The Relationship between Multiple-Intelligence and Thinking Patterns through Critical Thinking among 10th-Grade Students in Private Schools in Abu Dhabi

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Abstract

This study aimed at investigating the relationship between multiple-intelligence and thinking patterns through critical thinking among tenth-grade students in Abu Dhabi private schools. This study used descriptive approach and SEM. Also, the study sample consisted of 350 students from five private schools in Abu Dhabi. The instruments used were Gardner's multiple-intelligence scale and thinking patterns scale. Data was analysed using descriptive statistics, correlation coefficient and Amos. The results showed significant positive relationship between multiple intelligences (IV) and thinking patterns (DV) through critical thinking (MV). Direct relationships were found between linguistic intelligence (IV) and thinking patterns (DV) (r=.284); social intelligence (IV) and thinking patterns (DV) (r=.241); natural intelligence (IV) and thinking patterns (DV) (r=.113); musical intelligence (IV) and thinking patterns (DV) (r=.270); bodily-kinaesthetic intelligence (IV) and thinking patterns (DV) (r=.470). In conclusion, the findings revealed the influence of critical thinking on the relationship between multiple-intelligence and thinking patterns.

Keywords: multiple intelligences, thinking skills, tenth-grade, thinking patterns, critical thinking

Introduction

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.

Askooly (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. (Askooly, 2009).

Al-Sayyed (1995) 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 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-Sayyed, 1995).

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, Ruzzuqi and Abdul-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 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. (Ruzzuqi & Abdul- 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.

Abu-Hashim (2007) 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 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, 2007). 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. Also, 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.

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 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, 2011).

Problem Statement

Neglecting thinking among learners may have many negative effects. Education that neglects thinking skills builds knowledge for students through indoctrination and memorization and neglecting all activities that build the student's 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).

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 the ability to think among school students. This call has intensified over the past twenty years and has become known as the teaching thinking or education for thinking due to the negative effects of the lack of interest in thinking, which included 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, weakness in explaining the phenomena surrounding him and inability to harness them, which 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. (Winarti, Yuanita & Nur, 2019).

Many studies, including Al-Saliti (2006) study, have indicated that there are deficiencies in thinking patterns and skills among students. Therefore, 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.

Purpose of The Study

This study has two main objectives as follows:

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

2. To determine if there is an indirect relationship between the study variables i.e multiple-intelligence, thinking patterns and critical thinking among the 10th grade students in private schools in Abu Dhabi.

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. 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 capabilities that learners have and can use in their everyday lives. (Al-Samaili & Al-Zahrani, 2012)

Balawi (2011) has identified the theory of multiple intelligences developed by Gardner as a theory that 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, natural, spatial, musical, bodily-kinesthetic, interpersonal, and intrapersonal (Balawi, 2011).

The researcher thinks that the number of multiple intelligences is not limited to eight intelligences only and it can be increased in the future. The continuous research will

help in discovering and reaching other new multiple intelligences that cover all the sides of the learners' lives.

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.
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)

Al-Sayyed (1994) 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. 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 (Al-Sayyed, 1994).

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 (Al-Rubaie, 2013).

Teachers can improve their performance in the education process when adopting multiple intelligences as an input in teaching styles and it 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, 2018).

Table (1)

A summary of the multiple intelligences theory[1]

Intelligences	Basic components	Symbolic signs	Future career (Known characters)
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.
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
Spatial	Visual perception of the world and the ability to correctly and accurately visualize spatial	Imagination and Accuracy	Architect: Reem Colhas
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
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)
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
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)

[1] Author's conceptualisation

Thinking Patterns

The more intelligence is practiced by the learner through applying thinking skills the more thinking patterns are updated. There are three main types of thinking patterns including, visual thinking, creative thinking and critical thinking (Afaneh & Al-Khazindar, 2005). Visual thinking is one of the thinking patterns that educational institutions are interested in its development among students because of its many advantages. It is important to avoid hasty and impulse decisions and helps to give the best shot by taking full advantage of whatever knowledge, information, and skillset being possessed. While creative thinking is a different pattern of thinking which is a flexible thinking with the ability to change the state of mind, by changing the situation and the trend of ideas depending on the situation. It involves looking out for new ideas and concepts based on your past learning and life experiences. Critical thinking is a higher order, well-disciplined thought process, which involves the use of cognitive skills like conceptualization, interpretation, analysis, synthesis and evaluation for arriving at a valid, unbiased judgment. It is explained in details in the next section.

Critical Thinking

Critical thinking is one of the important and well-known thinking skills. 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. Critical thinking 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).

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, formulate assumptions and interpret data (Huitt, 1998). 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.

The researcher considers critical thinking as 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.

Beyer (1985) and Saadah (2014) mentioned the most important characteristics of critical thinking, which include:

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.
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.

The Relationship between Multiple-Intelligence and Thinking Patterns

The researcher believes that there is a relationship between multiple-intelligence and thinking 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.

Al-Sorour (2003) stated 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.

The researcher sees that 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. 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 stimulate the students' thinking skills that will definitely help them in the future.

Teaching thinking helps students to discover how to use their multiple intelligences in the taught lesson. Teaching students the practical applications needed to enhance and improve the weaknesses in their intelligence abilities and give them the opportunity to use their different types of intelligences in the classroom. It is also important to 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.

Research Design

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 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).

Also, this study has used the Structural Equation Modeling Method (SEM). It 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)

Sampling Method

The study sample consisted of 350 secondary level students studying in private schools in Abu Dhabi. Table (2) below shows the distribution of the study sample in Abu Dhabi private schools.

Table (2)

The Numbers of Tenth Grade Students in Abu Dhabi[1]

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

Research Instruments

The following instruments were used in this study:

Howard Gardner's Multiple-Intelligence Survey Instrument: The researcher found that Gardner scale is best suited to measure multiple intelligences, where many studies have used this scale, including: (Al-Jawaldeh, Al-Qamish, & Muqableh, 2011; Al-Shami, Nubi, & Al-Hamad, 2013; Rayyan, 2013; Armstrong, 2008). The scale consists of eight types of intelligence which are, linguistic, logical, interpersonal, intrapersonal, musical, spatial, naturalistic and bodily-kinesthetic.

Thinking Patterns Scale: 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 study of (Alhamuddin & Bukhori, 2016). In addition to the scale of (Farouk Abdel Salam and Mamdouh Suleiman) which was standardized by (Afaneh, 2005). 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).

Research Findings

The results showed significant positive relationship between multiple intelligences (IV) and thinking patterns (DV) through critical thinking (MV). Direct relationships were found between linguistic intelligence (IV) and thinking patterns (DV) (r=.284); social intelligence (IV) and thinking patterns (DV) (r=.241); natural intelligence (IV) and thinking patterns (DV) (r=.113); musical intelligence (IV) and thinking patterns (DV) (r=.270); bodily-kinaesthetic intelligence (IV) and thinking patterns (DV) (r=.470). The result of data analysis indicated the influence of critical thinking on the

[1] Author's conceptualisation

relationship between multiple-intelligence and thinking patterns.

Then, 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 revealed 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.

The Sobel test was necessary to uncover whether the mediator variable transfers the significant influence of the independent variable to dependent variable. Sobel test was mainly used to check 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 critical thinking skills mediate the relationship between two multiple intelligence factors—musical intelligence and bodily-kinesthetics.

Discussion

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 students (Askooly, 2009), while some studies such as (William, 2006) 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 (William, 2006). On the other hand, musical, spatial, natural bodily kinesthetic and logical intelligence have been found to have direct influence on critical thinking skill (Abu Mahadi, 2011; 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.

The results also showed that the path coefficient of direct between critical thinking

and thinking patterns 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 (Nishimura, Okada, Inagawa & 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 patterns (Atiyyah, 2015).

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 that verbal linguistic intelligence has a positive indirect effect on thinking pattern via both creative and critical thinking skills. Also, bodily-kinesthetics was observed to have positive indirect influence on thinking pattern via creative and critical thinking skills. While interpersonal intelligence has a significant and positive indirect influence on thinking pattern via creative and critical thinking skills. In addition, an indirect significant influence was also found between intrapersonal intelligence and thinking pattern via creative and critical thinking skills. The study supported the existing perspectives that multiple intelligence factors through creative and critical thinking skills determines the thinking pattern of students.

Conclusion

This study has added a new perspective to current literature on multiple intelligence in teaching and learning by testing the mediating effect of critical thinking. The results of this study have 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 critical thinking skills. Thus, it can be asserted that multiple intelligence had a significant and positive indirect influence on thinking pattern via critical thinking skills. Hence, it can be concluded that the proposed model supported causal relationship between multiple intelligence factors, critical thinking skills and thinking pattern of students in school.

It is recommended to conduct further studies on multiple intelligences, thinking skills, and thinking patterns applied on different academic levels. It is also important to study the relationship and linkage between the study variables and other variables such as learning styles and educational subjects and curricula to prove the necessity of including multiple intelligences and thinking skills & patterns in school curricula, textbooks and class activities.

References

[1] Abu Mahadi, S. (2011). Critical thinking skills in the high school physics curriculum and the extent to which students acquire them, unpublished Master Thesis. Islamic University, Palestine.

[2] Abu-Hashim, A. (2007). List of multiple-intelligence for the global construction of intelligences in the light of Gardner's theory and its relationship to self-efficacy, problem solving and academic achievement among university students. Journal of the Faculty of Education. Zagazig University, 1(55), 171-242.
[3] Afaneh, I., & Al-Khazindar, N. (2005). Classroom Teaching with Multiple-Intelligence. Amman: Dar Al-Masirah.
[4] Alhamuddin, A., & Bukhori, B. (2016). The effect of multiple intelligence-based instruction on critical thinking of full day Islamic elementary schools' students. Ta'dib, 21(1), 31. doi:10.19109/td. v21i1.590
[5] Aljawaldh, F., Al-Qamish, M., & Al-Muqablah, A. (2011). The level of talented students' teachers exercising multiple-intelligence in the classroom. Al-Quds Open Journal for Educational and Psychological Research and Studies, 1(1). Amman Arab University, Jordan.
[6] Al-Khafaf, I. (2011). Multiple Intelligences: An Applied Program (1st ed.). Amman: Dar Al-Manahij Publishing House.
[7] Al-Khuzaie, A., & Al-Amrani, A. (2013). The effectiveness of teaching through activities of multiple intelligences in developing scientific thinking in physics for fourth-grade students of science. Kufa Studies Journal, 1(31), 253-283.
[8] Allam, R. (2001). Research Methods in Psychological and Educational Sciences (3rd ed.). Cairo: University publishing center.
[9] Al-Otaibi, K. (2007). The effect of using some parts of the Kurt program in developing critical thinking skills and improving the level of academic achievement of a sample of secondary school students in Riyadh, unpublished doctoral thesis. Umm Al-Qura University, Makkah.
[10] Al-Rubaie, I. (2013). The effectiveness of an educational program according to multiple intelligences in understanding and acquiring mathematical concepts and reasoning for second-grade middle school students, unpublished doctoral thesis. University of Baghdad, Iraq.
[11] Al-Saliti, F. (2006). Critical and creative thinking and cooperative learning strategy in teaching reading, Amman: A wall of the international book.
[12] Al-Samaili, H., & Al-Zahrani, M. (2012). The effect of teaching according to multiple intelligences in forming a positive trend towards science subject for second year middle school students. Ministry of Education, Saudi Arabia.
[13] Al-Sayyed, A. (1995). Critical Thinking: A Study in Cognitive Psychology. Alexandria: Dar Al-Ma'rifah Al-Jami'yyah.
[14] Al-Sayyed, F. (1994). Intelligence from a New Perspective (5th ed.). Cairo: Dar Al-Fikr Al-Arabi.
[15] Al-Shami, J., Nubi, A., & Al-Hamad, M. (2013). Designing electronic activities according to the theory of multiple intelligences in the talented education course and its impact on achievement and the motivation towards learning among students of the Arab Gulf University. The third international conference on electronic e-learning, Riyadh, Saudi Arabia.

[16] Al-Sorour, N. (2003). An Introduction to the Education of the Talented and Gifted Individuals (1st ed.). Amman: Dar Al-Fikr Al-Arabi for publication and distribution.
[17] Al-Tamimi, M. (2015). Development of Critical Thinking: An Empirical Study on a sample of high school students in Kuwait, Unpublished Master Thesis, Arab Gulf University, Kingdom of Bahrain.
[18] Armastrong, T. (2008). Multiple intelligence in the classroom. Alexandria, association for prevision and curriculum development. Arbor, Michigan, USA.
[19] Askooly, K. (2009). Social Intelligence and its relation to critical thinking and some variables among students, unpublished Master Thesis. Islamic University, Gaza.
[20] Atiyyah, M. (2015). Thinking: Types, Skills, and teaching strategies (1st ed.). Cairo: Al-Dar Al-Masriyyah Al-Libnaniyyah.
[21] Balawi, M. (2011). Multiple intelligences among students of Al-Qaseem University. The Educational Journal, 25(100), 177-213.
[22] Beyer, r. (1985). Homosexuality and American psychiatry: the policy of diagnosis. New York: Basic books.
[23] Huitt, W. (1998). Critical thinking is an important issue in educational psychology interactive Valdosta, Valdosta state university.
[24] Hussein, A. (2012). The effect of using some teaching strategies based on the theory of multiple intelligences in supporting the educational activities and developing creative thinking and the direction towards school among students of community education schools. Journal of the College of Education, 1(95).
[25] Hussein, T. (2018). The comprehensive guide to thinking skills, (4th ed.). Amman: DeBono Thinking Center.
[26] Jarwan, F. (2014). Talent, Excellence and Creativity (3rd ed.). Amman: Dar Al-Masirah.
[27] Jarwan, F. (2007). Teaching thinking, Concepts and Applications (1st ed.). Amman: Dar Al-Fikr for publication and distribution.
[28] Langer, J. (2004). Let's Teach our Children the Sweetness of Thinking (1st ed.). Translated by: Sawsan Tabba. Riyadh: Obeikan Library.
[29] Nishimura, K., Okada, A., Inagawa, M., & Tobinaga, Y. (2012). Thinking patterns, brain activity and strategy choice. Journal of Physics: Conference Series, 344, 012004. https://doi.org/10.1088/1742-6596/344/1/012004
[30] Rayyan, A. (2013). Types of multiple intelligences among secondary school students in Hebron, Palestine. Al-Aqsa University Journal, 17(1), 193- 234.
[31] Ruzzuqi, R., & Abdul-Karim, S. (2015). Thinking and its Patterns (1st ed.). Amman: Dar Al-Masirah.
[32] Ruzzuqi, R., & Abdul-Karim, S. (2015). Thinking and its Patterns (2ne ed.). Amman: Dar Al-Masirah.
[33] Saadah, J. (2014). Teaching Thinking Skills. Amman: Dar Al-Shorouk for Publication and Distribution.

[34] Sahrawi, A., & Busalb, A. (2016). Structural Modeling (SEM) and the validity of psychological and educational research. The global construction model for the competencies of administrative facilitation in the educational institution. Psychological and Educational Sciences Journal, 3(2), 61-91.
[35] Tayeh, I. (2016). The effectiveness of a proposed program based on the theory of multiple intelligences in acquiring fiqh concepts and deductive thinking among ninth grade female students. Published MA thesis, Islamic University, Gaza.
[36] William, F. (2006). Classroom ideas for encouraging thinking and feeling, buffalo. ny: dok: publisher inc.
[37] Winarti, A., Yuanita, L., & Nur, M. (2019). The effectiveness of multiple intelligences based teaching strategy in enhancing the multiple intelligences and science process skills of junior High School students. Journal of Technology and Science Education, 9(2), 122. doi:10.3926/jotse.404
[38] Yamen, W. (2013). Mathematical thinking patterns and their relationship to multiple intelligences and the desire for specialization and achievement among the tenth grade students in Palestine, unpublished Master Thesis. An-Najah University, Palestine.