

## THE EFFICIENCY OF AN EDUCATIONAL PROGRAM BASED ON MONTESSORI CURRICULUM IN DEVELOPING LOGICAL THINKING IN KINDERGARTEN CHILDREN

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### ABSTRACT

The study aims to identify the efficiency of an educational program based on Montessori Kindergarten curriculum on developing logical thinking in Kindergarten's children. The study sample consisted of (58) male and female children; (30) of them were from the Montessori kindergarten and (28) were from a Private kindergarten, which uses Traditional Curriculum. A logical thinking test was adopted after a modification was applied to it in order to suit the Jordanian environment. The test was verified for validity and reliability. The Results revealed significant differences in logical thinking scores due to the kind of curriculum used in kindergarten in favor of Montessori curriculum. The findings also showed that there were no significant differences in the logical thinking scores due to gender. Through their findings, the researchers provided some inferences and recommendations.

**Keywords:** An educational program based on Montessori Curriculum, Logical thinking, Kindergarten children.

### INTRODUCTION

The childhood stage is considered to be the most important one in man's life because the child at this stage is most susceptible to the influences of the surrounding environment. It also constitutes the basic stage in the upcoming stages of development. Caring for the child is not new, but is as old as history. Ancient Egyptians established kindergartens whose curricula included clay and wooden toys for the well-off people. The Greeks afterwards brought up their children on toughness through tough games. Arab children later practiced games side by side with learning. Recently, childhood stage became of great concern to various international organizations including the international council for pre-education together with the United Nations Organization for children. (UNECEF). The International Conference on Education (1961) recommended: caring for pre-school children, applying a free program based on child's activity in compliance with his mental, emotional and physiological needs, and urging responsible authorities to establish educational initiations that care for pre-school children (Kindergartens).

The first years of man's life witness a fast development in several areas, especially in mental development. Many researchers and scientists like Erikson, Feud, Piaget, Hall, Havighurst emphasized the importance of the mental developments at the pre-school stage (Abu Hatab, 1996). Briefly, (1984) indicated that half of cognition developments is acquired through the first four years of age. One third of the rest is acquired the years of age 4-8. Modern Education has contributed in developing several types of thinking, such as logical thinking. Many educational institutions endeavored to develop it to become children's habit due to the belief that this kind of thinking needs the use of a huge amount of information to come to

logical solutions. It is also considered the cornerstone for higher levels of thinking, (Abu Hatab, 1996).

Some studies tried to prove that there is logical thinking in pre-school children, among those studies are: Piaget's (1978), and Filippova's (1986). These two studies found that logical thinking exists in infancy as it is the foundation on which the other kinds of thinking rest. Various research studies helped in developing programs, curricula, and special strategies for teaching children below six year of age. Such strategies help to develop thinking in general and logical thinking in particular. Example of those studies are: (Miller & Dyr, 1975) (Seefeldt, 1986), and (Elkind, 1986).

In addition to the preceding studies, the fifteenth national conference on curricula and preparation for modern life (2003), and the fourth national conference the reading-cognition society both stressed to practice forbidden activities that contribute to child thinking development and to reconsider the contents of textbooks used in kindergartens (AL-qaddah, 2008).

Recommendations of early childhood seminar (2004) stressed the need for training the kindergarten child on skills of scientific thinking, (Zamzami, 2005). The interest of the majority of Arab and foreign countries in this stage was reflected in designing goals and special programs for children of pre-school stage. For example, program goals for kindergarten children in America emphasized child's self activity which relates playing to cognition development, while in Britain the goals emphasized developing the skills of classification, quantity differentiation, relative and self-differentiations, distinction between reality and imagination, and vigilance and coding. In Japan children's cognition goal emphasized developing child's mental abilities through educational programs and activities. (Al-Oteibi, 2007).

As for the Arab world, the interest of most Arab countries (Egypt, Iraq, Jordan, Syria, Kuwait and Saudi Arabia) was seen in the objectives of kindergartens. For example, (Al-Oteibi, 2007) was authorized by Arab Education office to put down a set of objectives on cognition of kindergarten children some of which stipulate on developing child's abilities in classification, counting, serialization and relating cause to effect, in addition to establishing relations among things. All these constitute the components of logical thinking.

Jordan is one of the countries that has recently showed a great interest in the child and was a pioneer in the area to prepare a national strategic plan to develop early childhood. (2013-2014). That plan emphasizes creating a secure environment to develop child's abilities through the creation of legislatures, policies and programs that care for the physical, mental, social, and emotional sides of the child. This vision was embodied in the curriculum of Jordanian kindergartens. It also specified the child's development criteria which were divided into five major pivots related to: developing language, teaching reading and writing, developing child's social and emotional life, in addition to the physical one besides logical thinking and methods of teaching. The pivot of logic and thinking focused on secondary criteria that includes developing the concept of comparison, discovering special relation, and the awareness of the concept related to organizing and serialization. (skills of logical thinking). (Ministry of education, 2007).

Thus, Jordan is considered one of the countries that adopted modern trends in teaching pre-school children in addition to caring for quality of education as it concentrated on developing

to the best the children's mental abilities applying modern educational curricula like Montessori's and the Various intelligence, methods. Montessori's method represents one of the modern trends which revolutionized educational teaching. This method is applied throughout the world, regardless of the different languages, cultures and abilities. It aims at encouraging the child is behavior that encourages him to have self-confidence, self – dependence, self-respect, and respect for others. (Tepper, 2004).

As such, Montessori's method represents an educational technique which considers the child a person who has his own needs, desires, and capabilities. Many Studies were conducted comparing Montessori's method with traditional ways of teaching pre-school children. The results showed that Montessori method was efficient in teaching pre-school children in general. They also found discrepancy between the objectives of kindergartens adopting Montessori's and the traditional ones. The objective of Montessori's method was to train child's senses through using various educational machines, and to satisfy individual needs. As for the objectives of traditional kindergartens, the objectives concentrated on teaching letters and numbers to children in a traditional way to satisfy their collective needs (Savage, 1993), (Morgan, 1978), and (Foster, 1970).

### **Problem of the Study**

Developing education in its various stages in general and the pre-school stage in particular became a major concern for international scientists and educators such as: (Fropel, Pestalozzi, and Piaget). This century witnessed a clear interest, by specialists and parents, in the pre-school stage for the role that kindergartens play in qualifying the child to be correctly prepared before joining the preliminary stage so that he/she might not feel the sudden departure from home to school. Their activities should be given ample space to grow, and enough freedom to be able to develop new skills and abilities.

Modern education, therefore, paid attention to all aspects of the physical growth of the child, with special emphasis on thinking. Educational institutions tried to develop the process of thinking to make it easy to acquire and develop in children. This, however, needed new methods of education which could help, as was done by Montessori (1973), Piaget (1978), and Gardner (1991), in order to establish educational programs that could help children acquire varied skills and speed up their cognitive and intellectual growth. The traditional methods proved to be lagging in this respect.

Jordan is considered among the countries in which kindergartens Curricula varied. A study of (Mattar, Sharim, Al-Zu'bi, 2011) showed that there are different curricula in Jordanian kindergartens. Some of them follow the content-wise curricula as an academic educational method; others follow the children's developing characteristics; whereas the third type is mid-way between the academic and developmental methods, and is called the National Interactive Curriculum (NIC).

Furthermore, in Amman, world renowned Curricula (Montessori's and Multi-Intelligence Curriculum) are followed by some kindergartens. Each of these methods has several educational activities for children. The problematic question (of this research) is: to examine the efficiency of the Montessori's Curriculum in developing the logical thinking in children.

## IMPORTANCE OF THE STUDY

### Theoretical Importance

- Results of this research will add up to the efforts of previous studies on the relationship between the Jordanian children's physical and cognitive development.
- Researches and studies on the development of cognitive thinking of children are generally scarce.
- Concern in kindergartens will be directed to emphasize the new education methods instead of the traditional ones which mostly depend on accumulating knowledge, the modern education methods, i.e. Montessori's and Bwakir's, depend on deep understanding of the child's growth and education.

### Practical Importance

- Results of the study will help education authorities develop methods and courses in child education, as well as in educating kindergarten teachers in the method of Montessori and its effective educational tools.
- Results of the study will benefit the private and public kindergarten teachers to use educational tools which are similar to those used by Montessori, activities which may develop logical thinking.
- The Logical Thinking Quotient which is specifically developed for Jordanian environment could be applied in kindergartens.

### Objectives

The study aims to examine the efficiency of an educational program based on Montessori's method in developing the logical thinking for kindergarten children.

### Study hypotheses

- 1- There are no statistical differences in level  $\alpha=0.05$  of the average score between the number of students joining Montessori's kindergartens and those of the traditional ones in the overall degree of logical thinking.
- 2- There are no statistical differences in level  $\alpha=0.05$  of the average score between the number of students joining Montessori's kindergartens and those of the traditional ones in the skill of logical relations.
- 3- There are no statistical differences in level  $\alpha=0.05$  of the average score between the number of students joining Montessori's kindergartens and those of the traditional ones in the skill of logical serialization .
- 4- There are no statistical differences in level  $\alpha=0.05$  of the average score between the number of students joining Montessori's kindergartens and those of the traditional ones in the skills of organization and ordering.
- 5- There are no statistical differences in level  $\alpha=0.05$  of the average score between the number of students joining Montessori's kindergartens and those of the traditional ones in the cause-effect skill .
- 6- There are no statistical differences in level  $\alpha=0.05$  of the average score of logical thinking attributed to the variable of gender (male or female).

## Study Limitation

The study is confined to children between 5-6 years old, as of 2013-2014, in Montessori and private kindergartens.

## Terminology

1- Efficiency: it is defined by Aser (2003) as "the volume of effect produced by the independent variable on the dependent variable upon which the design of the study is built". Issa (1997) defines it as "the capacity of the program to satisfactorily achieve its aims when used as intended and under the same conditions in the future." In application, it is the amount of effect produced by the educational program on Montessori's method in developing logical thinking for kindergarten children.

2- The Montessori educational program: it is "the educational activities which aim at effecting behavioral, future and mental changes in children" (Gcleman, 1995). In application, it is the set of actually organized activities built on Montessori and applied in *Montessori Kindergarten*, Amman.

3- Logical thinking: Logical Thinking: defined by Al-Najahi (2005) as "expressing the successful judgment of things, showing their qualities, finding, or denying, connections among them, and providing the causes and effects of this judgment". In application, it is the child's performance of the logical relation skills, classifying and organizing, and the causes and effects, which are maintained in the overall points obtained by the child in the logical thinking scale used in the present study.

## Logical Thinking Skills

The present study is limited to four skills: logical relations, classification, ordering and serialization, and cause and effect. These logical thinking skills, according to Piaget (1978), are the most frequently used skills by 4-6 years old children. Many studies {e.g. Hassan (2001), Al-Najahi (2005), and Sharaf Ed-Din (2011)}, therefore, restricted the application of logical thinking criterion to pre-school children in these skills. The following are definitions of these skills:

1- Logical Relations Skill: Ubaidat and Abu Sameed (2005) defined it as "the capacity to conceive the function of the part and its relation to other parts, the relation between the part and the whole, the extent of effect practiced by the part on the whole, and the whole on the part." Al-Najahi defined it as "the capacity of the child to perceive connection between two things, and the conception of the relation between the part and the whole."

2- In application, it is defined as the marks obtained by the child when responding to activities of the logical relations skill contained in the logical thinking scale.

3- Classification skill: as defined by Al-Najahi (2005), it is "the way an individual treats similar things, grouping incidents and surrounding objects in certain categories." Sa'adeh (2006) considered it "an intellectual process through which things are grouped together on bases of their common qualities, making out of them meaningful units." In application, it is defined as the marks obtained by the child when responding to activities of the classification skill contained in the logical thinking scale.

4- Organizing and serializing skill: Al-Najahi (2005) defined it as "the ability of the child to order incidents and things in a particular order according to length, size, number, or chronological order and according to ascending or descending order." Sa'adeh (2006) defined it as "the skill used in arranging things and incidents in a particular order chosen very

carefully.” In application, it is defined as the marks obtained by the child when responding to activities of the organizing and serializing skills in the logical thinking scale.

5- Cause and effect skill: it is defined by Al-Najahi (2005) as “the ability to justify and solve problems, define causative relations between things, and predict the results of actions.” Sa’adeh (2006) defined it as “the skill used to determine the causality relations of different things.” In application, it is defined as the marks obtained by the child when responding to activities of the cause and effect skill in the logical thinking scale.

## **THEORETICAL FRAME**

### **Logical Thinking**

Logical thinking is considered one of the methods of thinking which depends on speculation rules. It is an intellectual activity based on correct hypotheses or presumptions as in syllogism, i.e. forming results out of sound premises. When there is correlation of thoughts, it is called a logical process, but when they are discordant with no correlation, it is called illogical thinking (Al-Khalili, 2005).

### **Logical thinking skills**

Thinking skills are generally graded starting with basic (logical) thinking skill: i.e. observation, comparison, classification, and organization of information. Then, compound processes follow; these include critical thinking, creative thinking, solving problems, and decision making. Each of these intellectual processes is composed of many skills: logical thinking is composed of important intellectual skills like interpretation, induction, deduction, production of logical judgments, the relations between cause and effect and others.

Many researchers, who dealt with the subject of logical thinking, showed the variety of its skills. Al-Shirbini and Sadeq (2002) considered that comparison, organization, generalization, analysis and construction are all basic skills of logical thinking. However, Tafesh (2004) mentioned other skills: i.e. classification, abstraction, sensation, induction and deduction.

The present study is limited to four main skills already specified according to previous studies and scales applied to pre-school children; they are:

- 1- Logical relations
- 2- Classification
- 3- Ordering and serialization
- 4- Cause and effect

All of which have been defined in the research terminology.

### **Montessori’s Curriculum** (applied in Montessori kindergarten)

Montessori Curriculum of education aims at a successful contribution of the child to practical life, which will make the child self-confident, self-dependent and respectful to others. This Curriculum has deep applications represented in its specifically designed devices. They proceed from the sensory (real) to the abstract (imaginative) in accordance with the child’s cognitive, emotional, perceptive and social development. This stimulates and enforces the child’s incentives for learning, in addition to satiating the child’s basic needs. The Curriculum is distinguished for employing the child’s senses and different visual, audio and touch abilities in education. The Curriculum has also many other activities, practices and



exercises, sensual and kinetic, to increase the children's acquisition of different skills, and educate them in reading, writing, calculating, natural sciences and several manual works. Montessori Curriculum is divided into three graded levels which correspond to the growing levels in children. This helps acquisition of skills convenient to the stages of their development. The levels are:

- 1- The first level is directed to children of 3 years old. Its function is to train children on certain activities, as washing hands and face, brushing teeth, combing hair, managing clothes and shoe polishing.
- 2- The second level is directed to children of 4 years old. It aims at training children on numerous sensory skills through working and playing using different geometrical shapes and devices, musical bells, meters and scales of different sizes.
- 3- The third level is directed to children of 5 years old. It aims at training them on audio-visual distinctions which initiate them into the skill of reading. This program also trains children on writing processes through practicing on sand and forming letters and words (Bahader 2014).

Montessori Curriculum is also greatly concerned with classroom orientation in order to arrange the suitable comfortable environment for children, finding games and special appliances to train them on different sensory activities and practical daily life skills. The course, devices and appliances of this Curriculum are organized in the three classroom corners:

- 1- The first corner is designed for the practical or movement activity; where the kid is trained on daily life activities and basic movement skills.
- 2- The second corner is for training the senses. It is mostly devoted to the development of the child's senses through different convenient devices and appliances.
- 3- The third is the academic corner. It aims at educating children on reading, writing and calculating skills (Mctamane, 2004).

### **Montessori's classrooms**

Montessori classroom constitutes of children aged (3-6) years. They are educated on how to behave towards each other (the younger with the older and vice-verse), which will help develop cooperation and brotherhood feelings among them. To do this, the classroom must be specifically arranged to hold these children as members of one family, where intimacy and love prevail. This Montessori classroom is the special place for the child to learn the importance of cleanliness and order, and to be considered the *utopia* of pure knowledge and information for all its dwellers (Cichuchi, 2006).

### **The Traditional Curriculum** (applied in a private kindergarten)

This Curriculum aims at developing the child's skills of memorization and recollection. It persists in providing children with abstract, fat-fetched and intangible information. This traditional curriculum focuses on subjects of study and their content without relating them to the child's self or personality. The courses are also presented to the child in an abstract program restrictive for both the child and the teacher. The teacher will find that teaching the child all the numerical, calculating, social and linguistic experience without any further readiness on the part of the child, especially in an early stage of fixation at this age is negative. Thus, as the teacher is the only source of information for the child, who will have to be only attentive. Therefore, the educational situation in the traditional Curriculum is no

more than a child sitting on a specific seat, a classroom with a board and the teacher on a chair to sit on, together with other educational devices to be hung on the walls (Bahader, 2014).

As kindergartens following the Traditional Curriculum aim at developing the basic skills of reading, writing and calculation, they mostly emphasize on the cognitive part, while neglecting the others, i.e. the emotional, sensory and kinetic. Courses are usually offered in abstraction. This will not achieve the required development (Bahader, 2014). The Curriculum used by Al-Sultan kindergarten is considered Traditional (academic).

## LITERATURE REVIEW

The two researchers reviewed a number of studies which dealt with the development of thinking in general, and programs of logical thinking and its skills in particular; in addition to studies dealing with logical thinking measures used with pre-school children. The following is a survey of these studies:

Al-Qaddah (2008) wanted to discover the effect of using educational activities in developing the thinking skills in pre-school children: viz. conception of forms and numbers, classification, comparison, interpretation and application. The study sample comprised of 73 (female and male) children of 5-6 years old. This sample has been divided into two groups: the first is experimental (35), and the second is controlled (38); the study was conducted in Jannet Al-Atfal kindergarten, Mansura city of Egypt. The study used the test of thinking skills for the children and showed the efficiency and importance of educational activities in developing the thinking skills; in addition to the statistical differences between the two groups, to the benefit of the experimental group.

Sharaf Eddin (2008) tested the validity of a suggested approach to develop the religious, linguistic, social, scientific, health and computer skills. The Curriculum is based on activities distributed on skills of classification, serialization and ordering, and the conception of relations among things. The sample of the study comprised of 60 children of the first and second levels of kindergartens of Sana'a city. The study used the suggested Curriculum together with suggested conceptions. It showed statistical differences in the average grades of children of the two groups to the benefit of the experimental ones, which show how this suggested Curriculum is effective in developing the suggested conceptions.

Suleiman (2008) tried to find how far the strategy of presentations and joining in kindergarten activities by children contribute in developing their mathematical skills of serialization, classification, symmetry, numbering and equivalent relations. The sample comprised of 30 children divided into two groups 15 from each of the first and second years of the kindergarten children of Al-Bayda city in Libya. The study used a number of mathematical activities employed in the light of the strategy of presentation through joining children. The study showed the positive effect of the strategy of presentation by joining the kindergarten activities in developing mathematical skills; it also showed a difference between first and second year children in mathematical conceptions to the benefit of the second group.

Al-Hooli study (2007) tried to test the effect of a new educational corner in the conceptions, skills and mathematical relations of kindergarten children as serialization, distinguishing geometrical forms and numbers, classification, ordering and basic relations (dimensions and sizes). The study sample comprised of 78 children from the second level of one of Kuwait



city kindergartens. The study used educational games to test of the cognitive standard in mathematical conceptions which showed that the experimental group children surpassed the children of the controlled group in mathematical conceptions, which points to the efficiency of the educational corner.

A comparative study, conducted by Lopata, Wallace, and Finn (2005), comprising 543 students in the state of New York, about the performance of students in the schools based on Montessori and traditional Curricula, showed that there were no differences of statistical value in the performance of students in both groups.

Basheer and Saleh (2005) tried to test the effects of using certain educational dimensions (comparison, classification, deduction, induction, decision taking, and solving problems) on the acquisition and development of skills and conceptions of kindergarten children. The sample of the study comprised of 40 children aged 5-6 years, chosen from a kindergarten attached to the Faculty of Kindergarten Education in Alexandria. The sample, was divided into two groups, experimental and controlled, and used the criteria of child education dimensional measure and the suggested expertise program. The results showed statistical value differences between the two groups to the benefit of the experimental one. The study also showed the efficiency of suggested expertise program.

Al-Qaddah (2001) suggested in his study a program to develop the basic scientific processes in kindergarten children (observation, classification, deduction, number using, and temporal and special relations). The sample of the study comprised of 60 children aged 5-6 years from one of the kindergartens of Al-Mansura city in Egypt. The study used the basic science scale and a suggested program for basic science skills. The results showed the existence of statistical value differences between the two groups in dimensional application of basic science to the benefit of the experimental group.

A likewise study conducted by Abdullah (2001) aimed at knowing the effects of educational case in developing the basic science processes for kindergarten children. The sample of the study comprised of 84 children, aged 5-6 years, from one of the kindergartens of Cairo city. The study used a specifically designed educational case and scale for kindergarten basic science processes. The results showed the existence of statistical value differences between the two groups in dimensional application of the scale to the benefit of the experimental group.

### **General Comments on the Literature**

As shown above, the survey of studies showed the efficiency of different educational programs in developing thinking in general, and the logical thinking and its skills in particular. The two researchers found that most reviewed studies dealt with the logical thinking skills involving the basic science processes by using various educational programs and activities, as in Al-Qaddah (2008), which discussed the effects of using a program built on the educational activities to develop the skills of classification, comparison, conception of things and interpretation. Moreover, Sharaf Eddin (2011) used the skills of classification, ordering, serialization, and conception of relations, and the development of scientific conceptions. The studies of Saleh and Basheer (2005), Al-Qaddah (2001), and Abdullah (2001) all used the suggested educational programs to develop basic science processes as comparison, classification, temporal relations, and others.

In the light of the above mentioned, and to the best of the researchers' knowledge, no scientific study has been conducted on the efficiency of Montessori Curriculum of logical thinking development, particularly in Jordan, which prompted this study.

## METHODOLOGY

The present research is considered one of the retrospective studies because it shed light past experiences of children without any change or the capacity to control. The researcher in retrospective studies is supposed to examine traits or behavior types and chosen incidents in a methodological organized way, without the slightest change or attempt for controlling. Then, the researcher studies the existing differences between individuals in the present time of study. The researcher will benefit from the changes or existing tribal differences in order to form the remedial (experimental) wholeness of the study (Mayers, 1990).

As the basic aim of this study is to test the validity of an existing educational program, built on Montessori's Curriculum of developing logical thinking in kindergarten children, there is a need to make a comparison between two groups of children in logical thinking.

The first group is enrolled at the Montessori kindergarten, which implements a Montessori Curriculum educational program. The other group is enrolled at Al-Sultan kindergarten, which implements the Traditional curriculum. These two groups are subjected to a post-test in order to check the efficiency of the implemented educational program (independent variable) in logical thinking (dependent variable).

### Study Population and Sample

The population of the study includes all children enrolled at private kindergartens in Amman. The study sample consists of (58) children, male and female, who enrolled at the Montessori and Al-Sultan kindergartens, including (30) children selected from Montessori kindergarten, 15 males and 15 females, and (28) children selected from Al-Sultan kindergarten, 15 males and 13 females, as illustrated in table (1).

Table (1) sample distribution by kindergarten and gender

Kindergarten	males	females	Sum
Montessori	15	15	30
AL-Sultan	15	13	28
Sum	30	28	58

Through purposive sampling, two kindergartens were selected; Montessori kindergarten, being the only kindergarten in Amman which implements an educational program based on the Montessori Curriculum, and Al-Sultan kindergarten, which provides traditional educational programs, in compliance with following conditions:

- 1- A child must have spent two consecutive years at the kindergarten.
- 2- A child must be (5-6 old)

## Instrument of the study

for the purpose of selecting the appropriate scale for measuring logical thinking and determining the skills it prerequisites, the researchers reviewed a group of scales which were used in measuring thinking in general and logical thinking in particular in preschool children, including the following:

- 1- The improved scale for logical thinking development (Najahi, 2005).
- 2- Logical thinking scale (zainoon and zaitoun, 2003).
- 3- Children's cognitive development scale (Abdou and Othman, 2002).
- 4- The improved listing of Piaget tasks (Khtabiah and Nawaqshi, 2000).
- 5- Children's kindergarten performance scale (Al-Batsh, 1998).

After examining the scales, Al-Najhi scale (2005), which was developed from the scale of David Wilson and others (translated by Muhi Aldeen Ahmad Hasaneen), was selected for the purpose of measuring preschool children's logical thinking, as it relies on skills confirmed to be of importance to preschool children and utilizes pictures, while other scales have favored a traditional formula of written and spoken material.

## Instrument description

Al-Najhi scale consists of (28) activity cards covering four major skills with each skill including several activities. The following is a review of these skills and the activities they include:

### 1- Logical relations skill, four activities:

- Activity (1) – Includes a binary or symmetric relation.
- Activity (2) – includes a functional relation.
- Activity (3) – includes a numerical relation.
- Activity (4) – includes a part-whole relation.

### 2- Classification skill, eight activities:

- Activity (5) – includes the concept of direction.
- Activity (6) – includes the irregular or odd.
- Activity (7) – includes the concept of similarity.
- Activity (8) – includes the concept of association.
- Activities (9) and (10) – include the concept of separation.
- Activity (11) – includes the concept of color.
- Activity (12) – includes the concept of shape.

### 3- Serialization and ordering, eight activities:

- Activity (13) – includes the concept of number in an ascending order.
- Activity (14) – includes the concept of number in a descending order.
- Activity (15) - includes the concept of age in an ascending order.
- Activity (16) - includes the concept of size in an ascending order.
- Activity (17) - includes the concept of size in a descending order.
- Activity (18) - includes the concept of length in an ascending order.
- Activity (19) - includes the concept of size in a descending order.
- Activity (20) – includes the concepts of chronology and chronological order.

#### **4- Cause-effect relationship**

##### **This skill consists of eight activities**

Activity (21) – includes environmental and healthy behaviors.

Activity (22) – includes positional relations.

Activity (23) – includes associational relations.

Activity (24) – includes nutritional behaviors.

Activity (26) – includes causative relations.

Activity (27) - includes cleanliness behaviors.

#### **Scale development**

In order to confirm its appropriateness for the sample, the scale was presented to a number of referees, and in the light of their recommendations and suggestions, an initial blueprint was set up for the logical thinking scale. Most original pictures were replaced by real colored photos in order to attract the children's attention as the originals were mostly schematic pictures. The photos were obtained from kindergarten curricula and illustrated books in addition to some children literature and childhood websites. The reliability and validity of the scale were validated as explained below.

#### **Scale validity**

Validity indicates the ability and capability of the test to measure the phenomenon it was set up to measure (Ojaili, 2010). The scale's face validity was verified through a number of referees and specialized experts to determine the degree for which measurement paragraphs represent. The scale was checked by (6) referees specialized in education, measurement and evaluation, and psychology to verify the suitability of the scale's paragraphs to their intended purposes, the correlation of the activities with each of the scale's skills and their suitability to preschool children, and the appropriateness of the photos in expressing these activities. Additionally, the referees were asked to add, amend, or remove any activity they deem unsuitable. Based on the views of the referees, all activities included in the scale were accepted as they received an approval rating of (80%), except for activity (3) which referees suggested to be replaced by another activity that is more suitable to the logical relations skill.

In the light of the referees' views, some photos' measurements were adjusted and some activities' questions were modified to be more intelligible to age category (5-6). Activity (12) was placed on a separate page after it was integrated with activity (11). After all the amendments were completed, the scale, in its final version, was examined by an expert in measurement and evaluation to determine the degree to which it satisfied the requirements of measurements development.

#### **Scale reliability**

Scale reliability indicates "the degree of consistency and stability in the achieved scores of a scale's performance over time. A highly reliable scale places the individual at a consistent category in the various measurement instances" (Ojaili, 2010). For the purpose of verifying the reliability of the scale, the two researchers utilized the test-retest method. The scale was reapplied to (20) children selected from a private kindergarten in Madaba governorate two

weeks after the first administration. Correlation coefficients ranged between (0.76-0.88) which is appropriate for the intents of this research, as illustrated in table (2).

**Table (2) reliability coefficients for logical thinking skills utilizing the test-retest method**

Order	Logical thinking skills	Correlation coefficient
1	Logical relations skills	0.88
2	Classification skills	0.82
3	Ordering and sequencing skills	0.78
4	Cause and effect skills	0.76

### Scale implementation procedures

**First – Pilot application:** The two researchers, in cooperation with kindergarten teachers, application and the test to a pilot sample outside the study sample consisting of (15) children from Al-Aqsa kindergarten in order to verify the clarity of the scales' instructions and activities, and to determine its required duration. The pilot administration indicated the clarity of the paragraphs of the scale, and the 10-15 minute duration. It also indicated the need for the teacher to demonstrate the activities of the scale to the children while the two researchers write down the answers on the answer sheet to ensure the child's adequate response to the activities of the scale.

**Second- final application:** the scale was applied at the selected kindergartens to (58) enrolled male and female children at the end of the second semester of (2013). The test was administered individually in a special room in cooperation with the kindergarten management. The two researchers explained the manner of administration to the teacher so that she would be able to properly demonstrate the activities of the scale and explain their requirements. The researchers then wrote down the answers in the child's answer sheet. The answer key for the logical thinking scale was prepared beforehand.

### Statistical Treatment

The data was processed through the statistical package for social science (SPSS), as they were inputted and statistically analyzed using the following statistical methods: (correlation coefficient, arithmetic mean, standard deviation, two independent samples t-test).

## RESULTS AND DISCUSSION

Results will be reviewed and discussed in the light of the hypotheses of the study as follows:

**First hypothesis:** There are no statistically significant differences at ( $\alpha=0.05$ ) between the mean scores of Montessori kindergarten children and the traditional kindergarten children in the total score for logical thinking.

To verify the validity of this hypothesis, the arithmetic means and standard deviations of the Montessori and traditional kindergarten children's scores were calculated for the total score of logical thinking. The results are indicated in table (3).

**Table (3) t-test results for mean total score differences according to curriculum**

Kindergarten curriculum	Number	Arithmetic mean	Standard deviation	T value	Significance
Montessori	30	80.900	4.964	9.991	0.000
Traditional	28	63.143	8.272		

The table above indicates that the arithmetic mean for the total score of the Montessori kindergarten children was (80.900) with a standard deviation of (4.964), while the total score of the traditional kindergarten children was (63.143) with a standard deviation of (8.272). The T-test was applied to two independent samples in order to determine the statistical significance of the difference between the two means. T was calculated at (9.991), which is statistically significant at ( $\alpha=0.05$ ), indicating statistically significant differences between the mean scores of the two groups in favor of the Montessori kindergarten children.

The researchers attribute this result to the fact that Montessori kindergarten possesses several constituents of excellence, including a spacious building, sufficient equipment, suitable tools and programs, using activities and toys which stimulate and create an environment that encourages the development of logical thinking in general.

This result concurs with the findings of the studies of (Savage, 1993), (Morgan, 1978), and (Forster, 1970) which have indicated the effectiveness of the Montessori Method in teaching preschool children especially in the area of thinking.

### Second hypothesis

There are no statistically significant differences at ( $\alpha=0.05$ ) between the mean scores of Montessori kindergarten children and the traditional kindergarten children in the logical relations skill. To verify the validity of this hypothesis, the arithmetic means and standard deviations of the Montessori and traditional kindergarten children's scores were calculated as indicated in table (4).

**Table (4) t-test results for mean relations skill scores by curriculum**

Kindergarten curriculum	Number	Arithmetic mean	Standard deviation	T value	Significance
Montessori	30	9.633	0.669	3.206	0.002
Traditional	28	8.643	1.545		

The table above indicates that the arithmetic mean for the logical relations skill of the Montessori kindergarten children was (9.633) with a standard deviation of (0.669), while the mean score of the traditional kindergarten children was (8.643) with a standard deviation of (1.545). The T- Test was applied to two independent samples in order to determine the statistical significance of the difference between the two means. T was calculated at (3.206), which is statistically significant at ( $\alpha=0.05$ ), indicating statistically significant differences between the mean scores of the two groups in the logical relations skill in favor of the Montessori kindergarten children.



This result can be attributed to the abundance of activities included in the Montessori educational program, which develop children's ability to identify relations between items and recognize similarities and differences between components of a group of items, in addition to the nature of the varied expertise provided to them which include determining functional, numerical, and part-whole relations.

These findings are comply with the findings of the study of (Sharaf AL-Deen, 2008), which concluded the effectiveness of the educational activities utilized in developing thinking skills in general and the logical relations skill in particular .

### Third hypothesis

There are no statistically significant differences at ( $\alpha=0.05$ ) between the mean scores of Montessori kindergarten children and the traditional kindergarten children in the classification skill. To verify the validity of this hypothesis, the arithmetic means and standard deviations of the Montessori and traditional kindergarten children's scores were calculated as indicated in table (5).

**Table (5) t-test results for mean Classification skill scores by curriculum**

Kindergarten curriculum	Number	Arithmetic mean	Standard deviation	T value	Significance
Montessori	30	31.900	2.171	6.880	0.000
Traditional	28	25.964	4.159		

The table above indicates that the arithmetic mean for the classification skill of the Montessori kindergarten children was (31.900) with a standard deviation of (2.171), while the mean score of the traditional kindergarten children was (25.964) with a standard deviation of (4.159).The T-Test was applied to two independent samples in order to determine the statistical significance of the difference between the two means. T was calculated at (6.880), which is statistically significant at ( $\alpha=0.05$ ), indicating that the difference between the mean scores of the two groups was factual rather than accidental, and was in favor of the Montessori kindergarten children.

The superiority of Montessori kindergarten children over the traditional kindergarten children in the classification skill is due to Montessori kindergarten's inclusion of toys, colored wooden tools, and geometrical shapes of various colors, sizes and lengths in their programs. These inclusions developed the classification skill in their children while the traditional kindergarten lacked such kinds of toys, tools and shapes.

These findings concur with the study findings of (Gaddah, 2008), (Suleiman, 2008), (Saleh and Basheer, 2005), and (Gaddah, 2011) of the effectiveness of educational activities in developing the classification skill in kindergarten children.

### Fourth hypothesis

There are no statistically significant differences at ( $\alpha=0.05$ ) between the mean scores of Montessori kindergarten children and the traditional kindergarten children in ordering and serialization skills To verify the validity of this hypothesis, the arithmetic means and

standard deviations of the Montessori and traditional kindergarten children's scores were calculated as indicated in table (6).

**Table (6) t-test results for mean ordering and serialization skill scores by curriculum**

Kindergarten curriculum	Number	Arithmetic mean	Standard deviation	T value	Significance
Montessori	30	25.767	4.074	5.910	0.000
Traditional	28	18.607	5.123		

Table (6) above indicates that the arithmetic mean for the serialization and ordering skills of the Montessori kindergarten children was (25.767) with a standard deviation of (4.074), which is higher than the mean score of the traditional kindergarten children which was (18.607) with a standard deviation of (5.123). The T-Test was applied to two independent samples in order to determine the statistical significance of the difference between the two means. T was calculated at (5.910), which is statistically significant at ( $\alpha=0.05$ ), indicating statistically significant differences between the mean scores of the two groups in the ordering and serialization skills in favor of the Montessori kindergarten children.

The superiority of Montessori kindergarten children over the traditional kindergarten children in the serialization and ordering skills is due to Montessori kindergarten's inclusion of equipment, tools, colored wooden rulers and cubes, and the varied items and foods which enable the development of children's skill in ordering the items according to size, feeling, taste, color, and length in an ascending or descending order. Such tools, equipment, and items are lacking in the traditional kindergarten.

These findings concur with the study findings of (Sharaf Al-Deen, 2008), (Suleiman, 2008), and (Holi, 2007) of the effectiveness of educational activities in developing the ordering and the serialization skills.

### **Fifth hypothesis**

There are no statistically significant differences at ( $\alpha=0.05$ ) between the mean scores of Montessori kindergarten children and the traditional kindergarten children in the cause and effect skill. To verify the validity of this hypothesis, the arithmetic means and standard deviations of the Montessori and traditional kindergarten children's scores were calculated as indicated in table (7).

**Table (7) t-test results for mean cause and effect skill scores by curriculum**

Kindergarten curriculum	Number	Arithmetic mean	Standard deviation	T value	Significance
Montessori	30	13.600	2.159	6.006	0.000
Traditional	28	9.929	2.493		

Table (7) above indicates a face difference between the arithmetic means and standard deviations for the serialization and ordering skills of the Montessori kindergarten children and the traditional kindergarten children. The arithmetic mean of the Montessori kindergarten

children was (13.600) with a standard deviation of (2.159), while the mean score of the traditional kindergarten children was (9.929) with a standard deviation of (2.493). The T-Test was applied to two independent samples in order to determine the statistical significance of the difference between the two means. T was calculated at (6.006), which is statistically significant at ( $\alpha=0.00$ ), indicating statistically significant differences between the mean scores of the two groups in the cause and effect skill in favor of the Montessori kindergarten children.

The researchers attribute the superiority of Montessori kindergarten children over the traditional kindergarten children in the cause and effect skill to the abundance of activities and life events and experiences that the children of Montessori kindergarten are subjected to, which help them reach new conclusions and understand life events and phenomena. Mustafa (2008) indicates that a child at this stage can envision the causal relation between his actions and their effects on his surroundings.

This result concurs with the findings of (Gaddah, 2008), which have indicated the effectiveness of educational activities in developing the interpretation skill.

### Sixth hypothesis

There are no statistically significant differences at ( $\alpha=0.05$ ) attributable to the gender variable between the mean logical thinking scores. To verify the validity of this hypothesis, the arithmetic means and standard deviations of the total scores in logical thinking and of each skill for males and females were calculated utilizing the independent two -sample t-test as indicated in table (8).

**Table (8) t-test results for mean logical thinking skills scores and total by gender**

Logical thinking skills	gender	number	Arithmetic mean	Standard deviation	T-value	significance
relations	Male	30	9.067	1.388	- 0.547	0.587
	Female	28	9.250	1.143		
classification	Male	30	28.600	5.315	- 0.772	0.443
	Female	28	29.500	3.238		
Ordering and serialization	Male	30	21.767	5.876	- 0.733	0.467
	Female	28	22.893	5.814		
Cause and effect	Male	30	12.000	2.889	0.456	0.650
	Female	28	11.643	3.070		
Sum	Male	30	71.433	11.993	- 0.627	0.533
	Female	28	73.286	10.378		

Table (8) above indicates that the values of T ranged between (-0.772) and (0.456), which are all statistically insignificant at ( $\alpha=0.05$ ), indicating that the face differences between males and females in the mean and total scores in logical thinking skills are nonfactual. This may be attributed to the fact that both males and females are subjected to the same activities and events in the kindergarten.

## CONCLUSIONS

Based on the previous findings, the researchers inferred the following:

- 1- It was found that the educational program based on Montessori curriculum in developing the logical thinking in Montessori's kindergarten plays a role in the components of logical thinking in general.
- 2- No differences were found between male and female in the skills of logical thinking or in the total score.

## RECOMMENDATIONS

- 1- There is a need for establishing more kindergartens which adopt the modern Montessori education program.
- 2- An interest, in qualifying both kindergarten principals and teachers, by exposing them to intensive courses on general modern educational programs, should be considered.
- 3- More interest should be directed toward developing kindergarten curricula through providing them with various equipment and games to encourage children to disclose their talents and hobbies. In addition, various activities which develop the children's logical thinking should also be added.
- 4- To apply the logical thinking criterion, developed by the two researchers, to suit the Jordanian environment, in public and private kindergartens.
- 5- To conduct studies on the efficiency of Montessori program on creative thinking of reading, writing, and life skills.

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