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# The Reality of Using the Laboratory in Teaching Science for the Seventh Grade and Its Role in Developing Critical Thinking Skills among Students from the Point of View of Teachers in Education of Madaba Governorate

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**ABSTRACT**
This study aimed to identify the reality of using the science laboratory in implementing the scientific activities and experiments mentioned in the seventh grade textbook, and to identify the extent of the effectiveness of the science laboratory in developing critical thinking among students from the teachers' point of view in education of Madaba Governorate. The study sample consisted of (94) male and female teachers in public schools affiliated to the Directorate of Education in Madaba Governorate, and the study tool was represented by a questionnaire that consisted of (23) items distributed over two areas. The results showed the effectiveness of the science lab in developing critical thinking skills from the point of view of the study sample. The results also showed that there were no significant differences due to gender and experience in the level of using the science lab in conducting scientific experiments, as the level of statistical significance is greater than 0.05 and therefore it is not statistically significant. The study recommended a set of recommendations, the most important of which is to activate the science laboratory more in conducting experiments and scientific activities contained in science books.
**KEYWORDS:** SCIENCE LABORATORY, CRITICAL THINKING, DEGREE OF USE.
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## INTRODUCTION

Science is one of the important topics that students learn, as it is one of the foundations on which nations build a generation that advances their scientific civilization, if it is employed in an appropriate manner to ensure the development of scientific thinking among students, learning problem-solving skills, and others. Many educators have viewed the laboratory as the essence of science, as the laboratory and laboratory experiments are an integral part of scientific activities in teaching and learning sciences. The laboratory, with its various activities, is the beating heart of science teaching in the different stages of education.

Educators did not overlook the great development taking place in various fields, but rather it motivated them to develop the goals of education in general and the goals of teaching science in particular, which has become not limited to the aspect of transferring information, but rather includes all aspects of experience such as skills, ways of thinking, tendencies and trends, and making the teaching of Science is a meaningful philosophy, as it is related to all aspects of life and has the most impact on individuals. Therefore, many countries have adopted educational policies aimed at developing and improving science education and have drawn up development policies to extend, in some cases, from ten to fifty years (Ezz El-Din, 2015).

Critical thinking is one of the most complex forms of thinking, due to its association with several behaviors such as logic, problem solving, decision-making and its close link to abstract thinking and reflective thinking in terms of the similarity of many characteristics, and interest in this type of thinking arose because of its repercussions in the learning process of skills and empowering learners Such as achieving the ability to solve problems and encouraging the spirit of inquiry, research and questioning, and not accepting facts without investigation or exploration, which leads to expanding students' knowledge horizons, and pushes them to launch into broader scientific fields, which works to enrich their knowledge structures and increase their qualitative learning. (Al-Darawsha, 2014).

## THE STUDY PROBLEM:

The science laboratory is considered one of the most important means used to implement scientific activities and experiments and is directly related to science because teaching science does not happen if experiments are not conducted, and given the interest of the Ministry of Education and its quest to develop the educational process and provide it to scientific laboratories in the majority of schools in the Kingdom, the problem of the current study emerges in knowing The level of science teachers' use of the science lab during the educational process, and the role of the science lab in developing critical thinking skills.

**STUDY QUESTIONS:**

The study attempted to answer the following questions:

•The first question: What is the level of using the science laboratory in teaching science in the education of Madaba Governorate?

•The second question: Does using the science laboratory in conducting laboratory experiments develop critical thinking skills?

•The third question: Are there statistically significant differences from the point of view of the trained teachers according to the variable of gender and experience?

**OBJECTIVES OF THE STUDY:**

The current study aimed to:

-Identify the reality of using the science laboratory in conducting laboratory experiments.

-Identifying the extent to which the science laboratory contributes to developing critical thinking skills.

-Identifying the differences in the level of using the science lab according to the variables (gender, experience).

**THE IMPORTANCE OF STUDY:**

The importance of these studies stems from the importance of the study in keeping pace with scientific developments and recent trends in active teaching by making use of the science laboratory as an unconventional teaching method. This increases the student's motivation towards learning and raises the level of self-reliance in making decisions, acquiring critical thinking skills, and employing these skills in different life situations.

**TERMINOLOGY OF STUDY:**

**SCIENCE LAB:** "a special place where devices and tools are available, and the opportunity is prepared to conduct an experiment in order to achieve limited practical goals, and the students themselves conduct the experiments." (Al-Ghamdi and Al-Mashtari, 2021).

**THE RESEARCHER DEFINES IT PROCEDURALLY:** it is one of the school's facilities designated for conducting practical experiments, and which is equipped with all the necessary supplies to carry out these activities. It is used in teaching science courses for the purposes of preparing and implementing the lesson and evaluating students' learning according to work plans prepared for experiments in the science book for the seventh grade.

**CRITICAL THINKING:** "A mental process that includes a set of thinking skills, singly or collectively, without committing to a specific order to verify the object or subject and evaluate it based on criteria in order to make a judgment about the value of the thing or to reach a conclusion, generalization, decision, or solution to the problem of interest" (Al-Darawsha , 2014).

**STUDY LIMITS AND LIMITATIONS:**

**OBJECTIVE LIMITS:** The study was limited to knowing the level of science teachers' use of the laboratory in conducting laboratory experiments, and the role of the laboratory in developing critical thinking skills.

**TEMPORAL LIMITS:** This study was implemented in the second semester of the academic year (2021-2022).

**SPATIAL LIMITS:** This study was applied to teachers of public schools affiliated to the Directorate of Education in Madaba Governorate.

The process of generalizing the results is limited to the study tool that was used in light of its veracity and reliability, and therefore it is not possible to guarantee obtaining the same results when applying another tool.

**THEORETICAL FRAMEWORK AND PREVIOUS STUDIES:**

**THEORETICAL FRAMEWORK:**

The general standards for science teaching reinforce the importance of science teaching in an experimental way, based on scientific investigation, self-learning and continuous formative evaluation. Directly with community issues and take appropriate decisions (Al-Shanaq and BaniRomi, 2009).

The objectives of teaching modern science go beyond understanding the three parts of science in attitudes, knowledge and skills, and the main objective is to provide learners with experiences that help them become scientifically educated. Direct, and gives realism to the information acquired by students, and develops the power of observation and scientific thinking through designing experiments and reaching results, imparting appropriate manual skills through training and design, and training on devices. (Al-Husseini, 2006).

Critical thinking is reflective mental thinking, focusing on deciding what an individual should believe in, or what he should do. Critical thinking revolves around the preparation and use of specific criteria, on the basis of which judgments can be made about the topics of focus and attention, such as: assumptions and principles, research methods and methods, or political decisions and public opinion topics, ... etc. - Critical thinking is the important and effective element in conducting some general cognitive processes, or verifying their veracity and

 

truthfulness (Ibrahim, 2010).

**PREVIOUS STUDIES:**

The researcher came up with a set of studies that are indirectly related to her study, and they are arranged according to their relevance to the study, from the most recent to the oldest.

Al-Ghamdi and Al-Muntashari (2021) conducted a study aimed at identifying the factors of activating science laboratories from the point of view of science subject supervisors and teachers in the Al-Baja educational region; The descriptive survey method was used, and the sample consisted of all science teachers and supervisors in secondary schools for boys in Al-Baha educational region, who numbered (113) teachers. In second place, a high degree of approval for each of them.The results also showed that there were no statistically significant differences due to the variables of qualification, years of experience and the type of school building between the average responses of the study community members around the axes (administrative factors, material and human factors, and the total degree of factors for activating science laboratories in secondary school in Al-Baha region).

Bin Lakhal and Khamad (2018) conducted a study aimed at identifying the impact of using the school laboratory in developing scientific thinking skills in physics for second year intermediate learners. Average randomly selected from Abdul Rahman bin Aisha Intermediate School in the municipality of Ghamra in the valley in the third semester of the 2013/2014 school year. The study sample was divided into two groups: an experimental group consisting of 28 learners who studied the field of electrical phenomena using the school laboratory method, and a control group consisting of 28 learners who studied the same field using the usual traditional method. The results showed the effectiveness of the science lab in developing scientific thinking in physics.

Ibrahim and Melhem (2012) shed light on the current situation of the use of the school laboratory in teaching science from the point of view of science teachers in public secondary schools and specialized mentors in Hama Governorate, and the descriptive analytical approach was used.The study tool was a questionnaire, and the sample consisted of (32) teachers and (26) specialist mentors. The results showed a low percentage of teachers who use the school laboratory when they have the possibility to use it, reaching (40.63) %. The most important obstacles that prevented the use of the laboratory from the point of view of science teachers and specialized mentors were the large number of students, the lack of equipment, and the absence of a specialized laboratory record. As for the differences between teachers' and professional mentors' estimates of the most important obstacles to the use of the laboratory in teaching, the results indicated that there were no statistically significant differences indicating that.

Al-Zahrani and Al-Raqi (2009) conducted a study aimed at identifying the extent to which school laboratories are used in middle night schools from the point of view of science teachers. And to identify the obstacles to using school laboratories in middle night schools from the point of view of science teachers and educational supervisors. And to identify the differences between the estimates of science teachers and educational supervisors of the most important obstacles to using the laboratory in teaching science in the middle night teacher. The descriptive approach was used, and the study tool was represented by a questionnaire, and the sample consisted of (33) teachers and (26) educational supervisors. The results showed the low use of the laboratory in night teaching, as the results indicated that the users of the school laboratory when they ended the conditions for its use did not exceed (40.9%). In addition to the many obstacles that limit the use of the laboratory in night teaching, the most prominent of which is the teacher’s lack of conviction of the importance of the laboratory for night school students, the large number of students in one semester, and the absence of laboratory records at night in the school. The results also showed that there were no significant differences at the level (0.05) between teachers' and educational supervisors' estimates of the most important obstacles to using the school laboratory in teaching science in middle night schools.

The Johansson (2008) study aimed to reveal the importance of science laboratories in schools from the point of view of teachers and students. The study was conducted in Sweden. The researcher made two questionnaires in order to reveal the importance of science laboratories and the obstacles facing science teachers and students. , consisted of (40) items, and the study sample consisted of (50) science teachers in Swedish schools, and 200 middle school students, and the results of the study showed that teachers do not perform the correct actual procedures for laboratory activities, and that there are many science teachers They do not show a clear interest in laboratory activities, and they do not show any experience during the experiment. The results also showed that there are no special training courses, and that many school laboratories are not equipped with the required laboratory tools, and that the reality of school laboratories does not match the standards required for school laboratories.

**COMMENTING ON PREVIOUS STUDIES:**

The current study differed from previous studies in terms of studying the level of science teachers’ use of the science laboratory in implementing scientific activities and experiments, and the role of the science laboratory in

 

developing critical thinking skills among students. Previous studies in defining the study curriculum, developing study tools, and determining appropriate statistical treatments for the purposes of the study.

## METHOD AND PROCEDURE:

### STUDY METHODOLOGY:

The descriptive analytical approach was used for its suitability to achieve the objectives of the study, to describe the reality of using the science laboratory in implementing scientific activities and experiments and the role of the science laboratory in developing critical thinking skills from the teachers' point of view.

### THE STUDY COMMUNITY AND ITS SAMPLE:

The study includes the study community designed by the researcher, which included all teachers in the Directorate of Education inMadaba Governorate, and an accessible sample was selected from the research community, and it consisted of (94) male and female teachers and demographic variables that include gender and experience because of these factors that have an impact on the study's axes, which affect In turn, in the level of science laboratory use, Table (1) shows the distribution of the study sample members according to their demographic variables.

**TABLE (1): DISTRIBUTION OF STUDY SAMPLE MEMBERS ON DEMOGRAPHIC VARIABLES**

| Number | Variable | Category | The number of sample members | Percentage% |
|---|---|---|---|---|
| 1 | Gender | Male | 34 | 36% |
| | | Female | 60 | 64% |
| | | Total | 94 | 100.0% |
| 2 | Experience | Less than 5 years | 25 | 27.0% |
| | | 5-10 years | 34 | 36.0% |
| | | More than 10 years | 35 | 37% |
| | | Total | 94 | 100.0% |

Shown from the table:

1. As for the gender variable, the number of males was 34, with a percentage of (36%), while the number of females was 60, with a percentage of (64%).
2. As for the experience variable, the frequencies (less than 5 years) reached 25 with a percentage (27%), and the frequencies b (from 5-10 years) reached 34 with a percentage (36%), while the frequency (more than 10 years) was 35 percentage (37%).

### STUDY TOOL:

The questionnaire was prepared in its initial form by referring to the theoretical literature, as it was designed to achieve the purpose of the study, covering all aspects addressed by the theoretical framework and the questions on which the study was based. The clarity of the questions, their sequence, coherence and coherence were taken into consideration when designing the questionnaire. During the mobilization, it was presented to a group of arbitrators with experience and specialization in education and teacher training from educational supervisors in the Ministry of Education, and teaching staff in the faculties of education in various Jordanian universities to explore their opinions on the accuracy of the wording, the integrity of the language, the clarity of paragraphs and the appropriateness of answer alternatives and the questionnaire was formed in its final form out of (23) paragraphs. It consists of two parts:

- The first part: includes the characteristics of the sample according to demographic information.
- -The second part: It is related to the objectives of the study to identify the level of use of the science laboratory in carrying out scientific activities and experiments, and to identify the role of the science laboratory in developing critical thinking skills of students from the teachers' point of view.

### SCALES USED IN DESIGNING THE QUESTIONNAIRE:

Each item was given a weight according to the five-point Likert scale, using the following expressions:
Very much agree (5 points), strongly agree (4 points), agree to a moderate degree (3 points), slightly agree (2 points), agree very little (1 point).
The cut-off point or a certified criterion divided into three levels was determined in the study through three levels. The value of the difference between the highest value on the scale (3) and the lowest value on the scale (1) was calculated divided by three levels (1-5)/3 = 1.33 Then this value is added to the lowest value in the scale, which is (1) in order to determine the upper limit of the category, and to determine the importance of the category, and Table (2) shows this.

 

**VERACITY OF THE TOOL:**

To verify the internal veracity of the study tool, the researcher used the Alpha Cronbach coefficient in order to calculate the internal veracity coefficients of the study variables in order to measure the internal veracity of the paragraphs of the tool. It represents the critical and acceptable value for the purposes of the current study, and the internal veracity coefficient is equal to (0.963), which is good because it is greater than (0.70).

**STUDY RESULTS AND DISCUSSION:**

The results were reached according to the research questions as follows:

First: the results related to the first question: What is the level of using the science laboratory in teaching science in the education of Madaba Governorate?

In order to answer these questions through the following: Arithmetic averages and standard deviations were extracted from the data of the study sample, and Table (2) illustrates this:

**TABLE (2): ARITHMETIC AVERAGES, STANDARD DEVIATIONS, AND THE ORDER OF THE STUDY TOOL ITEMS (THE REALITY OF USING THE LABORATORY IN SCIENCE TEACHING)**

| Number | Paragraphs | Arithmetic average | Standard deviation | Evaluation level | RII% Importance Indicator |
|---|---|---|---|---|---|
| 1 | Science lab technology is available at the school where I work. | 3.99 | 1.009 | High | 0.8 |
| 2 | The school administration contributes to the implementation of scientific laboratories strategies. | 3.77 | 0.920 | High | 0.75 |
| 3 | The school administration provides the raw materials needed to conduct experiments in laboratories. | 3.70 | 0.990 | High | 0.74 |
| 4 | The technology of the laboratories in the schools is complete in terms of equipment and devices. | 3.84 | 0.985 | High | 0.77 |
| 5 | The experiments conducted in the laboratory attract the attention of the students | 4.17 | 0.97 | High | 0.88 |
| 6 | The activities and experiments that are carried out in the laboratory help in consolidating the information among the students. | 3.73 | 0.952 | High | 0.75 |
| 7 | achieve science curriculum objectives using the lab. | 3.65 | 0.925 | High | 0.73 |
| 8 | When carrying out activities in the lab I help the students to gain knowledge. | 3.69 | 0.982 | High | 0.74 |
| 9 | Carrying out activities in the lab trains students to solve problems. | 3.70 | 0.916 | High | 0.74 |
| 10 | Carrying out activities in the lab helps students explore scientific facts | 3.75 | 0.914 | High | 0.75 |
| 11 | Focus on the theoretical side because it brings students success. | 3.74 | 0.917 | High | 0.75 |
| 12 | Laboratory use is a waste of time. | 3.82 | 0.954 | High | 0.76 |
| 13 | The use of laboratory technology is related to the competence of the teacher. | 3.72 | 0.922 | High | 0.74 |
| 14 | I have tendencies towards laboratory work. | 4.12 | 0.878 | High | 0.82 |
| 15 | Conducting experiments in the laboratory of indispensable aids. | 3.75 | 0.857 | High | 0.75 |
| 16 | Make sure to visit the lab for experiments every day. | 3.70 | 0.927 | High | 0.74 |
| 17 | Be sure to carry out activities and experiments even with raw materials and tools. | 3.71 | 0.891 | High | 0.74 |
| 18 | Believe in the importance of science lab and its usefulness to students. | 3.89 | 0.933 | High | 0.78 |
| | Total | 3.77 | 0.933 | High | 0.75 |

 

Table (2) shows that the arithmetic averages and standard deviations of the level of science laboratory use were high, ranging between ( 3.65-4.12) and paragraph (14) was the most important from the point of view of the sample members. Therefore, the level of science teachers' use of the laboratory in conducting scientific experiments came to a high degree. The researcher may attribute this result to teachers' awareness of the importance of the science lab and the importance of conducting professional experiments, and the science lab is one of the aids that help teachers deliver knowledge and science content to students in an easy and interesting way.

Fourth: The results related to the second question: Does the science lab affect the development of critical thinking skills from the teachers' point of view?

In order to answer these questions through the following: Arithmetic averages and standard deviations were extracted from the data of the study sample, and Table (3) illustrates this:

**TABLE (3) ARITHMETIC AVERAGES, STANDARD DEVIATIONS, AND THE ORDER OF THE STUDY TOOL ITEMS (THE ROLE OF THE SCIENCE LABORATORY IN DEVELOPING CRITICAL THINKING SKILLS)**

| Number | Paragraphs | Arithmetic average | Standard deviation | Evaluation level | RII% Importance Indicator |
|---|---|---|---|---|---|
| 1 | The science lab develops the students' ability to reflective thinking. | 3.75 | 1.009 | High | 0.75 |
| 2 | The science lab motivates students to strive and persevere. | 3.77 | 0.920 | High | 0.75 |
| 3 | The science lab develops in the students the ability to reason based on facts. | 3.70 | 0.990 | High | 0.74 |
| 4 | Experiments carried out in the science lab motivate students to investigate, investigate, collect and establish evidence objectively. | 3.67 | 0.985 | High | 0.73 |
| 5 | Laboratory experiments help students appreciate facts. | 3.71 | 0.977 | High | 0.74 |
| | Total | 3.72 | 0.977 | High | 0.74 |

It is evident from Table (3) that the arithmetic averages and standard deviations were at a high degree whereit ranged between (3.67-3.77) and paragraph (2) was the most important and paragraph (4) the least important from the point of view of the sample members. Therefore, the science lab works on developing critical thinking skills from the point of view of the study sample.

The third question: Are there significant statistically significant differences between the responses of teachers at the level of the science lab that are due to the variables of demographic factors, gender and experience?

**A - THEGENDER FACTOR.**

**TABLE (4): TESTING THE DIFFERENCES BETWEEN THE RESPONSES OF THE SAMPLE MEMBERS THAT ARE ATTRIBUTED TO THE GENDER FACTOR**

| number | Degrees of Freedom DF | sum of squares | squares averages | F . value | Statistical Indication |
|---|---|---|---|---|---|
| Between groups | 1 | 0.04 | 0.04 | 0.18 | 0.67 |
| Inside groups | 92 | 64.08 | 0.21 | | |
| Total | 93 | 64.12 | | | |

Through table (4) it is clear that the level of statistical significance is greater than (0.05), therefore it is not statistically significant, that is, there are no significant statistically significant differences in the level of science lab use of the gender variable. The researcher attributes this result to the awareness of teachers, whether male or female, about the importance of the science laboratory and the importance of conducting scientific experiments as aids to the educational process, and teachers are exposed to the same curricula and the same conditions in schools.

 

**B- EXPERIENCE FACTOR.**

**TABLE (5): TESTING THE DIFFERENCES BETWEEN THE RESPONSES OF THE SAMPLE MEMBERS THAT ARE ATTRIBUTED TO THE EXPERIENCE FACTOR**

| Contrast source | Domains | sum of squares | Degrees of Freedom | average squares | "F" value | Statistical significance |
|---|---|---|---|---|---|---|
| Years of Experience | Science lab usage level | 0.393 | 2 | 0.197 | 0.266 | 0.767 |
| The error | | 71.847 | 91 | 0.741 | | |
| Total | | 72.240 | 93 | | | |

The results of Table (5) show that there are no significant differences attributable to the experience factor in the use of the science laboratory in conducting scientific experiments, as the level of statistical significance is greater than 0.05, and therefore it is not statistically significant. This result may be attributed to the fact that science teachers are constantly exposed to training courses, since science is an important subject, and experiments and curricula are constantly updated, which improves teachers' experiences and develops them constantly, regardless of their years of experience.

**RECOMMENDATIONS**

Through the findings of the study, the researcher recommends the following:

1. Conducting studies similar to the current study to determine the impact of the science lab in enhancing other thinking skills.
2. Students acquire performing skills.
3. Encouraging science teachers to use the dry laboratory in teaching science because of its positive effects in increasing achievement.
4. Reducing the number of students in one classroom, allowing the science teacher to take the students to the laboratory.
5. Emphasis on the necessity of using the laboratory during teaching and following up on that during visits and supervisory visits.
6. Holding courses and training programs that will raise the efficiency of teachers in the field of using the laboratory.

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