British Journal of Education
Vol.5, No.1, pp.76-84, January 2017
Published by European Centre for Research Training and Development UK (www.eajournals.org)

# THE EFFECTIVENESS OF MARZANO'S DIMENSIONS OF LEARNING MODEL IN THE TENTH GRADE STUDENTS ACQUISITION OF SCIENTIFIC CONCEPTS IN SCIENCE AND THE DEVELOPMENT OF CRITICAL THINKING SKILLS AND THEIR ATTITUDE TOWARDS SCIENCE

**Fatima Eisa Abedl-rahman Alrababah**
Curricula and Teaching Department
Faculty of Education – Hail University, Assistant professor
Po Box: (2440) Hail, Saudi Arabia
**Tel: 00966536289358**

**ABSTRACT:** *The purpose of this study is to design the light module for the tenth grade students is Jordan depending on Marzano's Dimensions of Learning Model. It also aimed at identifying the effectiveness of Marzano's Dimensions of Learning Model in teaching the light module in the development of scientific concepts acquisition with the tenth grade students as well as identifying the effectiveness of Marzano's Dimensions of Learning Model in teaching the light module in the development of critical thinking skill among the tenth grade students. The researcher selected the study sample from the tenth grade female students in Mafraq Directorate of Education. The study produced a number of results and recommendations the most prominent of which are: There is a statistically significant effect for Marzano's Dimensions of Learning Model in the acquisition of the tenth grade students to scientific concepts in the subject of science, and that there is a statistically significant effect for Marzano's Dimensions of Learning Model in the development of critical thinking skills and the students' attitudes toward science. In addition, the researcher recommends the necessity of holding training and educational courses for the basic stage teachers that explain the importance of Marzano's learning model and how to stimulate the students to learn through the available strategies that suit the surrounding environment of their schools*.

**KEYWORDS:** Marzano's Model, learning dimensions, scientific concepts, critical thinking, current electricity.

## INTRODUCTION

The concept of scientific thinking art has been resonating everywhere and in most educational congregations urging the formation of creative and thinking mentality and removing education from the information storing nozzle and retrieving it through tests to the science of practical application in all the new situations. This can be accomplished by means of the academic curricula that should enable the individual to grasp the world of today and tomorrow. Of the skills that have to be available in the academic curricula is the skill of critical thinking and acquiring scientific concepts. This sort of skills ought to be provided to students in the general learning stages; and in order to develop the critical thinking skills, we have to identify the students' thinking in general whereupon we can interfere to help and guide the students when convenient. (Khatabiyeh, 2008).

This gave emergence to many teaching models which helped to develop the scientific thinking of school students and attain scientific concepts. Of those teaching models is



ISSN 2055-0219(Print), ISSN 2055-0227(online)

Marzano's Dimensions of Learning Model which is considered as the upshot of the researches which were conducted in the field of knowledge and learning in a framework called thinking dimensions. This model is also built on the props of theories and the fundament of the scientific researches and studies which handled the dimensions of the thinking process (Marzano, 1992).

**The Study Problem:**

Considering the reality of teaching in Jordan and the nature of the academic curricula adopted by the educational administrations, especially physics as a science subject, in relation to the development of critical thinking skills and the acquisition and organization of scientific concepts; we find that they are nothing but a cluster of cognitive expressions that cannot be interpreted into factual educational experiences. We also notice the decline of the academic achievement level of the tenth grade students in physics and their poor acquisition of scientific concepts. (The Jordanian Ministry of Education, 2016).Hence emerged the need to conduct this study which incorporates the following main query:

What is the effectiveness of Marzano's dimensions of learning model in the tenth grade students acquisition of scientific concepts in science and the development of critical thinking skills and their attitude towards science (physics)?

From this query stem the following sub – questions:

1- What is the effectiveness of the educational unit founded on the base of teaching through Marzano's dimensions of learning model in developing the acquisition of scientific concepts in science (physics) by the tenth grade students?

2- What is the effectiveness of the educational unit founded on the base of teaching through Marzano's dimensions of learning model in developing the critical thinking skill by the tenth grade students?

**The Study Objectives:**

1- Designing the light unit among the tenth grade students in Jordan relying on Marzano's dimensions of learning model.

2- Identifying the effectiveness of Marzano's dimensions of learning model in teaching the light unit in the development of acquiring scientific concepts among the tenth grade students.

3- Identifying the effectiveness of Marzano's dimensions of learning model in teaching the light unit in the development of critical thinking skill among the tenth grade students.

**The Study Importance:**

The importance of the study comes from its concern and focus on education as being the hub of the teaching – learning process to create a constructive learner with developed scientific thinking who is capable to bear novel learning responsibilities, provided with theoretical and applied knowledge and armed with learning and critical thinking skills. The study also concentrated on the harmony and dynamism between the teacher and student in the production of the teaching process and mechanism that can generate a generation that owns the ability of thinking art.

**Terminology and Procedural Definitions:**

- Marzano's Dimensions of Learning Model: It is a classroom (practical) teaching model which includes several successive procedural steps that concentrate on the interaction among five thinking dimensions represented in the acquisition of positives attitudes and



ISSN 2055-0219(Print), ISSN 2055-0227(online)

perceptions about learning, gaining new knowledge and its integration with the actually existed knowledge, the reinforcement and scrutiny of knowledge to reach at new ends and results, the meaningful use of knowledge and the development of utilizing the productive mind habits which may occur during learning and contribute in its success (Marzano's, 2000). It is procedurally defined as a set of strategies, teaching methods, planned executive procedures and teaching – learning classroom practices followed by the science female teachers with the basic tenth grade female students who represent the experimental group.

- Critical Thinking: A form of thinking which allows the individual to practice logical and pragmatic thinking. It can also be defined as the reflective and logical thinking which moves forward to generalization as well as the ability to examine and appraise the dictated solutions (Hart & Keller, 2003).

**The Study Limitations:**

The generalization of this study is restricted to the following:

1- The restriction of the study to one unit of the science (physics) book for the academic year (2016 – 2017).

2- The study population and sample were limited to the female students excluding the males in the Directorate of Education in Mafraq Governorate for the academic year (2016 – 2017).

3- Previous Studies:

The study of Al-Rahili (2007) which aimed at identifying the impact of using Marzano's dimensions of learning model in teaching science in the achievement and development of multiple intelligences among the second intermediate female students in Saudi Arabia. This study was applied on a sample of (70) female students in the city of Medina who were divided into two groups (experimental and control) whereby the information focus model was used to teach the experimental group and it took four weeks to measure the achievement and the level of multiple intelligence of the teachers before and after teaching. The results revealed statistically significant differences in achievement in favor of the experimental group with the value of (%77) at (a=0.05). The study recommended that the female teachers should use Marzano's dimensions of learning model in teaching science and follow training courses about using the model in teaching whether before or during service.

The study of Mandour (2008) which investigated the effectiveness of Marzano's dimensions of learning model in the development of conceptual comprehension and some mind habits among the sixth elementary grade students in the Kingdom of Saudi Arabia. The sample was chosen from the sixth elementary students of the governmental schools of the city of Eneizeh who counted (71) students in the first semester divided into two groups: experimental and control. The study tools included a conceptual comprehension test and mind habits scale.
The results indicated the presence of statistically significant differences among the students in the conceptual comprehension and mind habits in favor of the experimental group. The researcher pointed out that teachers do not usually exceed the first dimension when planning for the lesson and with less level the fifth dimension as the field needs more studies that support or refute the model.

The study of Al-Hisan (2008) identified the effectiveness of Marzano's dimensions of learning model in the development of some thinking skills and conceptual comprehension in science and perceptions to the classroom environment among the female students of the preparatory stage.


ISSN 2055-0219(Print), ISSN 2055-0227(online)

The study of Uthman (2008) showed the presence of statistically significant difference in the achievement test, the critical thinking scale and the scale of attitude towards science in favor of the experimental group. The study located the effectiveness of Marzano's dimensions of learning model in the development of achievement, decision making and attitude towards science among the first preparatory stage students. Ahmad (2008) conducted a study which pointed out the effectiveness of Marzano's dimensions of learning model in developing achievement and the problem solving ability in science among the preparatory stage students.

## THE THEORETICAL FRAMEWORK OF THE STUDY

Marzano's Dimensions of Learning Models:

1- Focus on Information: It is a planning model which concentrates on whatever connected to the second dimension which is the acquisition and integration of the relevant information, operations and procedures, that is the cluster of steps followed by the teacher to present information and skills in any educational unit by specifying the information then choosing the meaningful activities and tasks that realize the desired objectives of this model.

2- Focus on Issues: It is a planning model which concentrates on whatever connected to the fourth dimension concerning the application of information or using information meaningfully through the tasks and issues presented to students that is the set of steps followed by the teacher to determine a scientific issue connected to the main idea of the content studied by learners and then to specify the educational knowledge and activities to accomplish the task.

3- Focus on Exploration: It is a planning model which gives freedom to the students in choosing the scientific tasks and projects they like to be the source of using the information and knowledge they have in a meaningful manner as well as applying and executing them. This means that it is a set of steps the teacher follows to increase the ability of students to the free choice of the scientific projects related to the academic content, information and activities they learned in the classroom (Marzano, 1779).

### Types of Learning Dimensions in Marzano's Model:

Marzano (1997) stated that the learning process contains and requires the interaction of five thinking styles which he called: (Learning Dimensions). These five dimensions are the result and breed of the thinking styles which explain the way the mind works during learning and we are going to discuss these five dimensions in detail.

### First Dimension: The Positive attitudes toward learning:

Attitudes and perceptions negatively or positively affect the students' ability to learning. Of the key elements in learning is to create and establish positive attitudes and perceptions. For that reason, Marzano specified two aspects through which the positive attitudes towards learning can be developed namely:

1- Learning climate: When students feel comfortable and secured and that the learning place is safe and organized, they show positive attitudes toward learning. Of the teaching tools that develop positive attitudes toward learning climate:

a- Attending all the students in the class with due focus on eye contact.

b- Addressing the students with their first or favorite names.

c- Approaching students kindly and touching upon them in an acceptable manner.

d- Respecting all responses and appreciating the correct aspects of the incorrect responses.



ISSN 2055-0219(Print), ISSN 2055-0227(online)

e- Providing the students with sufficient instructions and hints to reach at the correct response.
f- Giving the students enough time to answer the questions.
g- Ordering the desks and the educational material inside the class in a way convenient to the students.
h- Specifying and organizing rest periods for the students when needed.
2- Classroom Tasks: Classroom tasks are very important and useful for students, and when students have positive attitudes toward the assigned classroom tasks, those tasks will be achieved properly. The teacher is to consider the following points in their teaching style to develop the positive attitudes toward classroom tasks:
a- Value of the task b- clarity of the task c- potentials
Marzano (2000) points out that using the cooperative teaching style leads to the development of the acceptability and understanding among the group members and the establishment of personal relations among students creating a positive feeling and attitude toward team – work to accomplish the tasks.

**Second Dimension: Acquisition and integration of knowledge**
Learning is an interactive process based on constructing the personal meaning out of the available information in the educational situation and realizing the integration of this information with the previous knowledge of the individual to create new knowledge in addition to the thinking and inference operations (al-Ba'li, 2003).

**Third Dimension: Extending and Refining knowledge**
The purpose of good learning is further and deeper than the mere acquisition of knowledge and stuffing minds with information and skills; it is rather searching for this information in memory and reshaping and refining it. Marzano (1997) specified many cognitive activities that can be utilized to activate the analytical thinking of the learner as follows:
1- Compare 2- classifying 3- inducing 4 – deducing
5- analyzing errors 6- constructing supported evidence 7- abstracting
8- analyzing viewpoint

**Fourth Dimension: Using knowledge meaningfully**
Individuals learn more effectively when they are able to use knowledge to accomplish serious tasks and duties that permit them to explore personal interests and benefits. Marzano (1997) stated that it is important to remember that the operations performed by the learner to develop learning and extend knowledge are not the goal by themselves because we do not compare for the sake of comparison itself or abstract for just abstracting but we use knowledge meaningfully when we take decisions.
Five types of tasks and duties encourage to use knowledge meaningfully and they are embodied in (Marzano, 1992):
1- Decision making 2- inquisition 3- problem solving
4- invention 5- experimental research

**Fifth Dimension: Productive habits of mind**
Good learning aims at making learners acquire the needed skills to learn any experience they go through. This means the development of the mental skills of the learners represented in the productive habits of mind. Marzano (1992) determined several mind habits he deemed necessary to be acquired by learners during the educational process represented in:


ISSN 2055-0219(Print), ISSN 2055-0227(online)

1- Self – regulated thinking and learning 2- critical thinking 3- creative thinking and learning.

## METHODOLOGY AND PROCEDURES

The study population and sample: The study population consisted of the basic tenth grade female students in the academic year (2016 – 2017) at Mafraq directorate of education schools counting (540) students distributed on (7) schools. The sample of the study consisted of (100) female students of the basic tenth grade who were selected following the random cluster method representing (%18.5) of the local population. The study sample was created in three sections at three randomly chosen schools. Two sections out of three were chosen randomly from the selected schools whereupon the teaching strategies were distributed on the chosen sections randomly. Table No. (1) Shows the distribution of the sample's groups on the treatment and schools.

**Table No. The distribution of the study sample's groups on strategies, schools and sections**

| Group | Treatment | School | No. | Cumulative percentage |
|---|---|---|---|---|
| Control | Traditional | Princess Alia daughter of Al Hussein Secondary School for Girls | 32 | %32 |
| 1ts experimental | Concept acquisition | Basic neighborhood officers for Girls | 32 | %64 |
| 2nd experimental | Critical thinking skills development | Al-Olaimat secondary neighborhood for Girls | 36 | %100 |
| Total | | 100 | | |

**The Study Tools:**
The research designed a unit of light from the physics subject according to Marzano's dimensions of learning model with the help of the theoretical literature and previous studies embodied in Marzano's dimensions of learning model and its uses in the subject of science in addition to the help of the science female teachers at Mafraq directorate of education who constituted the study sample. Thereafter, the researcher prepared two tools for the purposes of this study which were represented in two tests each of which consisted of (20) items. The first test included a number of scientific concept acquisition aspects in science subject while the second test was concerned with critical thinking skills development, after viewing sufficient amount of the literature, studies and researches which handled Marzano's dimensions of learning model (national assessment of education progress, 2010; Marzano, 2000; Marzano, 1997; Marzan, 1992; al-Rahili, 2007; Uthman, 2008).

**Statistical Treatment:**
The data of this study was treated according to the following methods:
1- Using Chronbach's Alpha to verify the liability of the tool.
2- Arithmetic means and standard deviations.
3- One – way ANOVA.


ISSN 2055-0219(Print), ISSN 2055-0227(online)

**Reliability of the study tool:**

The researcher used the reliability equation of the internal consistency (split – half) to verify the reliability of the two tools and to correct them through Spearman Brown equation. The following two tables indicate the value of split – half and the value of the split – half reliability and the value of corrected reliability.

The split – half reliability coefficient of the scientific concepts acquisition test in science reached at (0.83) while the corrected reliability coefficient was (0.93), which is an acceptable rate in this type of humanitarian studies. See table No. (2).

**Table No. (2) the reliability coefficient of the first study tool**

| Split – half reliability coefficient | Corrected reliability coefficient |
|---|---|
| 0.87 | 0.93 |

Corrected reliability equation = 2× split – half reliability coefficient / 1+split – half reliability coefficient

The split – half reliability coefficient in this study for the test of developing the critical thinking and the students attitudes toward science subject reached at (0.79) while the corrected reliability coefficient was (0.88) which is an acceptable rate in this type of humanitarian studies. See table NO. (3).

**Table No. (3). The reliability coefficient of the second study tool**

| Split – half reliability coefficient | Corrected reliability coefficient |
|---|---|
| 0.79 | 0.88 |

**Data analysis and hypotheses test:**

**First main hypothesis:** There is no statistically significant effect at (a=0.05) for Marzano's dimensions of learning model in the tenth grade students acquisition of scientific concepts in the science subject

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**Table No. (4) The arithmetic means, standard deviations and F – value of the study sample members responses to the first study tool**

| Group | Arithmetic mean | Standard deviation | df | F – value | Significance level |
|---|---|---|---|---|---|
| Experimental | 32 | 1.072 | 2 | 4.325 | 0.000 |
| control | 26 | 0.98 | 62 | | |

Viewing the former table, we find that there is a statistically significant effect at alpha (0.05) for Marzano's dimensions of learning model in the tenth grade students acquisition of scientific concepts in science where the calculated significance level was less than alpha (0.05) and consequently, the acceptance of the alternative hypothesis and the rejection of the null hypothesis, as the arithmetic mean of the experimental study sample members which reached at (32) indicates the effectiveness of Marzano's model where the arithmetic mean of



ISSN 2055-0219(Print), ISSN 2055-0227(online)

the control sample's members was (26) which is a clear and statistically significant difference.

**Second main hypothesis:** There is no statistically significant effect at (a=0.05) for Marzano's dimensions of learning model in the development of critical thinking and the attitudes of students toward science.

**Table No. (5) The arithmetic means, standard deviations and F – value of the study sample members responses to the second study tool**

| Group | Arithmetic mean | Standard deviation | df | F – value | Significance level |
|---|---|---|---|---|---|
| Experimental | 34 | 0.78 | 2 | 5.88 | 0.000 |
| control | 22 | 1.05 | 66 | | |

Viewing the former table, we find that there is a statistically significant effect at alpha (0.05) for Marzano's dimensions of learning model in the development of critical thinking and students attitudes toward science where the calculated significance level was less than alpha (0.05) and consequently, the acceptance of the alternative hypothesis and the rejection of the null hypothesis, as the arithmetic mean of the experimental study sample members which reached at (34) indicates the effectiveness of Marzano's model where the arithmetic mean of the control sample's members was (22) which is a clear and statistically significant difference.

## THE STUDY RESULTS

1- There is an effect for Marzano's dimensions of learning model in the tenth grade students acquisition of scientific concepts in science.
2- There is an effect for Marzano's dimensions of learning model in the development of critical thinking and students attitudes toward science.
3- The availability of the necessary skill and ability with the science female teachers at Mafraq directorate of education to use Marzano's dimensions of learning model as an effective teaching strategy in the students acquisition of scientific concepts, critical thinking development and positive attitudes toward science.

## RECOMMENDATIONS

1- Generalizing this study on the different educational establishments in Jordan to urge the teachers to follow Marzano's learning model especially with the basic tenth grade students.
2- Holding training and educational courses for the basic stage teachers to clarify the importance of Marzano's learning model and stimulate their students to learning through the available strategies which suit the surrounding environment of their schools.
3- Conducting more studies and researches about how to employ Marzano's learning model in different educational subjects and generalizing the results through the Jordanian Ministry of Education.


ISSN 2055-0219(Print), ISSN 2055-0227(online)

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ISSN 2055-0219(Print), ISSN 2055-0227(online)