection is high between them, and vice versa (Adas and Al-Kilani, 1986).

To ensure the internal consistency of the scale, the researcher conducted a pilot study where the sample consisted of (100) students from Al-Rawafid Private School, which is not part of the experimental sample. The researcher worked on calculating the correlation coefficient of the score of each item of the scale in the total score of the scale and the total score for each field. The results showed that all the values of the correlation coefficients are statistically significant, which means that all the items of the scale and its fields are consistent, which enhances the validity of the instrument, because each of the scale items measures the feature of the field to which it belongs.

Scale Reliability

There are several concepts of the reliability of the test or scale, and indicates that the reliability of the test is to give the same results if they are re-applied to the same group of individuals, which means that they are not affected by the change of external factors or conditions. This means that the test's results indicate the actual performance of the

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individuals. There are several methods for calculating reliability, including split-half and the cronbach alpha.

The researcher has used the SPSS on pilot study sample from outside the experimental (actual) sample of the study. It has reached (100) male and female students, and the value of the the cronbach alpha was (0.925), which is an acceptable value and is considered reliable. The instrument is reliable if the Cronbach alpha exceeds (75%), it indicates a high degree of reliability.

Adjustment of the Scale

The scale of multiple intelligences included eight fields, and each field consisted of eight items, and each item had five-points scale (strongly agree, agree, neutral, disagree, strongly disagree), and scores was given as: (5) for the choice (strongly agree), (4) for the choice (agree), (3) for the choice (neutral), (2) for the choice (disagree), and (1) for the choice (strongly disagree). So, the total score of the scale equals to the number of items multiplied by the score given to the item, so the maximum score of the scale (questionnaire) is (155) marks, and the minimum score is (31) marks.

Re-standardizing to the (actual) experimental research sample (10th grade students) in private schools in Abu Dhabi:

To ensure the validity of the scale for application to the tenth grade students, the researcher recalculated the reliability for the multiple intelligence scale, and calculated the construct validity using (factor analysis method), because the researcher desires to verify the psychometric characteristics of the scale (questionnaire), to help in using the

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structural equation modeling (SEM). The value of the reliability cronbach was (0.925), which is considered reliable.

Construct validity of the multiple intelligences scale:

Construct validity is the measurement of the scale (test) to form a specific hypothesis or a specific feature. It is also the ability of the scale to verify the validity of a hypothesis derived from the theoretical framework or previous studies, and it includes several types of internal consistency and factor validity that can be reached through factor analysis (Al-Hoot, 2015, p. 83).

Results of the factor analysis of the multiple-intelligence scale:

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The questionnaire (scale) of multiple intelligences consists of eight fields (dimensions). The confirmatory factor analysis was performed on the level of the eight fields of the scale using the method of analyzing the main components to ensure the construct validity of the scale. The number of factors was determined by one factor to ensure that the items belong to their fields, as in table (3.2) the relevance of the scale items to the intelligence type to which they belong was shown.

The results of the second-level factor analysis in the previous table indicate that all statistics related to the fields are good and acceptable. Accordingly, the scale in its final form is made up of (31) items, distributed over eight dimensions. The dimension of (linguistic intelligence) consists of four items, the logical intelligence dimension includes four items, while the spatial intelligence consists of three items, the bodily-

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kinesthetic intelligence consists of four items, the naturalistic intelligence consists of three items, while the musical intelligence includes four items, interpersonal intelligence consists of four items, and the intrapersonal intelligence included five items. So, the total number of items consisting of the scale became thirty-one (31) items. The score is (8) and the minimum of it is equal to (40); the student whose average score is less than (8) is considered not to have linguistic intelligence, and the student whose score ranges between (9) and (32) is considered to have linguistic intelligence with an average level, and a student whose average score is greater than (32) will be a student with a high level of linguistic intelligence.

3.10.2 Thinking Skills Test

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The researcher performed standardization for the scale on a pilot study sample of private school students from Al-Rawafid school. The researcher found the scale of Khaled Al-Otaibi (2007) which was prepared by Rashid Al-Sharqi, where he standardized it from Watson and Glaser's test, the test of similarities (Luxler), as well as Arabic for the Arabic language by (Malika and Ismail, 1991), and there is also a test by (Ghadnana Binali) where she designed the measuring instrument as a result of studies of (Hassan Abdel-Bari, 2001; Abdel-Rahman Al-Ahmad, 1998; Mustafa, 2000; Fathi Jarwan, 1999; Maryam Al Balushi, 2010; Saleh Abdul Kabir, 2008; Hassan Kamal Zaytoun, 1985; Beyer, 1997; Herbart and Wilberg, 1995 and Naill, 2006), Her test is the most appropriate to measure thinking skills and the scale consists of three sections: creative thinking, critical thinking and visual thinking. Written and multiple choice questions are used in the scale.

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Psychometric Characteristics of the Test:

Validity and reliability are considered two of the most important methodological conditions necessary when standardizing measurement instruments in scientific research to reach a high degree of accuracy and objectivity. The methods of estimating the validity and reliability of the measurement instruments vary, depending on the nature of the instrument and its purpose, and it is considered an important matter for its development and improvement, as well as to obtain a high degree of credibility of the results obtained from its application. Most measurement literature indicates that applying the tests in their original forms to environments other than the ones for which they were prepared is considered an act that does not give accurate results for the following reasons:

1. What is prepared and suitable for a particular society or cultural environment is not necessarily valid for another society or a different environment.
2. These tests are imbued with the cultural elements of the society for which they were prepared, because the test is a civilized substance whose content is derived from the civilization and culture of the society in which it is prepared.
3. Civilizational and cultural differences between societies lead to a difference in the standards, because the working style, civilizational characteristics, goals of education, cultural background and type of environment play a fundamental role in determining the performance on the tests. Therefore, when preparing and standardizing the tests, they should be compatible with the environment and its cultural patterns.

There are reasons for researchers to use standardized tests rather than developing new ones:

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1. It saves time, effort and money.

2. Some of the standardized tests were designed to measure some aspects of achievement in order to treat weaknesses, classify students and guide them.

3. The researchers were able to make a comparison between the responses of current students and previous students who got to answer the same test.

Standardization:

It is the precise identification of procedures for applying the test, checking the characteristics of its items after applying it to a sample representative of the actual population, correcting it and ensuring its validity, reliability and deriving the associated criteria. Accordingly, the validity and reliability of the test are important procedural steps. Then, the standardization includes testing the validity and reliability until the test is valid to achieve its desired goals.

Features of the measuring instrument standardizing process:

1. It is useful in designing a successful, accurate and specific measuring instrument for scientific research purposes.

2. It helps in collecting data from the actual sample with a high degree of accuracy and efficiency, through which it becomes clear the degree of learners' achievement of learning outcomes or the degree of availability of the measured feature of the research sample in any educational field.

3. Contributes to developing research measuring instruments by checking or reflecting on validity and reliability estimates, reviewing and amending weak items and deleting very weak items.

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4. It leads to accepting the results obtained from applying these instruments and making sure of them.

5. Useful in knowing whether the results can be generalized according to the sample.

6. It helps other researchers benefit from the results of applying the study instrument to the pilot study sample.

7. The measuring instrument is considered successful for the researcher and the examinee in order to develop the measurement process in the educational field in general.

8. Whoever wants to use the test can know the limits of its suitability for application through these procedures.

Standardization stages of the measuring instrument:

The standardization process goes through several stages (steps) which are:

1. Determine the goal or purpose of the test.

2. Preparing the initial draft of the test.

3. Determining the study population.

4. Determining the study sample and its method of selection.

5. Conducting pilot study.

6. Make the necessary adjustments to the test.

7. Determine the pilot study sample for applying the test and its experiment.

8. Correcting the test and analyzing its items.

9. Estimate the psychometric characteristics of the test (i.e. validity and reliability).

10. Extract standards.

11. Preparing the test guide.

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Methodological considerations to be taken into account when standardizing the research measuring instruments in terms of validity and reliability procedures for developing and improving them (Al-Sardi, 2012):

1. Taking into consideration the face validity made by the evaluators but using other types of validity is required.

2. Take into consideration the selection of specialized evaluators who have expertise and interests in the measuring instrument, and other measuring tools.

3. Do not neglect the content validity in the achievement tests.

4. Attention to the validity of factor analysis when discovering or confirming test factors.

5. Focusing on counting vocabulary or items, as well as dimensions and factors, and not only the total validity or reliability of the instrument.

6. Not to consider self-validity as the test's validity

7. Not to indicate the significance of the reliability factor, because the significance is for the correlation coefficient, not for the reliability factor.

8. When calculating the reliability of the test using the split-half method, it is necessary to correct the coefficient to calculate the reliability of the test.

9. Take into account the questions that revolve around the facts and the reliability of the questions that revolve around attitudes.

10. Do not to apply the study instrument to the actual (experimental) sample before application on the pilot study sample.

11. Appropriately taking into account the methods of estimating validity and reliability for the purpose of the measuring instrument, research objectives and questions.

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12. The need for researchers to use various methods to estimate validity and reliability in light of the study objective and not to limit them to a single method of assessment all tests and measures.

13. Taking into consideration the problem of guessing, as it affects the reliability process greatly in relation to the objective questions.

14. For some scales and questionnaires, the number of answer options can be increased to obtain greater reliability.

15. The researcher can increase the number of items in each dimension in the measuring instrument, provided that the increase is appropriate in light of the opinions of the evaluators and experts, and that the items are related to the dimension to which they belong.

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The instrument of measurement in psychology described as a behavioral science can be defined as a group of items or situations that represent the ability, feature, or characteristic to be measured. It can be said that the instrument only represents a sample of the components of this ability or feature. Whenever this sample is able to represent the actual population from which it was taken. Then, it is a good and valid instrument and its results can be relied upon (Al-Hoot, 2015).

The researcher has standardized the measuring instrument by extracting the psychometric characteristics to verify the validity and reliability of the scale, which makes the researcher reassured about the objectivity of the measuring instrument and its link to the subject of the measurement, and we will present some of the details below.

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Scale Validity

A valid scale is a one that measures what is set to measure it. Validity also includes to what extent or degree this instrument can measure what it was intended to measure. It is reached through a specialized judgment on the degree of measurement of the measured feature. The test is given to more than one evaluator to conduct face validity, which is going through the content of each of the scale items, and judging the extent of its link to the general feature. The degree of face validity of the test can be evaluated by the compatibility between the estimates of the evaluators (Odeh, 1993).

To verify the content validity in the study instruments, the researcher presented it to a group of evaluators who are specialized in educational psychology and in the state of Malaysia, Jordan and UAE (i.e. Prof. Dr. Suppiah Nachiappan, Assoc. Prof. Dr. Mohamed Yousif, and Dr. Ali Bani Hamad). The evaluators were asked to provide their opinions and general observations on the items of the scale. After analyzing their opinions and observations, some items were retained and some were modified to be appropriate for the scale and the age group of the sample members and the measured variable which is thinking skills. After reviewing the opinions of the evaluators and the people of knowledge and specialization, the scale in its final form consists of (14) questions.

Internal Consistency

The internal consistency indicates the degree to which all items of the scale are involved in measuring a specific characteristic. When the test is homogeneous, each item measures the same general factors in the feature or ability as any other item. It is

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calculated by measuring the correlation coefficient of each unit or item with the scale (the test as a whole). Whenever the items are homogeneous in what they measure, the consistency and the connection is high between them, and vice versa (Adas and Al-Kilani, 1986).

To ensure the internal consistency of the scale, the researcher conducted a pilot study where the sample consisted of (100) students from Al-Rawafid Private School, which is not part of the experimental sample. The researcher worked on calculating the correlation coefficient of the score of each item of the scale in the total score of the scale and the total score for each field. This means that all the items of the scale and its fields are consistent, which enhances the validity of the instrument, because each of the scale items measures the feature of the field to which it belongs.

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Scale Reliability

There are several concepts of the reliability of the test or scale, and indicates that the reliability of the test is to give the same results if they are re-applied to the same group of individuals, which means that they are not affected by the change of external factors or conditions. This means that the test's results indicate the actual performance of the individuals. There are several methods for calculating reliability, including split-half and the cronbach alpha. The researcher has used the SPSS on pilot study sample from outside the experimental (actual) sample of the study. It has reached (100) male and female students.

The thinking skills scale included three sections; each section consisted of two examples of statements. The first section was creative thinking skills, which consisted

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of two questions: 1- write as many words as you can that relate to education 2- write down as many uses as you can for car key. Second, the scale of critical thinking skills used to measure the skill of deduction, it consisted of two questions, each question consists of five sub-questions, each question includes five-point scale, and the examinee must choose one of the five points. Third, the scale of visual thinking skills has two questions and each question includes five-point scale. The examinee must choose one of the five points. Each item of the scale had five-point scale (i.e. true, probably true, insufficient data, probably false, false).

Construct validity of the thinking skills scale:

Construct validity is the measurement of the scale (test) to form a specific hypothesis or a specific feature. It is also the ability of the scale to verify the validity of a hypothesis derived from the theoretical framework or previous studies, and it includes several types of internal consistency and factor validity that can be reached through factor analysis.

Results of the factor analysis of the thinking skills scale:

Confirmatory factor analysis was conducted on the three dimensions of the scale by using the method of analyzing the main components to ensure the validity of the construct of the scale. The number of factors was determined by one factor in order to ensure that the item belongs to its dimension, but the researcher worked to keep the number of questions the same for fear that the structure (basis) of the test would be affected after deleting any of the questions that measure students' thinking skills.

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Accordingly, the final form of the scale consisted of (14) items, divided into three dimensions. First, the skill of fluency consists of two items. Second, the skill of deduction includes ten items. Third, the skill of distinguishing the different shape consists of two items, so the total of the items that make up the scale are 14 items. The total score of the scale is (30) marks and the minimum score is (6) marks. The student whose average score is more than (15) marks i.e. more than (50%) means the student has the ability to answer the test of thinking skills.

Thinking Patterns Scale:

The researcher performed standardization for the scale on a pilot study sample of private school students from Al-Rawafid school. The researcher found the scale of Torrance's test which was standardized by (Muhammad Thabet Ali Al-Din) as well as the scale of (Ahmed Al-Mutairi) who developed it with reference to the studies of (Al-Harbi, 2008; Al-Kumaiti, 2009; and Al-Shaabi, 2009). In addition to the scale of (Farouk Abdel Salam and Mamdouh Suleiman) which was standardized by (Afanah, 1998). It is best suited to measure thinking patterns, as many studies have used this scale. The scale consists of three dimensions, namely critical thinking (recognition of assumptions, interpretation, evaluation of arguments and deduction), creative thinking and visual thinking (successive matrix, visual symmetry, visual succession, and visual object recognition). The point-scale used are (yes, no, strong, weak, true and false).

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Psychometric Characteristics of the Test:

The instrument of measurement in psychology described as a behavioral science can be defined as a group of items or situations that represent the ability, feature, or characteristic to be measured. It can be said that the instrument only represents a sample of the components of this ability or feature. Whenever this sample is able to represent the actual population from which it was taken. Then, it is a good and valid instrument and its results can be relied upon (Al-Hoot, 2015).

The researcher has standardized the measuring instrument by extracting the psychometric characteristics to verify the validity and reliability of the scale, which makes the researcher reassured about the objectivity of the measuring instrument and its link to the subject of the measurement, and we will present some of the details below.

To verify the content validity in the study instruments, the researcher presented it to a group of evaluators who are specialized in educational psychology and in the state of Malaysia, Jordan and UAE (i.e. Prof. Dr. Suppiah Nachiappan, Assoc. Prof. Dr. Mohamed Yousif, and Dr. Ali Bani Hamad). The evaluators were asked to provide their opinions and general observations on the items of the scale. After analyzing their opinions and observations, some items were retained and some were modified to be appropriate for the scale and the age group of the sample members and the measured variable which is thinking patterns.

After reviewing the opinions of the evaluators, the final form of the scale consisting of three dimensions, which measure (recognition of assumptions and

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interpretation, evaluation of arguments, deduction, successive matrices, visual symmetry, visual sequence, test of shapes and creative thinking). They constitute a total of 22 questions in the thinking patterns test.

To ensure the internal consistency of the scale, the researcher conducted a pilot study where the sample consisted of (100) students from Al-Rawafid Private School, which is not part of the experimental sample. The researcher has made the sections of the thinking skills scale consisting of a number of limited questions, as it was difficult to delete some paragraphs due to the effect of deleting the questions on the number of the structure (essence) of the test. The researcher should have kept the same number of questions so that the test is suitable for measuring the thinking skills required of students to answer them.

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Scale Reliability

There are several concepts of the reliability of the test or scale, and indicates that the reliability of the test is to give the same results if they are re-applied to the same group of individuals, which means that they are not affected by the change of external factors or conditions. This means that the test's results indicate the actual performance of the individuals. The researcher conducted a test of thinking skills on the pilot study sample which made him familiar with the appropriate conditions for taking the test as well as determining the appropriate time (duration) for the test. Also, the researcher kept the same number of questions for fear that the structure (basis) of the test would be affected if any of the questions was deleted.

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Adjustment of the Scale

The scale of thinking patterns included three dimensions. The critical thinking test consisted of four dimensions (i.e. recognition of assumptions, interpretation, evaluation of arguments and deduction). Then, the creative thinking test consisted of two dimensions, while the visual thinking test included four dimensions, which are successive matrix, visual symmetry, visual succession, and visual object recognition. Each of the four dimensions consists of two questions so that the total number is 22 items, and accordingly the maximum score of the scale is (48) marks and the minimum score of the scale (the test) is (14) marks.

The Difficulties Faced in Conducting the Study

1. The sensitivity of the topic creates fear of individuals when conducting studies dealing with multiple intelligences and thinking skills and patterns.
2. Conducting this study and collecting data happened at the time of the final exams for the third semester, which means that there was not enough time for students to answer the questionnaire and thinking patterns and skills tests.
3. Travelling across Jordan, UAE, and Malaysia to seek opinions of experts and specialists in the measuring instruments.
4. The financial cost includes transportation, printing, statistical analysis, tuition and residence fees in Malaysia.
5. The effort and time that the researcher invested in conducting this study, as the researcher works as a teacher in a government school in the United Arab Emirates, and consequently, he was not fully devoted to writing the thesis.

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CHAPTER 4

FINDINGS

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4.1 Introduction

The detailed analysis procedure employed in this study has been outlined in the earlier chapter. The target and study population, sampling procedure, sample size and chosen participants, were all explained. Experiment design on how data were collected, analyzed and presented were all discussed in detail. This chapter presents the results according to the research hypotheses. The chapter summarizes the finding in both the descriptive and the inferential statistical analysis. Processes involved in testing assumptions for structural equation model (SEM) precisely the path analysis were discussed. Data screening such as missing data, outlier and multivariate normality analysis were conducted. As mentioned in chapter Three, SEM approach comprises of assessment of model fit for the path analysis and hypotheses testing.

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4.2 Response Rate

Simple random sampling procedure was used to select representative sample from the study population of more than five-hundred public university students. Two-hundred and fifty students were selected from population to participate in thinking skills and thinking pattern test.

4.3 Characteristic of Respondent

Two-hundred and fifty respondents from public universities in Jordan participated in this study. The respondents were both male and female, male represent 50.5% (127) while female represent 49.5% (123). Although, it can be observed that there was a balance representation of both genders in this study, however, the disparity between the number of males compared to female was expected because there are more male than female in tertiary institutions in Jordan. Table 4.1 below shows the gender distribution of the respondents.

Table 4.1

Gender

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	male	127	50.5	50.5	50.5
	female	123	49.5	49.5	100.0
	Total	250	100.0	100.0	

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4.4 Outliers

Each variable was screened for outliers via looking at the standardized score that exceeded the cut-of-point value. The results showed that the data set contained score that are within the range for multivariate analysis.

4.5 Assumptions

This sanction presents the assumptions of data analysis.

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4.5.1 Normality

Normality assumption states that data distribution should be normal. Normal distribution is established when the skewness and kurtosis values are within -1 and +1 (for skewness) for -3 and +3 (for kurtosis) Hair.et.al (2010). Since the variables of interest in this study are multivariate in nature, the researcher opted for threshold of-1 and +1 (for skewness) and -3 and +3 (for kurtosis) as suggested by Hair.et.al (2010). Violation of normality assumption can influence the results drawn from sample. Table 4.2 shows the skewness and kurtosis for each variable.

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Table 4.2

Skewness and Kurtosis for Variables in Multiple Intelligent

Variable	Skewness	Kurtosis
ThinkingPattern	-.546	.424
CreativeThinking	-.491	.233
CriticalThinking	-.075	.319
VisualThinking	.515	.133
verbalIntel	.841	.624
Intrapersonal	-.857	.964
Interpersonal	-.434	-.083
Natural	-.111	-.290
Musical	.059	-.859
Logical	-.271	.601
Spatial	.949	.966
Bodily	-.644	.900

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Table 4.2 shows that all the multiple intelligence variables are normal. As shown in the table, each variable is within skewness and kurtosis threshold values.

4.5.2 Multicollinearity

Multicollinearity is a situation whereby inter-variables correlation are more than 0.8. If, two different variables have correlation coefficient larger than 0.8 they will be highly correlated (Hair et.al., 2010). This indicates that these two variables are not different; or rather, they are the same (singularity). To find out multicollinearity among/between variables, it is recommended that test for variance inflated factor (VIF) be conducted. VIF value must be less than 10 and tolerance value must be greater than 0.1. As shown in the table 4.3 below, the inter-variable correlation for multiple intelligence variables is moderate.

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Table 4.3
Inter-variable Correlations

Correlations												
Variable	ThinkingPattern	Creative Thinking	CriticalThinking	VisualThinking	verbalIntel	Intrapersonal	Interpersonal	Natural	Musical	Logical	Spatial	Bodily
Thinking Pattern	1											
Creative Thinking	.740**	1										
CriticalThinking	.390**	.314**	1									
VisualThinking	-.008	.001	.138*	1								
verbalIntel	.016	-.016	.213**	.769**	1							
Intrapersonal	.241**	.222**	.375**	-.152*	-.123	1						
Interpersonal	.256**	.212**	.384**	-.112	-.076	.308**	1					
Natural	.342**	.326**	.235**	.044	.135*	.239**	.133*	1				
Musical	.475**	.410**	.331**	.103	.167**	.271**	.249**	.485**	1			
Logical	.289**	.267**	.317**	.057	.059	.315**	.276**	.287**	.477**	1		
Spatial	.000	-.041	.163**	.698**	.686**	-.119	-.071	.112	.209**	.081	1	
Bodily	.574**	.647**	.299**	.027	.053	.243**	.258**	.313**	.398**	.250**	-.044	1

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

4.6 Confirmatory Factor Analysis (CFA)

Confirmatory factor analysis (CFA) presumed that covariance between observed variables can be explained by a smaller number of underlying latent factors. CFA is the next steps after running the exploratory factor analysis where different factors were

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extracted through the pattern of relationship between the items, the purpose of confirmatory factor analysis is to examine and test the relationship between these constructs and their respective items.

4.6.1 Confirmatory Factor Analysis (CFA) Verbal Linguistic Intelligence (VLI)

The outcomes of the CFA for verbal linguistic intelligence (VLI) construct is shown in figure 4.1. With respect to adequacy or parsimony of the measurement models of the single latent variables, the results show that all the fit indexes are within the thresholds or cut-off point.

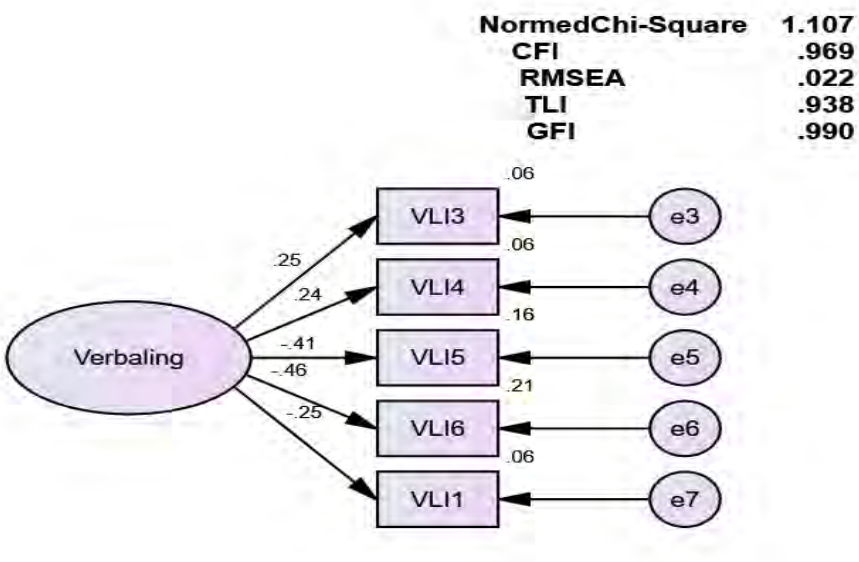


Figure 4.1 Verbal Linguistic Intelligence (VLI)

This indicates that items or indicators on the latent variables significantly correlate with the construct they measure. Non-significant relative chi-square or Normed-chi-square statistics for each of the latent variables $\{\chi^2 (cmin/df)\}$, values fall below the threshold point of 3.000 (Kline, 2011). Also, the Root mean square error of approximation

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(RMSEA) is below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of ≥ 0.950 see (table 4.4). In addition, Goodness-of-fit index (GFI) for each of the constructs are well above recommended threshold of 0.969 (table 4.4). Table 4.4 presents the summary of fit indexes of the model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent construct are then estimated. The estimate shows that all path coefficient is significant with critical ratio (CR) of more than 1.96 (see figure 4.1).

Table 4.4
Fit indexes: Verbal linguistic intelligence (VLI) Measurement model

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	1.107	3.0
CFI	0.969	0 .90
RMSEA	0.022	0.05
GFI	0.99	0.95
TLI	0.938	0 .90

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In the current study, the CFA is used to test the factor loading of each construct, estimating the measurement error, and indicating that the instrument is related to the latent variables. The factor loading for each construct is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

4.6.2 Confirmatory Factor Analysis (CFA) Logical/Mathematical Intelligence (LMI)

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The result of the measurement model for construct Logical Mathematical Intelligence (LMI) is shown in figure 4.2. The adequacy of the measurement models of the single latent variables results show that all the fit indexes are within the thresholds or cut-off point. This indicates that items or indicators on the latent variables significantly correlate with the construct they measure.

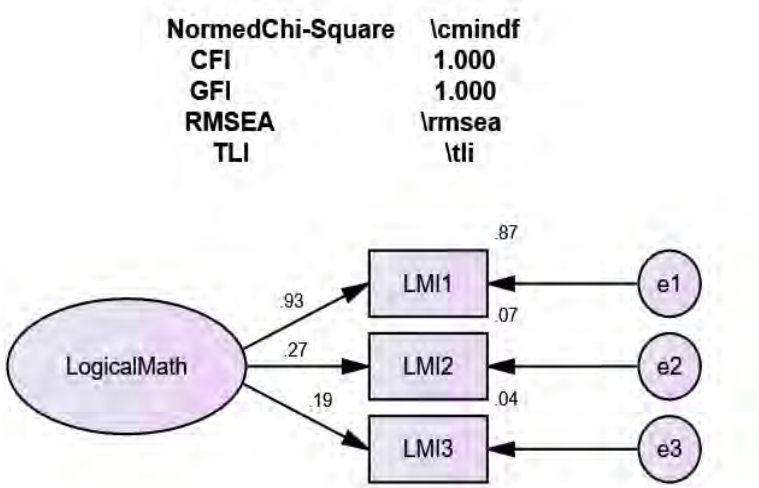


Figure 4.2 Logical/Mathematical Intelligence

Non-significant relative chi-square or Normed-chi-square statistics for each of the latent variables $\{\chi^2$ (*cmin/df*)$\}$, values fall below the threshold point of 3.000 (Kline, 2011). Also, the Root mean square error of approximation (RMSEA) is below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of $\geq$ 0.950 see (table 4.5). In addition, Goodness-of-fit index (GFI) for each of the constructs are well above recommended threshold of 0.90 (table 4.5). Table 4.5 presents the summary of fit indexes of the model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent

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construct are then estimated. The estimate shows that all path coefficient is significant with critical ratio (CR) of more than 1.96.

Table 4.5
Fit indexes: Logical/Mathematical Intelligence (LMI) Measurement model

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	Saturated (1)	3.0
CFI	1	0 .90
RMSEA	Saturated (0)	0.05
GFI	Saturated (1)	0.95
TLI	Saturated (1)	0 .90

In the current study, the CFA is used to test the factor loading of each construct, estimating the measurement error and indicating that the instrument is related to the latent variables. The factor loading for each construct is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

4.6.3 Confirmatory Factor Analysis (CFA) Spatial/Visual Intelligence (SVI)

The result of the measurement model for construct Spatial/Visual Intelligence (SVI) is shown in figure 4.3. The adequacy of the measurement models of the single latent variables results show that all the fit indexes are within the thresholds or cut-off point. This indicates that items or indicators on the latent variables significantly correlate with the construct they measure.

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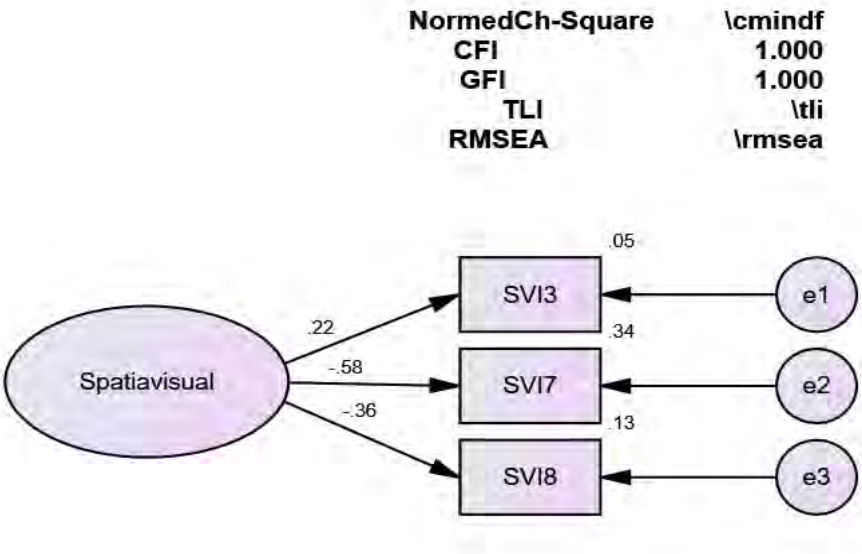


Figure 4.3 Spatial/Visual Intelligence

Normed-chi-square statistics for each of the latent variables $\{\chi^2\,(cmin/df)\}$, values fall below the threshold point of 3.000 (Kline, 2011). The Root mean square error of approximation (RMSEA) is below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of $\geq$ 0.90 see (table 4.6). In addition, Goodness-of-fit index (GFI) for each of the constructs are well above recommended threshold of 0.90 (table 4.6). Table 4.6 presents the summary of fit indexes of the model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent construct are then estimated.

Table 4.6
Fit indexes: Spatial/Visual Intelligence (SVI) Measurement model

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	Saturated (1)	3.0
CFI	1	0 .90
RMSEA	Saturated (0)	0.05
GFI	1	0.95
TLI	Saturated (1)	0 .90

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In the current study, the CFA is used to test the factor loading of each construct, estimating the measurement error and indicating that the instrument is related to the latent variables. The factor loading for each construct is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

4.6.4 Confirmatory Factor Analysis (CFA) Bodily-Kinesthetic Intelligence (BKI)

The result of the measurement model for construct Bodily-Kinesthetics Intelligence (BKI) is shown in figure4. The adequacy of the measurement models of the single latent variables results show that all the fit indexes are within the thresholds or cut-off point. This indicates that items or indicators on the latent variables significantly correlate with the construct they measure.

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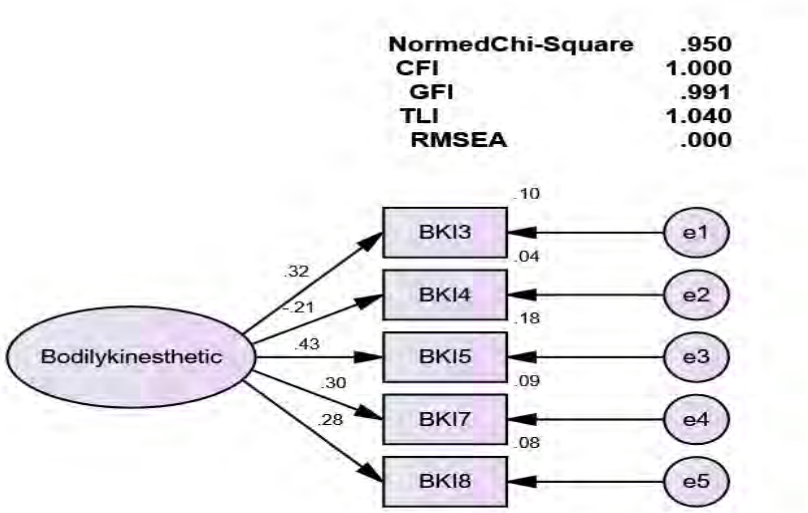


Figure 4.4 Bodily-Kinesthetic Intelligence

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Normed-chi-square statistics for each of the latent variables {χ^2 (*cmin/df*)}, values fall below the threshold point of 3.000 (Kline, 2011). The Root mean square error of approximation (RMSEA) is below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of $\geq$ 0.90 see (table 4.7). In addition, Goodness-of-fit index (GFI) for each of the constructs are well above recommended threshold of 0.90 (table 4.7). Table 4.7 presents the summary of fit indexes of the model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent construct are then estimated.

Table 4.7
Fit indexes: Bodily-Kinesthetics Intelligence (BKI) Measurement model

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	0.950	3.0
CFI	1	0 .90
RMSEA	Saturated (0)	0.05
GFI	0.991	0.95
TLI	1	0 .90

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In the current study, the CFA is used to test the factor loading of each construct, estimating the measurement error and indicating that the instrument is related to the latent variables. The factor loading for each construct is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

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4.6.5 Confirmatory Factor Analysis (CFA) Naturalistic Intelligence (NI)

The result of the measurement model for construct Naturalistic Intelligence (NI) is shown in figure5. The adequacy of the measurement models of the single latent variables results show that all the fit indexes are within the thresholds or cut-off point. This indicates that items or indicators on the latent variables significantly correlate with the construct they measure.

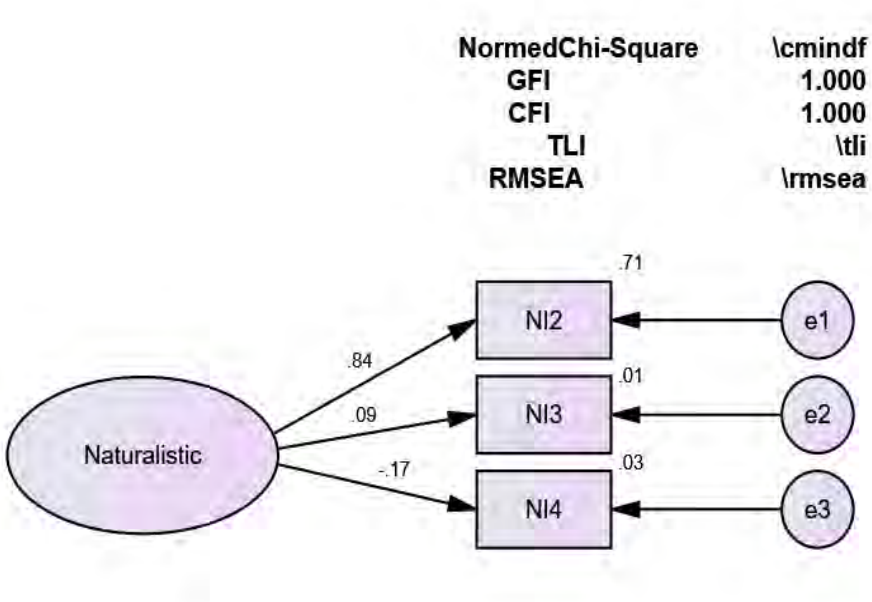


Figure 4.5 Naturalistic Intelligence

Normed-chi-square statistics for each of the latent variables {χ^2 (*cmin/df*)}, values fall below the threshold point of 3.000 (Kline, 2011). The Root mean square error of approximation (RMSEA) is below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of $\geq$ 0.90 see (table 4.8). In addition, Goodness-of-fit index (GFI) for each of the constructs are well above recommended threshold of 0.90 (table 4.8). Table 4.8 presents the summary of fit indexes of the model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent construct are then estimated.

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Table 4.8
Fit indexes: Naturalistic Intelligence (NI) Measurement model

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	Saturated	3.0
CFI	1	0 .90
RMSEA	Saturated	0.05
GFI	1	0.95
TLI	saturated	0 .90

In the current study, the CFA is used to test the factor loading of each construct, estimating the measurement error and indicating that the instrument is related to the latent variables. The factor loading for each construct is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

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4.6.6 Confirmatory Factor Analysis (CFA) Musical Intelligence (MI)

The result of the measurement model for construct Musical Intelligence (MI) is shown in figure6. The adequacy of the measurement models of the single latent variables results show that all the fit indexes are within the thresholds or cut-off point. This indicates that items or indicators on the latent variables significantly correlate with the construct they measure.

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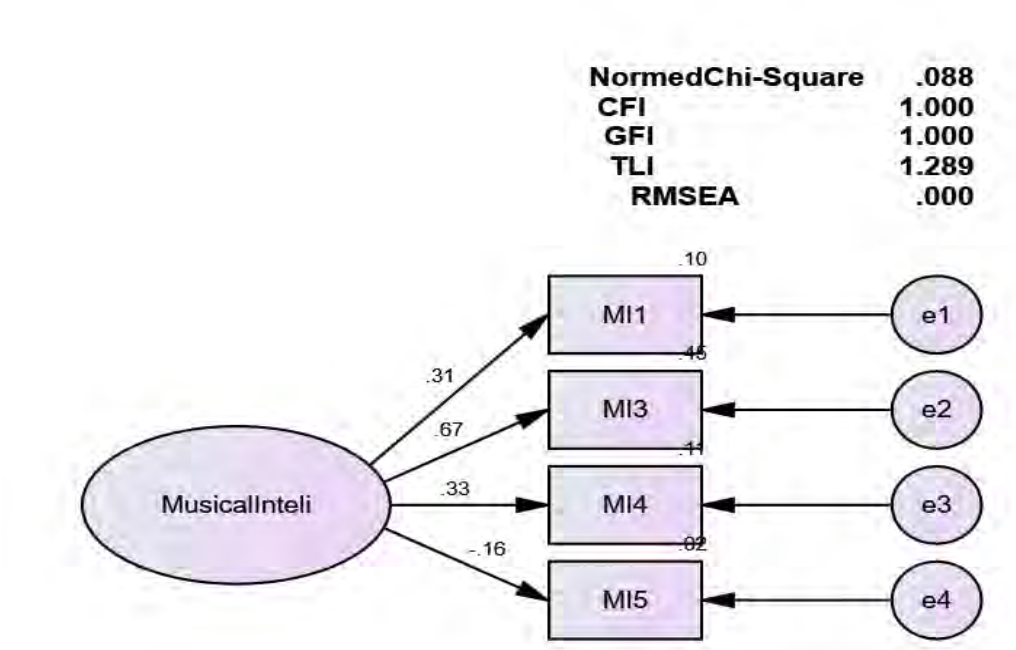


Figure 4.6 Musical Intelligence

Normed-chi-square statistics for each of the latent variables $\{\chi^2 (cmin/df)\}$, values fall below the threshold point of 3.000 (Kline, 2011). The Root mean square error of approximation (RMSEA) is below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of $\geq$ 0.90 see (table 4.9). In addition, Goodness-of-fit index (GFI) for each of the constructs are well above recommended threshold of 0.90 (table 4.9). Table 4.9 presents the summary of fit indexes of the model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent construct are then estimated.

Table 4.9
Fit indexes: Musical Intelligence (MI) Measurement model

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	0.088	3.0
CFI	1	0 .90
RMSEA	0.000	0.05

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GFI	1	0.95
TLI	1	0 .90

In the current study, the CFA is used to test the factor loading of each construct, estimating the measurement error, and indicating that the instrument is related to the latent variables. The factor loading for each construct is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

4.6.7 Confirmatory Factor Analysis (CFA) Interpersonal Intelligence (INTP)

The result of the measurement model for construct Interpersonal Intelligence (INTP) is shown in figure7. The adequacy of the measurement models of the single latent variables results show that all the fit indexes are within the thresholds or cut-off point. This indicates that items or indicators on the latent variables significantly correlate with the construct they measure.

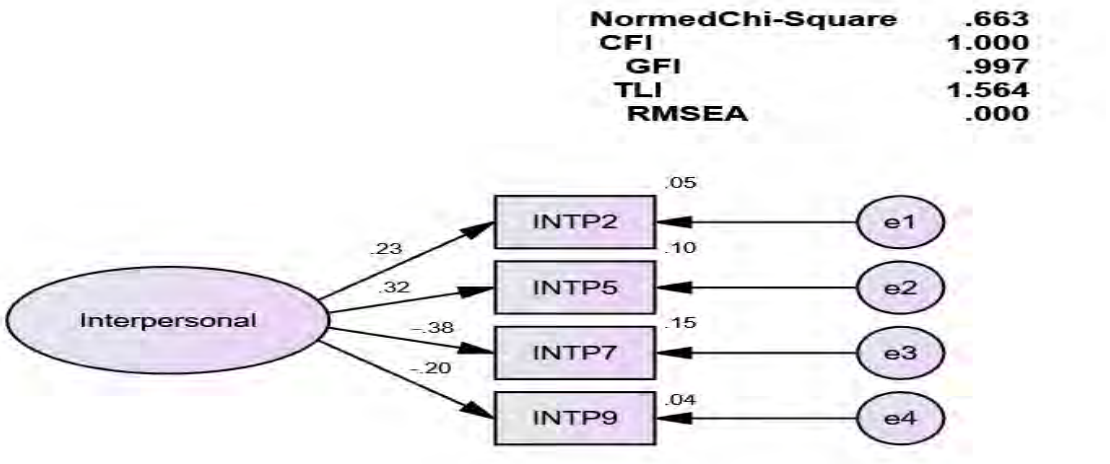


Figure 4.7 Interpersonal Intelligence

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Normed-chi-square statistics for each of the latent variables {χ^2 (*cmin/df*)}, values fall below the threshold point of 3.000 (Kline, 2011). The Root mean square error of approximation (RMSEA) is below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of $\geq$ 0.90 see (table 4.10). In addition, Goodness-of-fit index (GFI) for each of the constructs are well above recommended threshold of 0.90 (table 4.10). Table 4.10 presents the summary of fit indexes of the model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent construct are then estimated.

Table 4.10
Fit indexes: Interpersonal Intelligence (INTP) Measurement model

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	0.663	3.0
CFI	1	0 .90
RMSEA	0.000	0.05
GFI	0.997	0.95
TLI	1	0 .90

In the current study, the CFA is used to test the factor loading of each construct, estimating the measurement error and indicating that the instrument is related to the latent variables. The factor loading for each construct is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

4.6.8 Confirmatory Factor Analysis (CFA) Intrapersonal Intelligence (INTRAP)

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The result of the measurement model for construct Intrapersonal Intelligence (INTRAP) is shown in figure8. The adequacy of the measurement models of the single latent variables results show that all the fit indexes are within the thresholds or cut-off point. This indicates that items or indicators on the latent variables significantly correlate with the construct they measure.

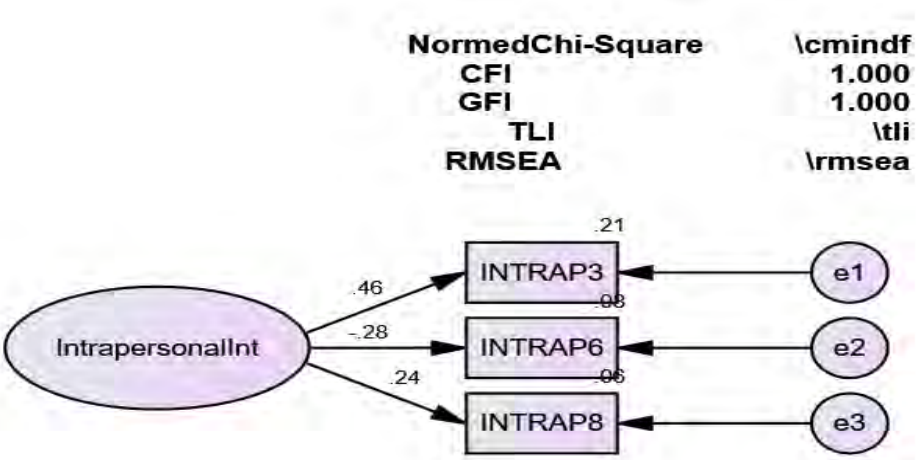


Figure 4.8 Intrapersonal Intelligence

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Normed-chi-square statistics for each of the latent variables $\{\chi^2\,(cmin/df)\}$, values fall below the threshold point of 3.000 (Kline, 2011). The Root mean square error of approximation (RMSEA) is below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of $\geq$ 0.90 see (table 4.11). In addition, Goodness-of-fit index (GFI) for each of the constructs are well above recommended threshold of 0.90 (table 4.11). Table 4.11 presents the summary of fit indexes of the model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent construct are then estimated.

Table 4.11
Fit indexes: Intrapersonal Intelligence (INTRAP) Measurement model

Fit indexes	Obtained	Require value

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CMIN/DF (if N > 200)	Saturated	3.0
CFI	1	0 .90
RMSEA	Saturated	0.05
GFI	1	0.95
TLI	Saturated	0 .90

In the current study, the CFA is used to test the factor loading of each construct, estimating the measurement error. and indicating that the instrument is related to the latent variables. The factor loading for each construct is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

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4.6.9 Confirmatory factor Analysis (CFA) for the Eight Multiple Intelligence Constructs

Confirmatory factor Analysis was conducted to further established the dimensions of multiple intelligence construct based on the data collected for this study. The outcomes of the CFA for is shown in figure9. With respect to adequacy or parsimony of the measurement models of the multiple latent variables, the results show that all the fit indexes are within the thresholds or cut-off point. This indicates that items or indicators on each of the latent variable significantly correlate with the construct they measure. Non-significant relative chi-square or Normed-chi-square statistics for each of the latent variables $\{\chi^2 (cmin/df)\}$, values fall below the threshold point of 3.000 (Kline, 2011; Hair et al, 2010). Also, the Root mean square error of approximation (RMSEA) are

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below threshold of 0.05, the Bentler comparative fit index CFI as well as TLI are higher than the acceptable fit of ≥ 0.90 see table 12. In addition, Goodness-of-fit index (GFI) for each of the eight constructs are well above recommended threshold of 0.90.

Table 4.12 presents the summary of fit indexes of the multiple intelligence measurement model. Due to the fit model, the individual parameters are further evaluated, and all the path relationships between indicators and the latent construct are then estimated. The estimate shows that all path coefficient is significant with critical ratio (CR) of more than 1.96 see figure 4.9.

The negative loadings in the measurement models (fig 4.1-4.8) suggest a negative linear association between the latent variable and the observed variable, and if they were to be computed as observed scores to approximate the latent variable (e.g., by summing or averaging items), it would be appropriate to reverse-score the negative loading. However, the researcher decided to keep the model in latent space because the causation analysis to determine path coefficient among the latent variables will depend on summing the observed factor score for each of the latent factors involved in the modelling as suggested by (Farrell & Rudd,2009). This justifies the inclusion of negative factor loadings in the analysis as all the loadings get the associated perks of latent models. Factors score indetermination is a situation where factor loadings are determined up to the sign, which is arbitrary. Negative factor loading can be treated as factors consisting of positive loadings (Beauducel, 2015). Having some negative loadings is not at all problematic - it's just like having negative coefficients in regression.

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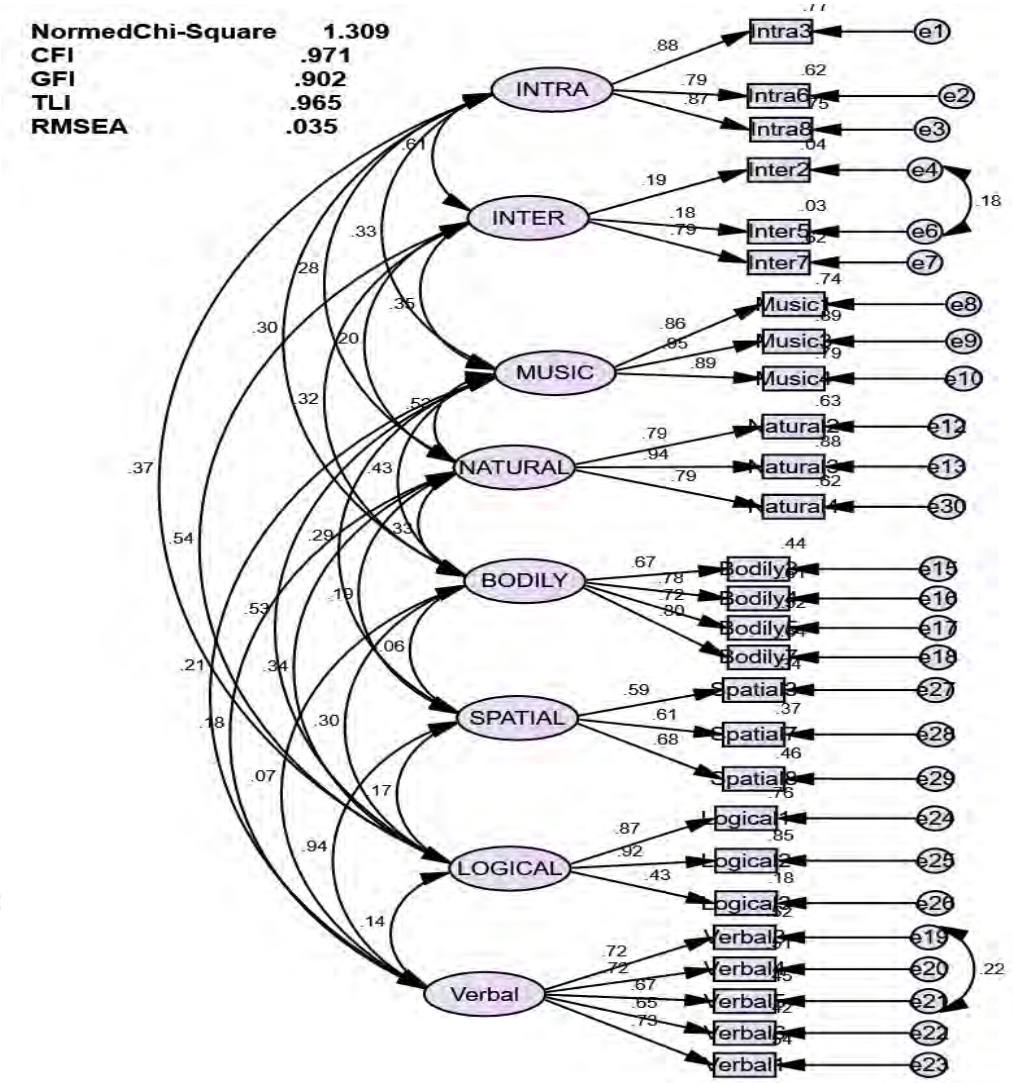


Figure 4.9 CFA Multiple Intelligence Constructs

Table 4.12
Fit indexes: Multiple Intelligence Measurement model

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	1.309	3.0
CFI	0.971	0 .90
RMSEA	0.035	0.05
GFI	0.902	0.95
TLI	0.965	0 .90

The CFA test the validity of the single model (Hair et al., 2006). In the current study, the CFA analysis method is used to examine the convergent validity for each variable. The CFA is also used to test the factor loading of each construct, estimating the measurement error and indicating the instrument are related to the latent variables.

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The factor loading for each construct of more than 0.40 is acceptable with a sample size of 250 respondents. This confirmatory factor analysis is important for two reasons. First, it helps exclude any scale item or latent factor that is not well fit, therefore, creating a model that perfectly fits. Secondly, it is also used to test the reliability and unidimensional of multi-item measures.

The convergent validity test shows the extent to which indicators of a special constructs converge (Hair et al., 2010). It is recommended that for a sample size of more than 300 respondents the loading should be above equal more than 0.70. In the current study, the convergent validity result for each of the multiple intelligence construct shows that most of the loading are greater than 0.7 (see figure9). These values are within the range and, therefore, acceptable considering the number of the respondents (250). This indicates a satisfactory proof of convergent validity.

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4.7 The Structural Equation Model (SEM)

This section presents the structural equation model for multiple-intelligence, thinking skills and thinking pattern

Hypothesized model

To test the relationship between the predictors and criterion variables, all the variables were put together into a single model as shown in figure 4.10. This full-fledged model is a representation of both theoretical and research model. The SEM analysis comprises of one initial/hypothesized and two revised models.

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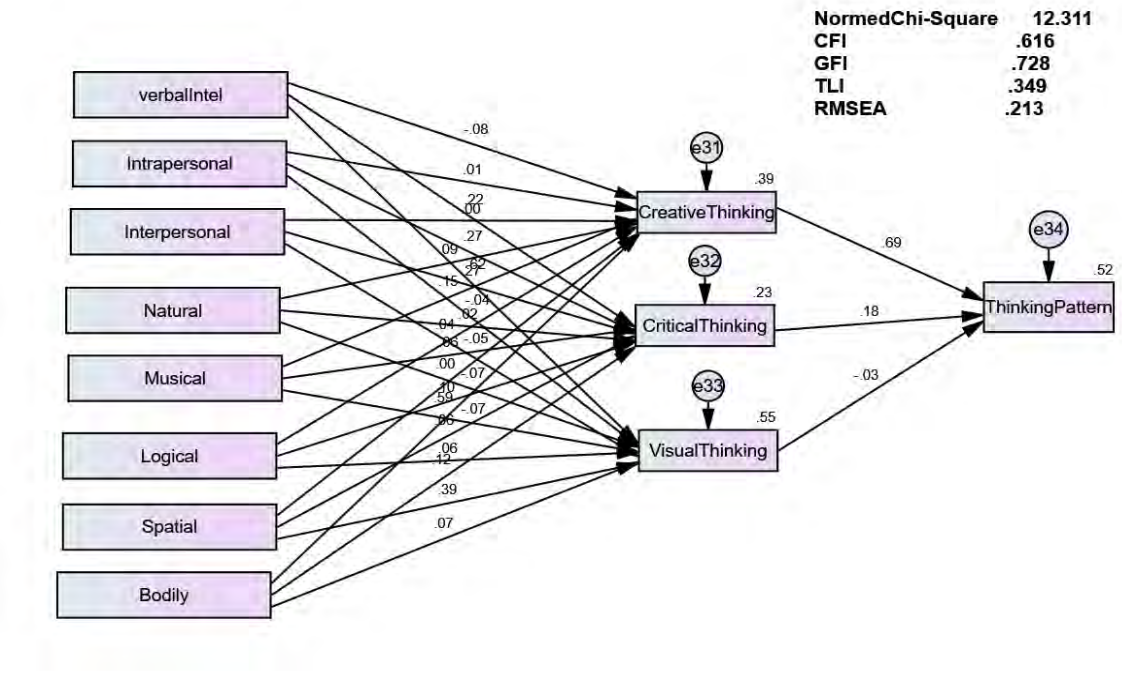


Figure 4.10 Hypothesized model for Multiple intelligence, Thinking Skills and Thinking Pattern

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The result of structural model of Multiple intelligence, Thinking Skills and Thinking Pattern together with the standardized estimates and fit indices obtained are shown in figure 4.10. The full-fledged hypothesized model does show satisfactory goodness-of fit. See table 4.13. The model indicates eight predictors of thinking skills (Creative, Critical and Visual) and three predictors (Creative, Critical and Visual) of thinking pattern.

Table 4.13
Fit indexes
Hypothesized model for Multiple intelligence, Thinking Skills and Thinking Pattern

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	12.311	≤3.0
CFI	0.616	≥0 .90
RMSEA	0.213	≤0.05
GFI	0.728	≥0.95
TLI	0.349	≥0 .90

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The fit indexes of hypothesized model are not favorable. In addition, a look at the path coefficients indicated that the model need revision. Some of the path coefficients are not significant for example, the path between visual thinking skill and thinking pattern is not significant. In addition, the path coefficient between independent variables (the eight-multiple intelligence) and mediating variables (creative, critical and visual thinking skills) are not significant because the critical ratio (CR) values in both instances did not meet the cut-of-point of 1.96 see table 4.14.

Table 4.14
Hypothesized model Path coefficients

			Estimate	S.E.	C.R.	P	Assessment
CreativeThinking	<---	verbalIntel	-.077	.045	-1.703	.089	
CreativeThinking	<---	Intrapersonal	.005	.041	.116	.908	
CreativeThinking	<---	Interpersonal	.004	.047	.081	.935	
CreativeThinking	<---	Natural	.068	.039	1.732	.083	
CreativeThinking	<---	Musical	.097	.032	3.056	.002	
CreativeThinking	<---	Logical	.041	.049	.834	.404	
CreativeThinking	<---	Spatial	-.004	.046	-.077	.939	
CreativeThinking	<---	Bodily	.576	.048	11.938	***	
CriticalThinking	<---	verbalIntel	.144	.037	3.888	***	
CriticalThinking	<---	Intrapersonal	.162	.033	4.875	***	Supported
CriticalThinking	<---	Interpersonal	.187	.038	4.911	***	
CriticalThinking	<---	Natural	.011	.032	.357	.721	
CriticalThinking	<---	Musical	.028	.026	1.097	.273	
CriticalThinking	<---	Logical	.070	.040	1.731	.084	
CriticalThinking	<---	Spatial	.041	.038	1.089	.276	
CriticalThinking	<---	Bodily	.086	.039	2.175	.030	
VisualThinking	<---	verbalIntel	.529	.036	14.599	***	Supported
VisualThinking	<---	Intrapersonal	-.028	.033	-.862	.389	
VisualThinking	<---	Interpersonal	-.045	.037	-1.202	.230	
VisualThinking	<---	Natural	-.050	.031	-1.601	.109	
VisualThinking	<---	Musical	-.039	.025	-1.545	.122	
VisualThinking	<---	Logical	.052	.040	1.321	.187	
VisualThinking	<---	Spatial	.337	.037	9.083	***	
VisualThinking	<---	Bodily	.064	.039	1.666	.096	
ThinkingPattern	<---	CreativeThinking	.769	.049	15.567	***	
ThinkingPattern	<---	CriticalThinking	.276	.069	4.018	***	
ThinkingPattern	<---	VisualThinking	-.038	.053	-.713	.476	Not supported

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There is significant relationship between the creative and critical thinking skills and thinking pattern as shown in table 4.14. However, the indirect influence of visual thinking skills on thinking pattern cannot be established. These shortcomings necessitate the need to revise the hypothesized model.

Revised structural model One for Multiple intelligence, Thinking Skills and Thinking Pattern

The result of structural model of Multiple intelligence, Thinking Skills and Thinking Pattern together with the standardized estimates and fit indices obtained are shown in figure 4.11. The full-fledged hypothesized model does show satisfactory goodness-of fit. The model indicates eight predictors of thinking skills (Creative, Critical and Visual) and three predictors (Creative, Critical and Visual) of thinking pattern.

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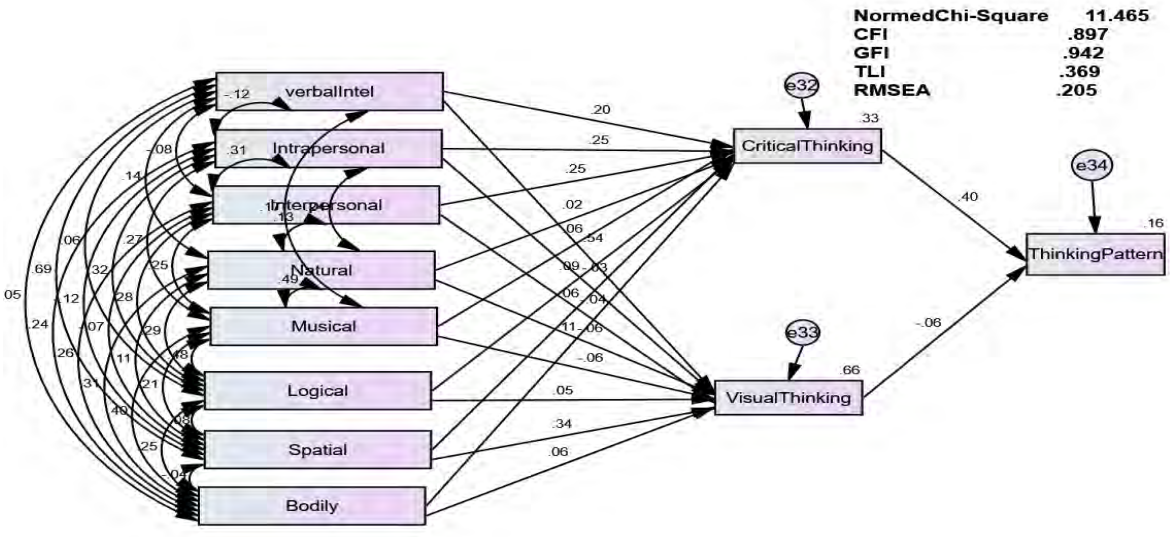


Figure 4.11 Revised mode1 for Multiple intelligence, Thinking Skills and Thinking Pattern

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The fit indexes of hypothesized model are not favorable. In addition, a look at the path coefficients indicated that the model need revision. Some of the path coefficients are not significant for example, the path between visual thinking skill and thinking pattern is not significant. In addition, the path coefficient between independent variables (the eight-multiple intelligence) and mediating variables (creative, critical and visual thinking skills) are not significant because the critical ratio (CR) values in both instances did not meet the cut-of-point of 1.96.

Revised structural model Two for Multiple intelligence, Thinking Skills and Thinking Pattern

The analysis of the structural model shown in figure11 did not fit properly given it non-significant of two of the major hypotheses. Due to this poor data fit, the researcher attempts to produce a better model for both the goodness-of fit as well as path coefficient. As such, the paths that are not significant were removed from the model along with the problematic indicators. With this step, the model was improved. Figure 4.12 shows the result of the second revised structural model.

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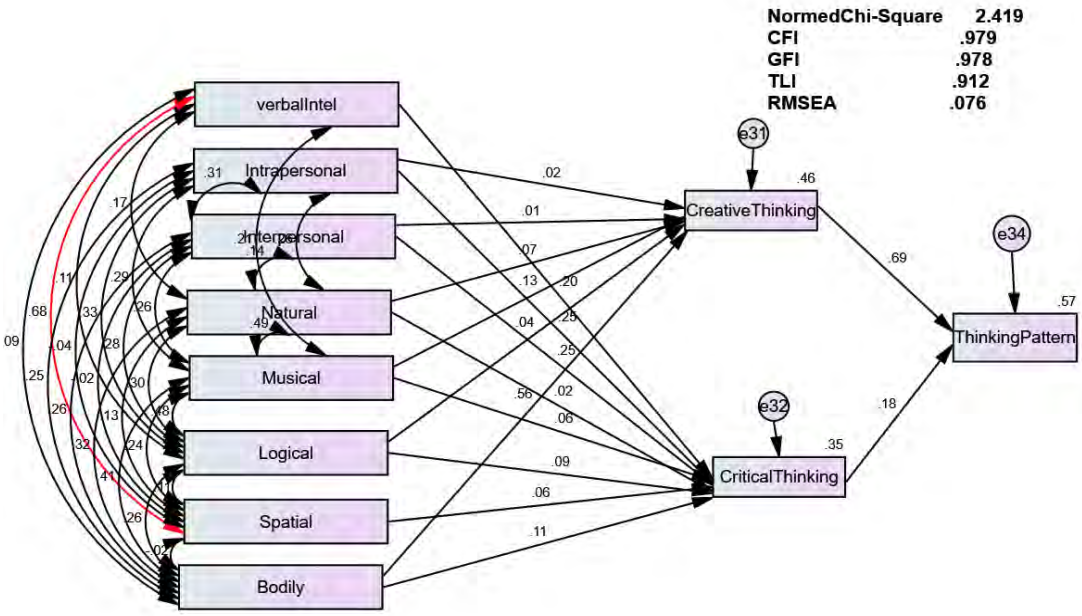


Figure 4.12 Revised structural model for Multiple intelligence, Thinking Skills and Thinking Pattern

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The full-fledged revised model shows satisfactory result for all fit indexes see figure 4.12. With respect to general adequacy of the revised model, the results revealed an acceptable model fit. The relative Chi-square or Normed chi-square where the chi-square fit index divided by the degree of freedom (CMIN/*df*) was estimated to be 2.419 which fall below the threshold point of 3.000 (Kline, 2011), Root mean square error of Approximation (RMSEA) = 0.076, Comparative fit index (CFI) = 0.979, TLI=0.912, Goodness-of-fit index (GFI)=0.978. These results therefore satisfied the general hypothesis that the structural model fitted the data. Table 4.15 presents the summary of fit indexes of the model.

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Table 4.15
Fit indexes

Fit indexes	Obtained	Require value
CMIN/DF (if N > 200)	2.419	3.0
CFI	0.979	0.90
RMSEA	0.076	0.05
GFI	0.978	0.95
TLI	0.912	0 .90

As a result of the fit model, the individual parameters were further evaluated, and hypotheses of the path relationships are then estimated. The results of the path coefficients are shown in the table 4.15.

H_1 There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.

Relationship Between Multiple intelligences (IV) and Thinking skills (creative) (MV)

Table 4.16 shows that there is positive relationship between the multiple intelligence variables, thinking skills (Creative). The C.R and p-value of are above the threshold of 1.96 and 0.05 respectively. This means, that the probability of getting a t-value is large with absolute value of <0.000. That is, the path coefficients that indicate the relationship between multiple intelligence and creative thinking skills is significantly different from zero at 0.000 level. Therefore, H_1 is supported. In other word, a significant relationship is observed between multiple intelligence, creative thinking skills. Bodily kinesthetics (BKI) appeared to have strong relationship with creative thinking skills with

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standardized beta (β) of .556, critical ratio CR (10.531) standardized error (SE) of .055 and p-value of 0.000. This is followed by musical intelligence with standardized beta (β) of .087, critical ratio CR (2.101) standardized error (SE) of .041and p-value of .036. However, no significant relationship was observed in the relationship between other multiple intelligence factors such as Intrapersonal, interpersonal, natural, logical, spatial, and verbal intelligence, and creative thinking skills as shown in table 4.16.

Relationship Between Multiple intelligences (IV) and Thinking skills (critical) (MV)

Table 4.15 shows that there is positive relationship between the multiple intelligence variables, thinking skills (Critical). The C.R and p-value of are above the threshold of 1.96 and 0.05 respectively. This means, that the probability of getting a t-value is large with absolute value of <0.000. That is, the path coefficients that indicate the relationship between multiple intelligence and critical thinking skills is significantly different from zero at 0.000 level. Therefore, H_1 is supported. In other word, a significant relationship is observed between multiple intelligence, critical thinking skills. Interpersonal appeared to have strong relationship with critical thinking skills with standardized beta (β) of .187, critical ratio CR (4.489) standardized error (SE) of .042 and p-value of 0.000. This is followed by Intrapersonal intelligence with standardized beta (β) of .162, critical ratio CR (4.362) standardized error (SE) of .037 and p-value of .0000. Verbal linguistic intelligence also has a significant relationship with critical thinking skill with standardized beta (β) of .144, critical ratio CR (2.803) standardized error (SE) of .051 and p-value of .005. However, no significant relationship was observed in the relationship between other multiple intelligence factors such as Musical, logical, spatial,

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naturalistic, and bodily-kinesthetics intelligence, and critical thinking skills as shown in table 4.16.

Relationship Between Thinking skills (MV) and Thinking pattern (DV)

Relationship between thinking skill and thinking pattern was tested and the result is shown in table 4.15. There is positive relationship between the thinking skills (creative and critical) and students' thinking pattern variables. The C.R and p-value of are above the threshold of 1.96 and 0.05 respectively. This means, that the probability of getting a t-value is large with absolute value of <0.000. That is, the path coefficients that indicate the relationship between thinking skills and thinking pattern is significantly different from zero at 0.000 level. Therefore, H_1 is supported. In other word, a significant relationship is observed between thinking skills and thinking pattern. creative thinking skill appeared to have strong relationship with thinking skills and thinking with standardized beta (β) of .771, critical ratio CR (16.092) standardized error (SE) of .048 and p-value of 0.000. This is followed by critical thinking skill with standardized beta (β) of .268, critical ratio CR (4.165) standardized error (SE) of .064 and p-value of .0000.

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Table 4.16
Hypothesized model Path coefficients
Standardized Regression Weights

Constructs			Estimate	S.E.	C.R.	P	Assessment
H1. There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.			.47	0.54	2.207	***	Supported
Thinking skills		Multiple intelligence					
CreativeThinking	<---	Intrapersonal	.017	.046	.384	.701	
CreativeThinking	<---	Interpersonal	.011	.051	.215	.830	
CreativeThinking	<---	Natural	.061	.046	1.339	.181	
CreativeThinking	<---	Musical	.087	.041	2.101	.036	Supported
CreativeThinking	<---	Logical	.039	.059	.664	.506	
CreativeThinking	<---	Bodily	.576	.055	10.531	***	Supported
CriticalThinking	<---	verbalIntel	.144	.051	2.803	.005	Supported
CriticalThinking	<---	Intrapersonal	.162	.037	4.362	***	Supported
CriticalThinking	<---	Interpersonal	.187	.042	4.489	***	Supported
CriticalThinking	<---	Natural	.011	.037	.306	.760	
CriticalThinking	<---	Musical	.028	.034	.826	.409	
CriticalThinking	<---	Logical	.070	.048	1.468	.142	
CriticalThinking	<---	Spatial	.041	.053	.771	.441	
CriticalThinking	<---	Bodily	.086	.045	1.907	.057	
Thinking Pattern							
ThinkingPattern	<---	CreativeThinking	.771	.048	16.092	***	Supported
ThinkingPattern	<---	CriticalThinking	.268	.064	4.165	***	Supported

Mediating effects of Thinking Skills on the relationship between the Eight Multiple intelligence factors and Thinking Pattern

Variable is considered a mediator if it carries the influence of independent variables/predictors to a given dependent variable/criterion measure. Mediation occur when the following scenario happen:

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1. The independent variable significantly affects the mediator,
2. The independent significantly affects the dependent variable in the absence of the mediator
3. The mediator significantly affects the dependent variable and
4. The effect of the independent on the dependent contrast when the mediating variable(s) is included in the model (MacKinnon & Dwyer 1993 and MacKinnon, Warsi, & Dwyer 1995).

The mediating relationship between the independent variables eight multiple intelligence factors, thinking skills and thinking pattern was analyzed. In the test of mediating effect between eight multiple intelligence factors, thinking skills and thinking pattern, it was found that only two (creative and critical thinking skills) out of three thinking skills fully mediate the relationship between the eight multiple intelligence factors and thinking pattern.

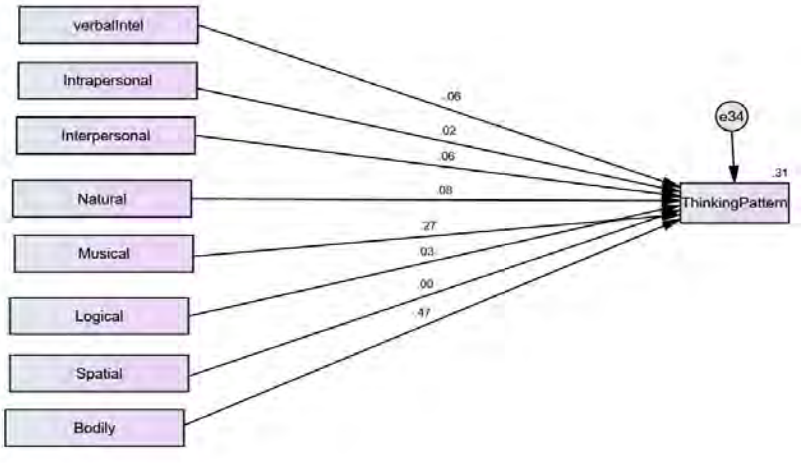


Figure 4.13 Relationship between Multiple intelligence and thinking pattern

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Relationship between Multiple intelligence factors (MI) and Thinking Pattern Before Mediator

Table 4.17
Direct relationship Between Multiple intelligence and Thinking pattern

				Estimate	S.E.	C.R.	P
ThinkingPattern	<---	verbalIntel	**Multiple Intelligence**	-.057	.053	-1.072	.284
ThinkingPattern	<---	Intrapersonal		.020	.048	.422	.673
ThinkingPattern	<---	Interpersonal		.064	.055	1.172	.241
ThinkingPattern	<---	Natural		.072	.046	1.584	.113
ThinkingPattern	<---	Musical		.187	.037	5.046	***
ThinkingPattern	<---	Logical		.029	.058	.500	.617
ThinkingPattern	<---	Spatial		.000	.054	-.008	.994
ThinkingPattern	<---	Bodily		.500	.056	8.852	***

After entering multiple intelligence to this model, the direct relationship between Multiple intelligence and thinking pattern are not that significant without mediator as shown in table 4.17.

Mediating effect of Thinking Skills (Creative thinking) on the relationship between Multiple intelligence factors and Thinking pattern Using Sobel Test

The mediating effect of creative thinking skill on the relationship between multiple intelligence factors and thinking pattern was tested in single model as shown in figure14. To further establish the full or partial mediation of creative thinking skill. Sobel test was conducted to determine the overall significant mediating effect of

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creative thinking skills on relationship between multiple intelligence factors and thinking pattern.

Table 4.18

Direct and Mediating Effect Using Sobel Calculator-creative thinking as mediator

Direct relationship without Mediator			Indirect Relationship with Mediator			
H2: There is no direct and statistically significant effect at the level of significance (0.05) between multiple intelligences (IV) and the development of thinking patterns (DV) through the thinking skills (MV- mediator) among 'grade 10' students (males and females) in private schools in Abu Dhabi.						
	Estimate	P-value		Estimate	P-value	Effect
Intrapersonal-thinking pattern	.020	.673	Intrapersonal-creative thinking	0.771	0.6770	No Mediation
Interpersonal-thinking pattern	.064	.241	Interpersonal-creative thinking	0.771	0.0458	Full Mediation
Natural-thinking pattern	.072	.113	Natural-creative thinking	0.771	0.0192	Full Mediation
Musical-thinking pattern	.187	0.000	Musical-creative thinking	0.771	0.0000	Full mediation
Logical-thinking pattern	.029	.617	Logical-creative thinking	0.771	0.6172	No Mediation
Spatial-thinking pattern	.000	.994	Spatial-creative thinking	0.771	1	No Mediation
Bodily-thinking pattern	.500	0.000	Bodily-creative thinking	0.771	0.0000	Full mediation

The outcome of Sobel test analysis and two tail probability value revealed similar findings to that of structural equation model analysis on mediating role of creative thinking in the relationship between Musical intelligence and thinking pattern. The

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result reveals that creative thinking skill (β=0.771, P=0.0000) mediates the relationship between musical intelligence and thinking pattern. Similar Sobel result was also obtained for bodily kinesthetics. Creative thinking skill (β=0.771, P=0.0000) mediates the relationship between bodily kinesthetics intelligence and thinking pattern. More so, the outcome of Sobel test analysis and two tail probability value revealed similar findings to that of structural equation model analysis. This suggests that creative thinking (β=0.771, P=0.0432) has indirect influence on thinking pattern of students. Similarly, Sobel mediating test shows that creative thinking (β=0.771, P=0.0458) mediates the relationship between interpersonal intelligence and thinking pattern. put in different way, interpersonal intelligence indirectly influences thinking pattern through creative thinking skills. In addition, Sobel mediating test shows that creative thinking (β=0.771, P=0.0192) mediate the relationship between Natural- intelligence and thinking pattern

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Nevertheless, Sobel mediation test for Intrapersonal intelligence revealed similar findings with that of structural equation model. The test shows that creative thinking (β=0.771, P=0.6770) does not mediate the relationship between intrapersonal intelligence and thinking pattern. In the same vein, the outcome of mediation test indicates that creative thinking (β=0.771, P=0.6172) does not mediate the relationship between logical intelligence and thinking pattern. Sobel mediating test shows that creative thinking (β=0.771, P=1) does not mediate the relationship between Spatial intelligence and thinking pattern.

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Mediating effect of Thinking Skills (Critical thinking) on the relationship between Multiple intelligence factors and Thinking Pattern Using Sobel Test

The mediating effect of critical thinking skill on the relationship between multiple intelligence factors and thinking pattern was tested in single model as shown in figure 4.14. To further establish the full or partial mediation of critical thinking skill, Sobel test was conducted to determine the overall significant mediating effect of critical thinking skills on relationship between multiple intelligence factors and thinking pattern.

Table 4.19

Direct and Mediating Effect Using Sobel Calculator-critical thinking skill as mediator

Direct relationship without Mediator			Indirect Relationship with Mediator			
H2: There is no direct and statistically significant effect at the level of significance (0.05) between multiple intelligences (IV) and the development of thinking patterns (DV) through the thinking skills (MV- mediator) among 'grade 10' students (males and females) in private schools in Abu Dhabi.						
	Estimate	P-value		Estimate	P-value	Effect
Verbal linguistics-thinking pattern	-.057	.284	Verbal linguistics-critical thinking	.268	0.0175	Full Mediation
Intrapersonal-thinking pattern	.020	.673	Intrapersonal-critical thinking	.268	0.6784	No Mediation
Interpersonal-thinking pattern	.064	.241	Interpersonal-critical thinking	.268	0.0322	Full Mediation
Natural-thinking pattern	.072	.113	Natural-critical thinking	.268	0.0426	Full Mediation
Musical-thinking pattern	.187	0.000	Musical-critical thinking	.268	0.0012	Full mediation

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Logical-thinking pattern	.029	.617	Logical-critical thinking	.268	0.6195	No Mediation
Spatial-thinking pattern	.000	.994	Spatial-critical thinking	.268	1	No Mediation
Bodily-thinking pattern	.500	0.000	Bodily-critical thinking	.268	0.0000	Full mediation

The outcome of Sobel test analysis and two tail probability value revealed similar findings to that of structural equation model analysis on mediating role of critical thinking in the relationship between Musical intelligence and thinking pattern. The result reveals that critical thinking skill (β=0.268, P=0.0000) mediates the relationship between musical intelligence and thinking pattern. Similar Sobel result was also obtained for bodily kinesthetics. Critical thinking skill (β=0.268, P=0.0000) mediates the relationship between bodily kinesthetics intelligence and thinking pattern. The outcome of Sobel test analysis and two tail probability value revealed similar findings to that of structural equation model analysis. This suggests that critical thinking (β=0.268, P=0.0175) mediates the relationship between verbal linguistic intelligence and thinking pattern of students. Thus, it can be concluded that verbal linguistic multiple intelligence indirectly influences thinking pattern. Similarly, Sobel mediating test shows that critical thinking (β=0.268, P=0.0322) fully mediate the relationship between interpersonal intelligence and thinking pattern. In addition, Sobel mediating test shows that critical thinking (β=0.268, P=0.0426) mediates the relationship between Natural-intelligence and thinking pattern.

On the other hand, the Sobel mediation test for Intrapersonal intelligence revealed similar findings with that of structural equation model. The test shows that

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critical thinking (β=0.268, P=0.6784) does not mediate the relationship between intrapersonal intelligence and thinking pattern. In the same vein, the outcome mediation test indicates that critical thinking (β=0.268, P=0.6195) does not mediate the relationship between logical intelligence and thinking pattern. Sobel mediating test shows that critical thinking (β=0.268, P=1) does not mediate the relationship between Spatial intelligence and thinking pattern.

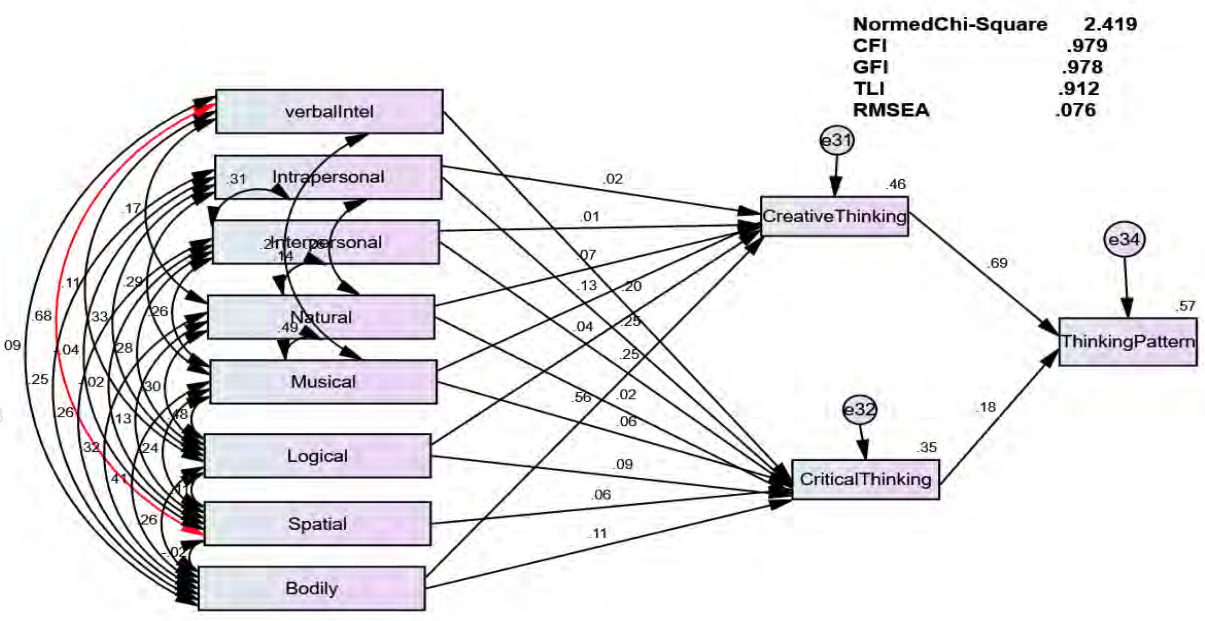


Figure 4.14 Relationship between Multiple intelligence and thinking pattern

In summary, Sobel test is necessary to uncover whether the mediator variable transfers the significant influence of the independent variable to dependent variable. In other words, Sobel test is used to establish whether the indirect effect of the independent variable on the dependent variable through the mediator variable is significant. The outcome of Sobel test analysis findings suggests that both creative and critical thinking skills mediate the relationship between two multiple intelligence factors—musical intelligence and bodily-kinesthetics.

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CHAPTER 5

DISCUSSION AND CONCLUSION

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5.1 Introduction

This chapter is a summary and reflection this study. It provides insight into the research findings and their interpretation. This chapter is divided into three parts. Part one discusses the findings and the relevant theories and literatures. The second part points-out the implications of the findings. The last part highlights the recommendations for further research and conclusion.

5.2 Discussion

What is the relationship between the variables of the study (multiple intelligences) as an independent variable, (thinking skills) as a mediator variable and (patterns of

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thinking) as a dependent variable among 'grade 10' students in Abu Dhabi private schools? From this research question, subsequent research questions were formulated to support main research question.

Does multiple intelligence factor (IV) have a significant relationship with creative thinking skills (MV)?

This research question examines the indirect causal relationship between verbal linguistic and thinking pattern. It is tested in *Hypothesis: There is no relationship between multiple intelligences (IV) and creative thinking skills (MV-mediator) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient of direct between these two variables was of practical importance and statistically significant. This indicates that multiple intelligence factor—musical and bodily kinesthetic intelligence significantly influence students' creative thinking skill. Previous literatures have revealed that musical and bodily kinesthetic intelligence of students have effects on creative or innovative thinking capacity of individual thinking skills of students (Lynes a. Burke and Joanne m Williams, 2007; hoett, 2002), while some studies such as (Al-Sarraj's study 2011) did not find any direct influence of musical and bodily kinesthetic intelligence on creative thinking skill. There is evidence showing the direct effects of musical and bodily kinesthetic intelligence on creative thinking skill (Ahmed, 2010; Al-Jarrah and Al-Rababiah, 2011). On the other hand, interpersonal, intrapersonal, verbal linguistic, spatial, natural and logical intelligence have been found to have direct

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influence on creative thinking skill (Acat, 2002; Ahmed, 2010; Al-Sayed, 2008). This is true when teacher wants to work on the thinking skills of students, he/she must take into consideration the role of musical and bodily kinesthetic intelligence capacity of the student (hoett, 2002; Najm, 2007; Al-Jazzar and Al-Qurashi 2006). The study of (Alawnah and Bala'wi, 2010) revealed that there is an impact of multiple intelligence, including musical intelligence on the development of learning styles and patterns of thinking, including creative thinking. The studies of (Nawal Abdel Fattah, 2007; Munir Mousa, 2007; Abdullah Ali; 2005; Saniah Mohamed; 2004; & Ibrahim Abdul Rahman, 1997) have explained the influence of multiple-intelligences, including bodily-kinesthetic intelligence on the development of creative thinking among students. The study conducted by (Jane, 2006; Gerry, 2003; & Ann 1998) showed the effect of bodily-kinesthetic intelligence in particular and multiple-intelligences in general on the development of thinking skills, including creative thinking among secondary school students.

There is no doubt that there is a relationship (whether direct or indirect, between multiple intelligences and thinking patterns through the mediating variable (thinking skills) or without the mediating variable. It has been shown that there is a direct relationship between linguistic intelligence and thinking patterns, as well as an indirect relationship between bodily-kinesthetic and musical intelligence and creative thinking, and also a direct relationship with the rest of the multiple intelligences and creative thinking, when teachers are activated to teach thinking skills in the lessons and studies in the secondary stage (tenth grade). Moreover, the researcher believes that the relationship between multiple intelligences and thinking patterns and skills is most evident in linguistic, musical and bodily-kinesthetic intelligence, as their effects appear

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clearly, and the teacher can highlight them easily. This does not reduce the existence of the relationship between the rest of the multiple intelligences and the thinking skills and patterns, but rather does not appear at times. Clearly for the learners, it may need many accurate measures to measure them and also to distinguish most of the learners with linguistic, musical and bodily-kinesthetic intelligence, as it constitutes a large proportion of their learning. However, educational systems do not give much attention to the development of the rest of the multiple intelligences, such as natural and social intelligence. This leads to the creation of weakness and lack of strong association between these multiple intelligences and thinking skills and patterns.

Does multiple intelligence factor (IV) have a significant relationship with critical thinking skills (MV)?

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This question examines the indirect causal relationship between verbal linguistic and thinking pattern. It is tested in *Hypothesis: There is no relationship between multiple intelligences (IV) and critical thinking skills (MV-mediator) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient of direct between these two variables was of practical importance and statistically significant. This indicates that multiple intelligence factor—interpersonal, intrapersonal and verbal linguistic intelligence significantly influence students' critical thinking skill. previous literatures have revealed that interpersonal, intrapersonal and verbal linguistic intelligence of students have effects on critical or innovative thinking capacity of individual thinking skills of

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students (Al-Muhanna, 2013; Asqoul, 2009), while some studies such as (Lynes a. Burke and Joanne m Williams) did not find any direct influence of interpersonal, intrapersonal and verbal linguistic intelligence on critical thinking skill. There is evidence showing the direct effects of interpersonal, intrapersonal and verbal linguistic intelligence on critical thinking skill (Lynes a. Burke and Joanne m Williams). On the other hand, musical, spatial, natural bodily kinesthetic and logical intelligence have been found to have direct influence on critical thinking skill (Abu Al-Ainain, 2007; Al-Tamimi, 2015). This is true when teacher wants to work on the thinking skills of students, he/she must take into consideration the student.

Does thinking skills creative (MV) has a significant relationship with thinking pattern (DV)?

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This research question examines the indirect causal relationship between verbal linguistic and thinking pattern. It is tested in *Hypothesis: There is no relationship between creative thinking skill and (MV) and thinking pattern (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient of direct between these two variables was of practical importance and statistically significant. This indicates that creative thinking skill significantly influence students' thinking pattern. Literatures have revealed that creative thinking skill of students have effects on thinking pattern of students (Redha Mosaad and Mohammed Hammad, 2002), while some studies such as (foong, shariffuddin and mislan, 2012) did not find any direct influence creative

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thinking skill on thinking pattern. There are evidences showing the direct effects of creative thinking skills on thinking pattern (Al-Sami' and Samar Lasheen, 2006).

Does critical thinking skills (MV) has a significant relationship with thinking pattern (DV)?

This research question examines the indirect causal relationship between verbal linguistic and thinking pattern. It is tested in *Hypothesis: There is no relationship between critical thinking skill and (MV) and thinking pattern (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient of direct between these two variables was of practical importance and statistically significant. This indicates that critical thinking skill significantly influence students' thinking pattern. Literatures have revealed that critical thinking skill of students have effects on thinking pattern of students (Gardner (1996), while some studies such as (Kazuo Nishimura1, Akira Okada, Michiyo Inagawa and Yoshikazu Tobinaga, 2012) did not find any direct influence critical thinking skill on thinking pattern. There are evidences showing the direct effects of critical thinking skills on thinking pattern (Benhabib and Nishimura 1998).

Does creative thinking skill mediate the relationship between Multiple-Intelligence factor (Verbal intelligence) and thinking pattern?

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This research question examines the indirect causal relationship between verbal linguistic and thinking pattern. It is tested in *Hypothesis: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that creative thinking skill mediate the relationship verbal linguistic intelligence and thinking pattern. previous literatures have revealed that creative thinking skills of students or innovative thinking capacity of individual influenced the association between verbal linguistic intelligence and thinking pattern (Redha Mosaad and Mohammed Hammad, 2002), while some studies such as (Huda Abdel Hamid, 2001) did not find any indirect influence. There is evidence indicating the mediation effects of creative thinking skill on thinking pattern (Abdullah Ali, 2006, and Abu Hashem, 2004). On the other hand, creative thinking skill has been found to fully mediate the relationship between verbal linguistic intelligence and thinking pattern (Redha Mosaad and Mohammed Hammad, 2002). This is true when teacher wants to work on the thinking pattern of students, he/she must know the creative thinking capacity of the student (Redha Mosaad and Mohammed Hammad, 2002)

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Does creative thinking skill mediate the relationship between Multiple-Intelligence factor (Interpersonal intelligence) and thinking pattern?

This research question examines the indirect causal relationship between interpersonal linguistic and thinking pattern. It is tested in Hypothesis: *There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that creative thinking skill mediate the relationship interpersonal linguistic intelligence and thinking pattern. Previous literatures have revealed that creative thinking skills of students or innovative thinking capacity of individual influenced the association between interpersonal linguistic intelligence and thinking pattern (Zahlouka, Maha, Adam, Basma, Saleh, and Weam), while some studies such as (Al-Tamimi, 2015) did not find any indirect influence. There is evidence indicating the mediation effects of creative thinking skill on thinking pattern (Al-Tamimi, 2015). On the other hand, creative thinking skill has been found to fully mediate the relationship between interpersonal linguistic intelligence and thinking pattern (Al-Tamimi, 2015). This is true when teacher wants to work on the thinking pattern of students, he/she must know the creative thinking capacity of the student (Zahlouka, Maha, Adam, Basma, Saleh, and Weam)

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Does creative thinking skill mediate the relationship between Multiple-Intelligence factor (Intrapersonal) and thinking pattern?

This research question examines the indirect causal relationship between interpersonal linguistic and thinking pattern. It is tested in Hypothesis1: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi. The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that creative thinking skill mediate the relationship Intrapersonal intelligence and thinking pattern. previous literatures have revealed that creative thinking skills of students or innovative thinking capacity of individual influenced the association between Intrapersonal intelligence and thinking pattern (Najm, 2007), while some studies such as (Rose, 1987) did not find any indirect influence. There is evidence indicating the mediation effects of creative thinking skill on thinking pattern (Najm, 2007). On the other hand, creative thinking skill has been found to fully mediate the relationship between Intrapersonal intelligence and thinking pattern (Rose, 1987). This is true when teacher wants to work on the thinking pattern of students, he/she must know the creative thinking capacity of the student (Najm, 2007).

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Does creative thinking skill mediate the relationship between Multiple-Intelligence factor (Natural intelligence) and thinking pattern?

This research question examines the indirect causal relationship between Natural linguistic and thinking pattern. It is tested in *Hypothesis: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that creative thinking skill mediate the relationship Natural linguistic intelligence and thinking pattern. Previous literatures have revealed that creative thinking skills of students or innovative thinking capacity of individual influenced the association between Natural linguistic intelligence and thinking pattern (Acat, 2002), while some studies did not find any indirect influence. There is evidence indicating the mediation effects of creative thinking skill on thinking pattern (Al-Sami' and Samar Lasheen, 2006). On the other hand, creative thinking skill has been found to fully mediate the relationship between natural linguistic intelligence and thinking pattern (Ahmed, 2010; Tomas Armstrong, 1994). This is true when teacher wants to work on the thinking pattern of students, he/she must know the creative thinking capacity of the student (Al-Sami' and Samar Lasheen, 2006).

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Does creative thinking skill mediate the relationship between Multiple-Intelligence factor (logical) and thinking pattern?

This research question examines the indirect causal relationship between Natural linguistic and thinking pattern. It is tested in Hypothesis1: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi. The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that creative thinking skill mediate the relationship logical linguistic intelligence and thinking pattern. previous literatures have revealed that creative thinking skills of students or innovative thinking capacity of individual influenced the association between logical intelligence and thinking pattern (Redha Mosaad and Mohammed Hammad, 2002), while some studies did not find any indirect influence. There is evidence indicating the mediation effects of creative thinking skill on thinking pattern (Huda Abdel Hamid, 2001). On the other hand, creative thinking skill has been found to fully mediate the relationship between logical intelligence and thinking pattern (Huda Abdel Hamid, 2001). This is true when teacher wants to work on the thinking pattern of students, he/she must know the creative thinking capacity of the student (Abdullah Ali, 2006, and Abu Hashem, 2004).

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Does creative thinking skill mediate the relationship between Multiple-Intelligence factor (Musical) and thinking pattern?

This research question examines the indirect causal relationship between Musical and thinking pattern. It is tested in Hypothesis1: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi. The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that creative thinking skill mediate the relationship Musical intelligence and thinking pattern. previous literatures have revealed that creative thinking skills of students or innovative thinking capacity of individual influenced the association between Musical intelligence and thinking pattern (Al-Jarrah and Al-Rababiah, 2011). There is evidence indicating the mediation effects of creative thinking skill on thinking pattern (Alawnah and Bala'wi, 2010). On the other hand, creative thinking skill has been found to fully mediate the relationship between Musical intelligence and thinking pattern. This is true when teacher wants to work on the thinking pattern of students, he/she must know the creative thinking capacity of the student.

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Does creative thinking skill mediate the relationship between Multiple-Intelligence factor (Bodily-kinesthetic intelligence) and thinking pattern?

This research question examines the indirect causal relationship between Bodily linguistic and thinking pattern. It is tested in Hypothesis: *There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that creative thinking skill mediate the relationship Bodily linguistic intelligence and thinking pattern. previous literatures have revealed that creative thinking skills of students or innovative thinking capacity of individual influenced the association between Bodily linguistic intelligence and thinking pattern (Al-Sayed, 2008). There is evidence indicating the mediation effects of creative thinking skill on thinking pattern (Jabir Abdul Hamid, 2003). On the other hand, creative thinking skill has been found to fully mediate the relationship between Bodily linguistic intelligence and thinking pattern (Nawal Abdel Fattah, 2007; Munir Mousa, 2007; Abdullah Ali; 2005; Saniah Mohamed; 2004; & Ibrahim Abdul Rahman, 1997). This is true when teacher wants to work on the thinking pattern of students, he/she must know the creative thinking capacity of the student (Jane, 2006; Gerry, 2003; & Ann 1998).

In the context of this study, the researcher tried to test whether creative thinking skill mediate the relationship between verbal linguistic intelligence and thinking pattern. But the findings did not show that such effect exist. No mediation effect was

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detected between intrapersonal intelligence and thinking pattern. In addition, No Mediation effect is found between spatial intelligence and thinking pattern.

Does Critical thinking skill mediate the relationship between Multiple-Intelligence factor (Verbal linguistic intelligence) and thinking pattern?

This research question examines the indirect causal relationship between verbal linguistic and thinking pattern. It is tested in *Hypothesis: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that Critical thinking skill mediate the relationship verbal linguistic intelligence and thinking pattern. previous literatures have revealed that Critical thinking skills of students or innovative thinking capacity of individual influenced the association between verbal linguistic intelligence and thinking pattern (Al-Muhanna, 2013). There is evidence indicating the mediation effects of critical thinking skill on thinking pattern (Abu Al-Ainain, 2007). On the other hand, critical thinking skill has been found to fully mediate the relationship between verbal linguistic intelligence and thinking pattern. This is true when teacher wants to work on the thinking pattern of students, he/she must know the Critical thinking capacity of the student.

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Does Critical thinking skill mediate the relationship between Multiple-Intelligence factor (Interpersonal intelligence) and thinking pattern?

This research question examines the indirect causal relationship between interpersonal linguistic and thinking pattern. It is tested in Hypothesis: *There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that Critical thinking skill mediate the relationship interpersonal linguistic intelligence and thinking pattern. previous literatures have revealed that Critical thinking skills of students or innovative thinking capacity of individual influenced the association between interpersonal linguistic intelligence and thinking pattern (Asqoul, 2009). There is evidence indicating the mediation effects of Critical thinking skill on thinking pattern. On the other hand, Critical thinking skill has been found to fully mediate the relationship between interpersonal linguistic intelligence and thinking pattern. This is true when teacher wants to work on the thinking pattern of students, he/she must know the Critical thinking capacity of the student (Asqoul, 2009).

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Does Critical thinking skill mediate the relationship between Multiple-Intelligence factor (Intrapersonal) and thinking pattern?

This research question examines the indirect causal relationship between interpersonal linguistic and thinking pattern. It is tested in Hypothesis1: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi. The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that Critical thinking skill mediate the relationship intrapersonal linguistic intelligence and thinking pattern. previous literatures have revealed that critical thinking skills of students or innovative thinking capacity of individual influenced the association between interpersonal linguistic intelligence and thinking pattern (Asqoul, 2009). There is evidence indicating the mediation effects of Critical thinking skill on thinking pattern. On the other hand, Critical thinking skill has been found to fully mediate the relationship between interpersonal linguistic intelligence and thinking pattern. This is true when teacher wants to work on the thinking pattern of students, he/she must know the Critical thinking capacity of the student.

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Does Critical thinking skill mediate the relationship between Multiple-Intelligence factor (Natural intelligence) and thinking pattern?

This research question examines the indirect causal relationship between Natural linguistic and thinking pattern. It is tested in *Hypothesis: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that Critical thinking skill mediate the relationship Natural linguistic intelligence and thinking pattern. Previous literatures have revealed that Critical thinking skills of students or innovative thinking capacity of individual influenced the association between Natural linguistic intelligence and thinking pattern (Amin, 2009). There is evidence indicating the mediation effects of Critical thinking skill on thinking pattern. On the other hand, Critical thinking skill has been found to fully mediate the relationship between Natural linguistic intelligence and thinking pattern. This is true when teacher wants to work on the thinking pattern of students, he/she must know the Critical thinking capacity of the student (Al-Sarraj's study 2011).

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Does Critical thinking skill mediate the relationship between Multiple-Intelligence factor (Spatial) and thinking pattern?

This research question examines the indirect causal relationship between Natural linguistic and thinking pattern. It is tested in Hypothesis1: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi. The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that Critical thinking skill mediate the relationship spatial intelligence and thinking pattern. previous literatures have revealed that critical thinking skills of students or innovative thinking capacity of individual influenced the association between spatial intelligence and thinking pattern. while some studies such as did not find any indirect influence. There is evidence indicating the mediation effects of critical thinking skill on thinking pattern. On the other hand, critical thinking skill has been found to fully mediate the relationship between spatial intelligence and thinking pattern.

Does Critical thinking skill mediate the relationship between Multiple-Intelligence factor (Musical intelligence) and thinking pattern?

This research question examines the indirect causal relationship between Musical linguistic and thinking pattern. It is tested in *Hypothesis1: There is no relationship*

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between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi. The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that Critical thinking skill mediate the relationship Musical intelligence and thinking pattern. previous literatures have revealed that critical thinking skills of students or innovative thinking capacity of individual influenced the association between musical intelligence and thinking pattern. On the other hand, critical thinking skill has been found to fully mediate the relationship between musical intelligence and thinking pattern. This is true when teacher wants to work on the thinking pattern of students, he/she must know the critical thinking capacity of the student.

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Does Critical thinking skill mediate the relationship between Multiple-Intelligence factor (logical) and thinking pattern?

This research question examines the indirect causal relationship between Musical linguistic and thinking pattern. It is tested in Hypothesis1: There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi. The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that critical thinking

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skill mediate the relationship logical intelligence and thinking pattern. Previous literatures have revealed that critical thinking skills of students or innovative thinking capacity of individual influenced the association between logical intelligence and thinking pattern. There is evidence indicating the mediation effects of critical thinking skill on thinking pattern. On the other hand, critical thinking skill has been found to fully mediate the relationship between logical intelligence and thinking pattern. This is true when teacher wants to work on the thinking pattern of students, he/she must know the critical thinking capacity of the student.

Does Critical thinking skill mediate the relationship between Multiple-Intelligence factor (Bodily-kinesthetic intelligence) and thinking pattern?

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This research question examines the indirect causal relationship between Bodily linguistic and thinking pattern. It is tested in Hypothesis: *There is no relationship between multiple intelligences (IV), thinking skills (MV-mediator) and the development of thinking patterns (DV) at the level of significance (0,05) among 'grade 10' students (males and females) in private schools in Abu Dhabi.* The results show that the path coefficient both direct and indirect between these two variables was of practical importance and statistically significant. This indicates that Critical thinking skill mediate the relationship Bodily intelligence and thinking pattern. previous literatures have revealed that critical thinking skills of students or innovative thinking capacity of individual influenced the association between Bodily intelligence and thinking pattern. There is evidence indicating the mediation effects of critical thinking skill on thinking pattern. On the other hand, critical thinking skill has been found to fully mediate the

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relationship between Bodily linguistic intelligence and thinking pattern. This is true when teacher wants to work on the thinking pattern of students, he/she must know the critical thinking capacity of the student.

In the context of this study, the researcher tried to test whether creative thinking skill mediate the relationship between verbal linguistic intelligence and thinking pattern. But the findings did not show that such effect exist. No mediation effect was detected between intrapersonal intelligence and thinking pattern. In addition, No Mediation effect is found between spatial intelligence and thinking pattern.

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5.3 Implications

The main implication of this study is the establishment of multiple-intelligent, thinking pattern and thinking skills model which is based on framework derived from previous studies. This enabled the researcher to formulate, measure and test multiple intelligence model. Based on the findings, this research proposed that multiple intelligence factors—verbal linguistic, bodily-kinesthetics, intra and interpersonal intelligence, logical, musical, and natural intelligence indirectly influence thinking pattern through creative and critical thinking skills. This study has contributed to the development of multiple intelligence literature with its findings that verbal linguistic, bodily-kinesthetics, intra and interpersonal intelligence, logical, musical and natural intelligence indirectly influence thinking pattern through creative and critical thinking skills.

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The empirical analysis of this study also contributed to existing knowledge on Structural Equation Modelling (SEM). The results of SEM have enhanced the understanding of indirect influence of predictive variables (multiple intelligence factors) on the criterion measure (thinking pattern) via the mediators (thinking skills).

Moreover, the study results have confirmed the necessity to include multiple intelligences, thinking skills, and thinking patterns in schools' curricula and textbooks, and to make many practical and applied lessons for multiple intelligences, thinking skills, and thinking patterns. All teachers, educators, and people of specialization have to be aware and well-educated about the importance of teaching multiple intelligences, thinking skills, and thinking patterns in curricula and schools through training, workshops and educational courses for teachers and supervisors in the educational field to benefit the largest possible number of workers and specialists.

In addition, this study will provide an insightful information to government, school administrator, principals, teachers, students and parents and various education stakeholders of the need to adopt the use of multiple intelligence and thinking skills elements in teaching and learning, and in assessment. Higher order thinking of students can further be enhanced with right combination of multiple intelligence factors and critical and creative thinking skills, thus improvement in their educational journey.

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5.4 Conclusion

The current study aims at modeling the relationship between multiple intelligences on the development of thinking patterns. Multiple intelligence is a new medium of enhancing both cognitive, affective, and psychomotor skills of students in teaching and learning in today's modern education.

This study has added a new perspective to current literature on multiple intelligence in teaching and learning by testing the mediating effect of thinking skills. The research model base on multiple intelligence and thinking pattern, was proposed and tested with data collected from secondary school students. This study produced an adequate structural model using path analysis. The results demonstrated a strong and positive relationship between the predictors and criterion variables. Multiple intelligence factors--verbal linguistic, bodily-kinesthetics, intra and interpersonal intelligence, logical, musical, and natural intelligence indirectly influence thinking pattern through creative and critical thinking skills. It can be concluded that the proposed model supported causal relationship between multiple intelligence factors, thinking skills and thinking pattern of students in school.

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5.5 Recommendations

According to the findings of the study, some recommendations and suggestions were made for educators and those working in the educational field. These recommendations are presented below:

1. Further studies on multiple intelligences, thinking skills and learning styles need to be conducted.
2. Studies on multiple intelligences, thinking skills, and thinking patterns need to be conducted and applied on other academic levels such as the primary and intermediate levels.
3. Studies on the relationship and linkage between multiple intelligences, thinking skills & thinking patterns and educational subjects and curricula need to be conducted.
4. Educating teachers, educators, and people of specialization about the importance of teaching multiple intelligences, thinking skills, and thinking patterns in curricula and schools.
5. Providing training, workshops and educational courses for teachers and supervisors in the educational field to benefit the largest possible number of workers and specialists.
6. It is necessary to include multiple intelligences, thinking skills, and thinking patterns in curricula and textbooks, and to make many practical and applied lessons for multiple intelligences, thinking skills, and thinking patterns

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APPENDIX

APPENDIX A

A PANEL OF EXPERTS

Name	Degree	Field	Location
1. Assoc. Prof. Dr. Mohamed Yousif	PhD	Educational Psychology	UPSI- Malaysia
2.Dr. Ali Bani Hamad	PhD	Educational Psychology	University of Jordan- Jordan
5. Prof. Dr. Suppiah Nachiappan		Educational Psychology	UPSI- Malaysia

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APPENDIX B

Letter request for content validity

Dear Dr,

Assalamualaikum.

Firstly, I would like to thank you very much for your support and assistance to me, and I greatly appreciate the time and effort that you give to show me the right path of seeking knowledge.

I am the researcher (Ali Mohammed Dawahdeh) from Sultan Idris Education University. I am doing a study entitled (Modeling The Relationship Between Multiple-Intelligence And Thinking Skills And Its Influence On Developing Thinking Patterns Among Tenth-Grade Students In Private Schools In Abu Dhabi), as a doctoral thesis, and I would like to present this scale, which includes three tests that measure (multiple intelligences as an independent variable, thinking skills as a mediator variable, and thinking patterns as a dependent variable). So, I would like to take your opinion regarding this scale, the content, the validity of the statements, and the appropriateness of the scale for this study in order to ensure the validity and reliability of the measurement tool through which I will collect the study data and analyze it to reach the desired results.

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The scale included three tests: The first test measures (Multiple Intelligences), which included eight types of intelligence that were classified by the scientist (Howard Gardner), which are linguistic, logical, bodily-kinesthetic, natural, musical, spatial, interpersonal and intrapersonal. Each type of intelligence includes eight items. multiple intelligences are the set of skills that enable individuals to solve their life problems. The second test measures (thinking skills), which is the mental information performed by the brain in order to collect, save and store the information by means of analysis, planning and evaluation procedures to reach conclusions and formulate decisions. This thinking skills test measures the skill of fluency, deduction, and object recognition. Several questions were set to measure each skill of these three skills. The third test measures (thinking patterns), which are mental processes that can be classified to distinguish each type from the other i.e. creative, scientific, and divergent thinking...etc. This scale includes three patterns of thinking, which are creative, critical, and visual thinking. Several questions were set to measure each of these patterns.

In the end, thank you very much again for providing help and assistance to me to produce this scale in the best way, in order to collect data and reach the best results that I seek in this study, and this will also assist researchers after me.

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APPENDIX C

Expert comments on the questionnaire for content validity

Q. N	Multiple Intelligence questions	It's issue		Note	expert evaluators
		Yes	No		
1	I enjoy reading books.		No		
2	I can understand the words in my mind before I **write or read** them.	Yes		Choose one **write or read**	Prof. Suppiah
3	Some people have to ask me about some of the meanings of the words I **say or write**.	Yes		Choose one **Say or write**	Prof. Suppiah
4	I like to participate in dialogues.		No		
5	Explain my thoughts to others with ease.		No		
6	I feel the importance of foreign languages.		No		
7	Taking notes helps me remember.		No		
8	I enjoy crosswords and other word games like Scrabble.	Yes		Avoid using (and) so that the item contains one idea	Dr. Mohamed Yousif
9	I am good at mental arithmetic.		No		
10	Mathematics and/or Science are my favorite school classes.		No		
11	Sometimes I think of abstract objects and imaginary things.		No		
12	Sort things by their common characteristics.		No		
13	I feel bad about things that are not logical.		No		
14	Enjoy competitions that need mental effort.		No		
15	Aged calculators are very useful in accomplishing my duties.		No		
16	I enjoy playing brainteasers and logic puzzles.		No		
17	When I close my eyes, sometimes I can see clear images in my head that seem real		No		
18	I have a good sense of colors and I'm very attracted to them		No		
19	I enjoy solving jigsaw, maze and/or other visual puzzles.		No		
20	I enjoy reading books more when they have lots of pictures and drawing.		No		
21	Enjoy artistic creativity in all its forms.		No		

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22	I care about making maps.		No		
23	I like 3D games like Lego games.		No		
24	Enjoy drawing absurdly on my notebooks.		No		
25	I like to occupy myself in one or more sport activities		No		
26	Sitting still for long periods of time is difficult for me.		No		
27	My favorite thoughts come when I am at **work or on long walks**, or when I am busy with some physical activities.	Yes		Delete the sentence after a word walks because it is superfluous and unnecessary. Multiple ideas should be fragmented here Shorten the item so that it becomes easy and understandable to the examinee	Prof. Suppiah Dr. Mohamed Yousif Dr. Ali Bani Hamad
28	I love imitating others.		No		
29	I prefer learning by doing.		No		
30	Enjoy manual work.		No		
31	I practice nonverbal communication with others such as sign language.	Yes		Shorten the item so that it becomes easy and understandable to the examinee	Dr. Ali Bani Hamad
32	Usually when I talk with people, I gesture with my hands and use body language.	Yes		Shorten the item so that it becomes easy and understandable to the examinee	Dr. Ali Bani Hamad
33	I like all kinds of animals.	Yes		The meaning should be specific: I like some kinds of animals	Dr. Mohamed Yousif
34	I enjoy fishing, animals, agriculture and cooking a lot.		No		
35	I collect rocks, shells and insects such as butterflies, stamps and sports' cards.		No		
36	Enjoy studying natural phenomena.		No		

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37	I have the ability to identify species.		No		
38	I like to visit nature reserves.		No		
39	I am attracted to raising animals in my home.		No		
40	I am interested in listening to weather forecasts		No		
41	I have a good singing voice		No		
42	Sometimes, when I walk, I remember melodies of some songs.		No		
43	I can easily keep time to a piece of music.		No		
44	I am interested in playing musical instruments.	Yes		The meaning should be specific: I love to play one of the musical instruments	Dr. Mohamed Yousif
45	I can focus on the annoying sounds.		No		
46	I can remember things when I put them in poetic rhymes.		No		
47	I am more interested in listening to music than watching series.		No		
48	I remember the singing poems.		No		
49	I am the kind of person others come to for advice		No		
50	I have at least three close friends	Yes		Some close friends	Dr. Mohamed Yousif
51	I prefer group activities and enjoy playing group games		No		
52	I am interested in following forums and social sites.		No		
53	I learn by dealing with others. I learn by dealing with others.	Yes		Shorten the item so that it becomes easy and understandable to the examinee	Dr. Ali Bani Hamad
54	Pay attention to social problems and look for solutions.		No		
55	Best study in group fashion.		No		
56	I feel happy while dealing with others.		No		

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57	I like to spend time alone thinking about things that are important to me.	Yes		Shorten the item so that it becomes easy and understandable to the examinee	Dr. Ali Bani Hamad
58	I have some important goals for my life that I think about often		No		
59	I have hobbies and interests that I prefer to do on my own		No		
60	I know my strengths and weaknesses		No		
61	I like to be the leader of my group.		No		
62	When I am convinced of something I give it my full effort.		No		
63	I am passionate about moral values.		No		
64	I love to help others.		No		

Part (1): Dr. Muhammad Youssef's suggestions

1. The questionnaire should include 8 items for each intelligence, and not 4 items
2. Avoid using (and) so that the item contains one idea

Part (2): Comments of Prof. Suppiah

Write the source of instruments as it is or done adaptation.

Part (3): Bani Hamad notes

Increase the number of items for each type of intelligence from four to eight items.

Modify some of the items that have more than one meaning, such as I enjoy Scrabble and mazes games, to become I enjoy Scrabble games.

Shorten some items that are too long for the examinee to read, understand, and answer.

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APPENDIX D

Letter requesting students to respond and answer the scale and tests.

Dear student,

Assalamualaikum.

I am glad to present this scale, which measures your multiple intelligences, thinking skills and thinking patterns, to obtain some valuable and real information that will be used by the researcher in the field of academic studies and research.

Please note that this does not require the writing of your name, which confirms to you that the information you provide will be confidential and will be used only for research purposes, so please write the correct data honestly and carefully, with objective and frank answers.. Thank you and your effort you will make to accomplish this test is highly appreciated.

The purpose of the test: This scale aims to know the types of multiple intelligences, thinking skills and thinking patterns you possess.

Test Instructions:

1. This test includes three sections, the first section is a questionnaire of multiple intelligences, the second section is a scale (test) to measure thinking skills, and the third section is a scale (test) for thinking patterns.
2. If you wish to change one of your answers, be sure to delete the previous answer.
3. Mark a (√) in front of the status that applies to the word or statement.
4. Read each statement carefully.
5. Do not leave any answer blank.

Thank you very much

Name of Researcher: Ali Mohammed Dawahdeh

School Name: …….

Grade 10 ☐

Gender: Male ☐ Female ☐

APPENDIX E

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Multiple intelligences questionnaire

Likert scale options:
1.Strongly Agree 2. Agree 3. No opinion 4. Disagree 5. Strongly Disagree (Nawfal, 2007)

Multiple intelligences questionnaire						
Verbal/Linguistic Intelligence		1	2	3	4	5
1	I enjoy reading books					
2	I can understand the words in my mind before I write them.					
3	Some people have to ask me about some of the meanings of the words I say					
4	I like to participate in dialogues.					
5	Explain my thoughts to others with ease.					
6	I feel the importance of foreign languages.					
7	Taking notes helps me remember.					
8	I enjoy crosswords games like Scrabble					
Logical/Mathematical Intelligence		1	2	3	4	5
9	I am good at mental arithmetic					
10	Mathematics and/or Science are my favorite school classes					
11	Sometimes I think of abstract objects and imaginary things					
12	Sort things by their common characteristics.					
13	I feel bad about things that are not logical.					
14	Enjoy competitions that need mental effort.					
15	Aged calculators are very useful in accomplishing my duties.					
16	I enjoy playing brainteasers and logic puzzles					
Spatial/Visual Intelligence		1	2	3	4	5
17	When I close my eyes, sometimes I can see clear images in my head that seem real					
18	I have a good sense of colors and I'm very attracted to them					
19	I enjoy solving jigsaw, maze and/or other visual puzzles					
20	I enjoy reading books more when they have lots of pictures and Drawing					
21	I enjoy artistic creativity in all its forms.					
22	I care about making maps.					
23	I like 3D games like Lego games.					
24	I enjoy drawing absurdly on my notebooks.					
Bodily-Kinesthetic Intelligence		1	2	3	4	5
25	I like to occupy myself in one or more sport activities					
26	Sitting still for long periods of time is difficult for me					
27	My favorite thoughts come when I am at work or on long walks					
28	I love imitating others.					
29	I prefer learning by doing.					

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30	I enjoy manual work.					
31	I practice nonverbal communication like sign language.					
32	When I talk, I gesture with my hands and use body language					
Naturalistic Intelligence		1	2	3	4	5
33	I like some kinds of animals					
34	I enjoy fishing, animals, agriculture and cooking a lot.					
35	I collect rocks, shells and insects such as butterflies, stamps and sports' cards.					
36	I enjoy studying natural phenomena.					
37	I have the ability to identify species.					
38	I like to visit nature reserves.					
39	I am attracted to raising animals in my home.					
40	I am interested in listening to weather forecasts					
Musical Intelligence		1	2	3	4	5
41	I have a good singing voice					
42	Sometimes, when I walk, I remember melodies of some songs					
43	I can easily keep time to a piece of music					
44	I love playing one of the musical instruments					
45	I can focus on the annoying sounds.					
46	I can remember things when I put them in poetic rhymes.					
47	I am more interested in listening to music than watching series.					
48	I remember the singing poems.					
Interpersonal Intelligence		1	2	3	4	5
49	I am the kind of person others come to for advice					
50	I have some close friends					
51	I prefer group activities and enjoy playing group games					
52	I am interested in following forums and social sites					
53	I learn by dealing with others.					
54	Pay attention to social problems and look for solutions.					
55	Best study in group fashion.					
56	I feel happy while dealing with others.					

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APPENDIX F

Thinking Skills Assessment

First: Creative Thinking Skills Assessment:

*** Fluency skill:**

1. Name everything you can think of education.

……..…
……..……
……..…
……..

2. Write down as many key uses as possible.

……..…
……..……
……..…
……..

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Second: Critical Thinking Skills Assessment:

*** Deduction skill:**

- **The statement:**

A competition was held between a group of students to select the ideal student. The result was that Sharif received most votes while the other students received a relatively smaller number of votes.

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Suggested Conclusions:

	Totally True	Probably true	Missing data	Probably Wrong	Totally Wrong
1) Other students are not fit for student leadership					
2) Sharif is the best student in scientific subjects					
3) Sharif is more loyal to his colleagues than other students					
4) Sharif loves all his family and they love him too					
5) Other students are scientifically successful, but socially unsuccessful					

- **The Statement:**

A test of innovation was applied to students in a classroom at a high school. The grade in this test was above average, and the result of the test showed that students with high grades were those who scored the highest grades in curriculum subjects.

Suggested Conclusions:

	Totally True	Probably true	Missing data	Probably Wrong	Totally Wrong
1) There is a close relationship between innovation and academic excellence					
2) Only an innovative student is able to attend high school					
3) If this test was applied to primary school students, we would have the same result					
4) Innovative students are intelligent					
5) Only excellent students in school curriculum can attend secondary school					

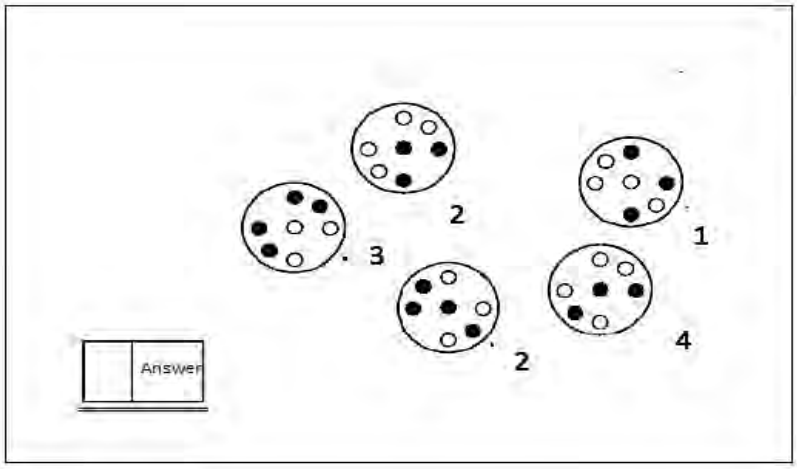
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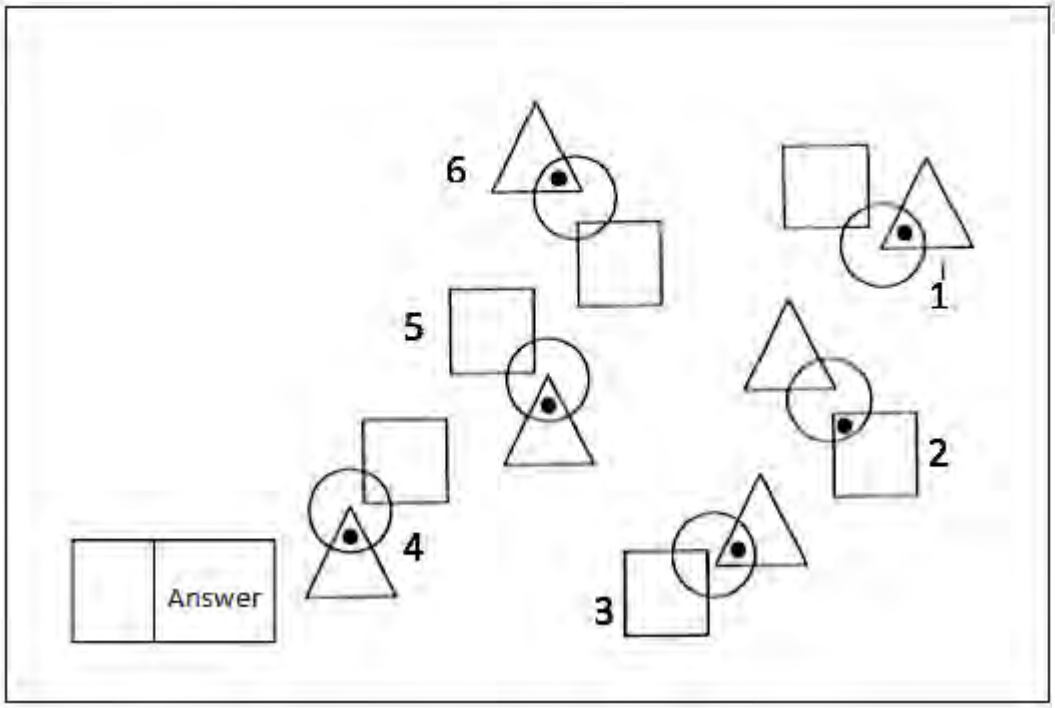
Third: Visual Thinking Skills Assessment:

***Object recognition skill test:**

What is the different shape in the pictures below?



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APPENDIX G

Thinking Patterns Assessment

First: Critical Thinking Assessment:

Recognition of Assumptions:

The assumption: 1. Expected 2. Unexpected

* Although television is one of the best educational tools, it is not suitable for all fields of education

1. TV is suitable for all fields of education.		
2. There are educational means other than television.		
3. Other educational tools are better than television.		

Interpretation:

* Amir received his final highest grade in Mathematics at the Secondary School; he studied at the King Abdul Aziz Secondary School in Mecca.

The result: 1. Expected 2. Unexpected

1. All students in this school received the final highest score in mathematics.		
2. Amir is likely to be excellent in all subjects.		
3. Amir is loved by all his colleagues.		

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Evaluation of Arguments:

Suggested Answers: 1. Strong 2. Weak

*Example: Is the school's sole task is to teach students the curriculums

1. Yes, because without school curriculums, schools will not be established.		
2. No, there are other school tasks apart from teaching the curriculums.		
3. Yes, because the main criterion for university enrollment is the student's school grade point average.		

Deduction:

Answers: 1. Correct 2. Incorrect

*Example: All students in secondary school study English and some secondary schools teach German.

1. All students who study English are students in secondary school.		
2. Some who study English, study German.		
3. All who study German do not study English.		

Second: Creative Thinking Assessment:

1. What would happen if all oceans disappeared?
   ……
   ……
   ……

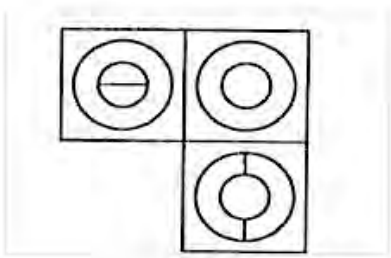
2. What happens if the sun does not shine throughout the year?
   ……
   ……
   …….

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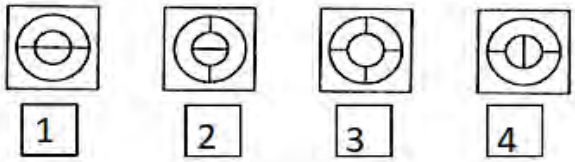
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Third: Visual Thinking Assessment:

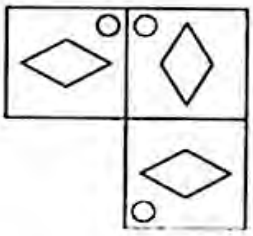
*** Successive Matrix:**



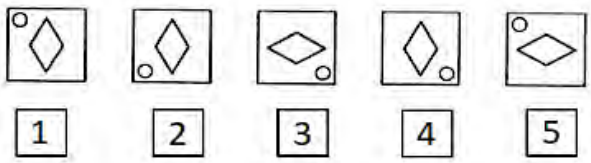
What is the missing shape? 



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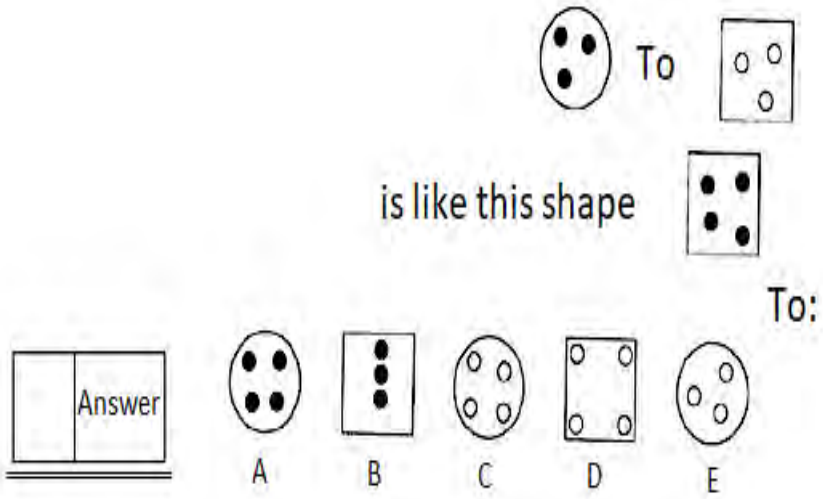
What is the missing shape? 



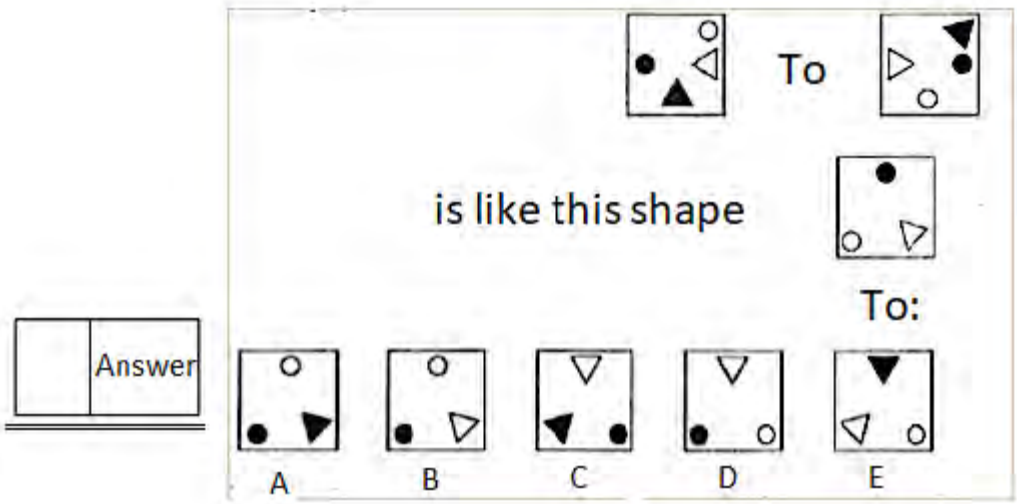
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*** Visual Symmetry test:**



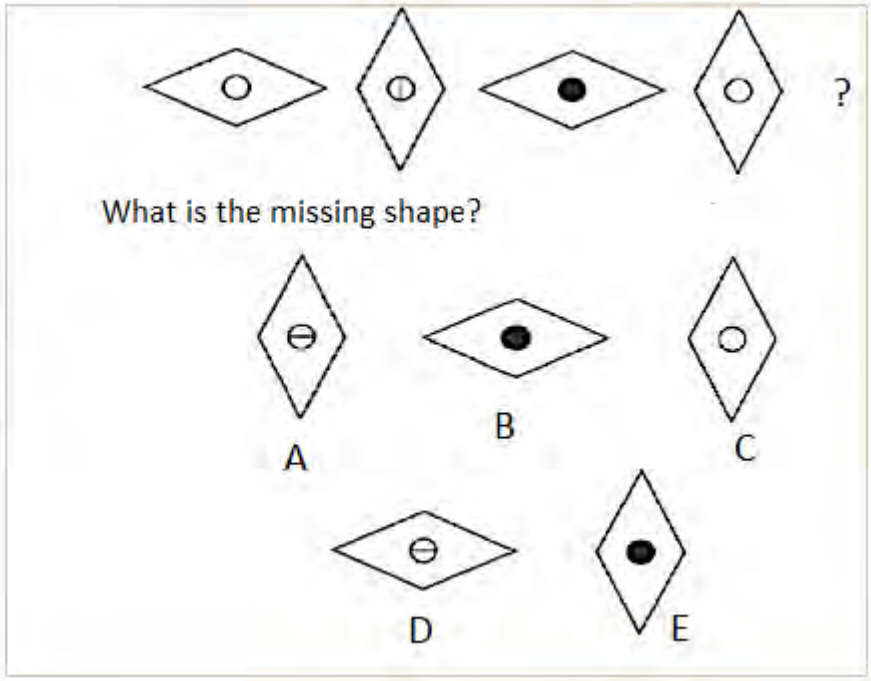
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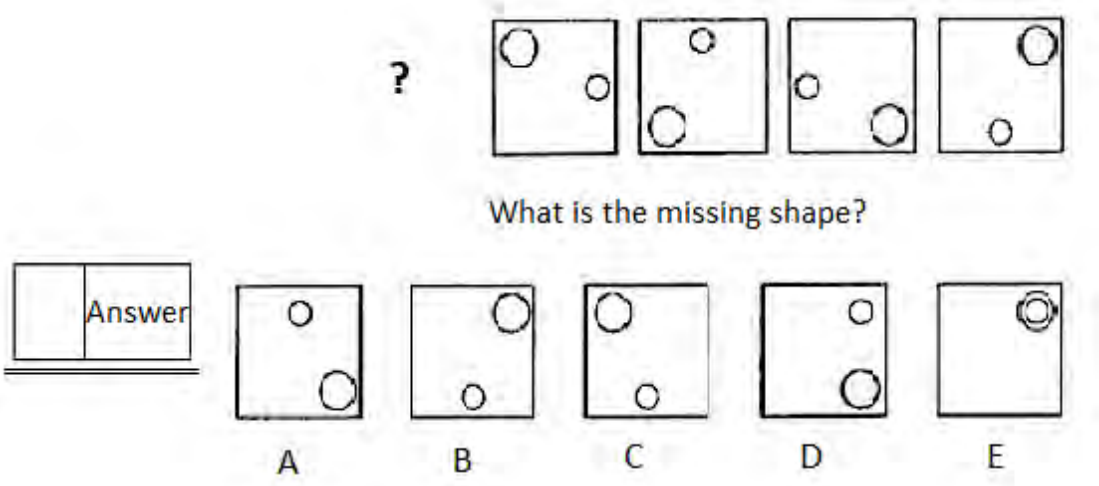
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*** Visual Succession Test:**



Answer

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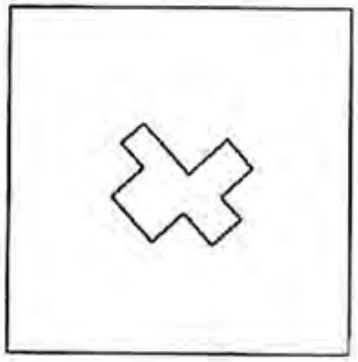
Answer

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*** Object Recognition test:**

Which one of the shapes below fits the shape inside the box?

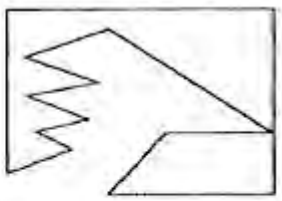


Answer

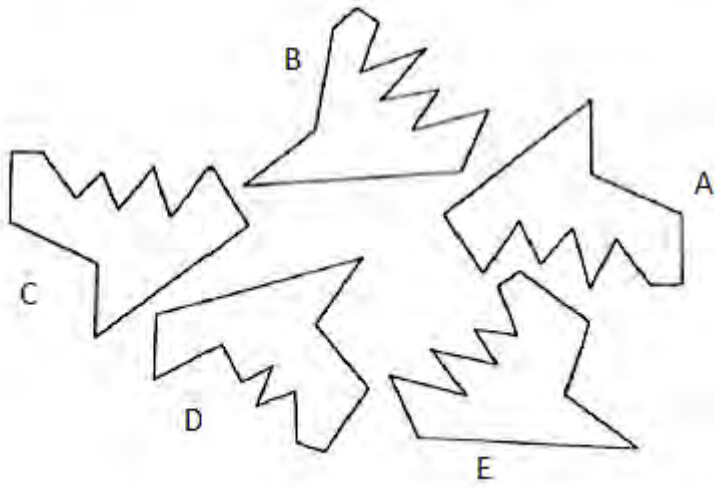


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Which one of the shapes below fits the shape inside the box?



Answer



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