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Attitudes of Science Teachers for Gifted Students towards the Virtual Laboratory and the Challenges they face from their Viewpoint

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Abstract

This study aimed to identify the attitudes of science teachers for gifted students towards the virtual laboratory and the challenges they face from their viewpoint. The study ultimately depended on the descriptive analytical method. Moreover, the study population included a number of (185) male as well as female teachers who work in public schools in Karak Governorate, while the study sample included (56) male as well as female teachers. They were chosen randomly. Furthermore, this study's results ultimately reflected that science teachers' attitudes towards the virtual laboratory recorded a positive level with an arithmetic mean of (3.47). The challenges that ultimately face science teachers for gifted students in the use of virtual laboratory recorded a high level, with an arithmetic mean of (3.94). Besides, the results also reflected the absence of statistically significant differences concerning teachers' attitudes towards the virtual laboratory according to these variables: (gender - academic qualification - job experience). The obstacles facing science teachers for gifted students in the virtual laboratory recorded a high level and with an arithmetic mean of (3.94). The results also reflected that there were no statistically significant differences in teachers' attitudes towards the virtual laboratory, according to the variables: (gender, educational qualification, and job experience). The study recommended the necessity of holding courses as well as workshops for teachers and students to develop their attitudes towards the virtual laboratory, and to train them on how to use it, and to provide virtual laboratories to include all schools. The study also recommended the necessity of modifying science curricula to match its application in the virtual laboratory.

Keywords: virtual laboratory, teachers' attitudes, gifted students.

INTRODUCTION

The world nowadays is witnessing rapid technological developments as well as changes in various fields. Amidst this rapid technological progress, educational institutions must keep pace with these rapid and growing changes to develop teaching as well as learning methods that ensure the educational outcomes' quality. Thus, many educators see that the use of modern educational technologies is an urgent necessity because of its various advantages. That is, educational practices in general and teaching of science in particular are witnessing huge leaps for the better to keep pace with this era characterized by scientific and technical progress.

Science is one of the most important fields which computers and its applications have made a great revolution in its education. Science is one of the subjects that most require, in its teaching and interpretation of its concepts, the use of virtual laboratories so as to help teachers reach the learning goals and outcomes that they seek to achieve with their students and also to help students acquire multiple and diverse experiences (Al-Shahri, 2009). The laboratory can be considered an integral part of the so-called scientific education for teaching science, as it is the beating heart of science education in

its various stages. That is, science cannot be considered a science unless it is associated with and accompanied by experimentation and laboratory work. Thus, recent trends in scientific education attach great importance and a prominent role to the laboratory and its activities in teaching science. This role is represented in the laboratory being closely linked to the scientific methodological subjects that are expected to be accompanied by activities and scientific investigation on the one hand as well as the achievement of the teaching science' goals on the other hand (Zaytoun, 2004). The importance of the laboratory in science education is highlighted in proving the truth of information, scientific knowledge, and students' focus on understanding of the scientific material, not memorizing it.

The laboratory's importance in science education is highlighted in proving the truth of information, scientific knowledge, and students' understanding of the scientific material and not memorizing it, thus trying to apply it in their life or in the field of future study, achieving the principle of learning by doing, acquiring scientific trends and tendencies and helping to develop scientific thinking and provide opportunity for Creativity and Innovation (Al Baltan, 2011). In the virtual laboratory, computer applications are used. Such applications include software and multimedia that can be downloaded and used through the personal computer, or through the Internet. They are mostly self-running applications and do not need operational applications. Moreover, these applications consist of a main screen through which experiments are conducted on one side of all the tools, devices and materials needed to conduct experiments in any branch of science (Llu et al., 2015). The programs used in the virtual laboratory are also characterized by the presence of different mediums for conducting experiments, such as vacuum, air, water and dark mediums, along with the presence of various sources to emit all types of waves and frequencies, as well as different one- and two-dimensional media. The programs are also equipped with a large number of ready-made experiments as models that cover the experiences of different branches of science (Babateen, 2011). In spite of the continuous seminars by educators to use new methods in teaching science, such as the use of the virtual laboratory, this topic has not received in Jordan the study and research it deserves. Therefore, the present study seeks to know the attitudes of science teachers for gifted students towards the virtual laboratory and the challenges they face from their viewpoint, as it is a new method that constitutes an explicit challenge to using the usual method worthy of research and study.

Problem Statement

On the basis of the role and necessity of scientific laboratories in facilitating and understanding science subject in a theoretical and procedural manner, and since the prescribed curricula are full of educational, learning and scientific experiences that stand in the way of teachers to use the laboratory, and due to the lack of sufficient time for teachers to implement practical activities inside the laboratories, due to the weak ability of the teacher to use and employ skills inside the laboratories, whether real or virtual, along with the acute shortage of equipment and materials, we find that there are several obstacles that hinder work in the laboratory. This prevented the application of scientific experiments as a basic requirement in understanding science and scientific phenomena. Relying on what was indicated by the results of previous studies such as (Thiqa, 2011; Al Baltan, 2012; Al Zahrani, 2010), which ultimately recommended the need to develop new teaching methods as per the capabilities in every place and time, as well as according to the needs and capabilities of those societies, and being in line with the global trends towards the use of computers in the field of education in general, and teaching methods in particular, this study seeks to know the attitudes of science teachers for gifted students towards the virtual laboratory and the challenges they face from their viewpoint. It does so by seeking fruitful answers to the following questions:

1. What are the attitudes of science teachers for gifted students in the Directorate of Education of the Southern Mazar Brigade in the Karak Governorate towards the use of the virtual laboratory from their point of view?

2. What are the challenges that science teachers for gifted students face in the Directorate of Education of the Southern Mazar Brigade in the Karak Governorate in using the virtual laboratory from their point of view?

3. Do the attitudes of science teachers for gifted students in the Directorate of Education of the

Southern Mazar Brigade in the Karak Governorate differ according to the variables: (gender, educational qualification, and job experience)?

Significance of the Present Study:

This study is famous for its examining of an important topic, which is ultimately concerned with the science teachers' attitudes towards the use of virtual laboratory in teaching science and the obstacles they face from their point of view. Moreover, It is hoped that this study will be able to achieve its desired objectives which are as follows:

1. To highlight the importance of the virtual laboratory since it is so important in facilitating science education in general, as it is one of the modern strategies in teaching science.

2. Knowing the science teachers' attitudes towards the virtual laboratory and the challenges they face in teaching science.

3. The importance of this study also lies in the fact that it is one of the few studies conducted in Jordan – as far as the researcher is concerned - in the field of research on the science teachers' attitudes towards the virtual laboratory in teaching science and the challenges they face from their point of view. It may enrich the educational literature related to the virtual laboratory.

Study Objectives:

The current study aims to:

1. Reveal the attitudes of science teachers for gifted students in the Directorate of Education of the Southern Mazar Brigade in the Karak Governorate towards the virtual laboratory from their point of view.

2. Identify the challenges facing science teachers for gifted students in the Directorate of Education of the Southern Mazar Brigade in the Karak Governorate in using the virtual laboratory from their point of view.

3. Reveal the different attitudes of science teachers for gifted students in the Directorate of Education of the Southern Mazar Brigade in the Karak Governorate according to the different variables: (gender, educational qualification, and job experience).

The Study Delimitations::

The results of the present study are delimited to::

Human delimitations: All science teachers for gifted students in public schools affiliated to the Directorate of Education of the Southern Mazar District in the Karak Governorate>).

Place delimitations: This study was conducted in public schools affiliated to the Directorate of Education of the Southern Mazar Brigade in the Karak Governorate..

Time delimitations: .The first semester of the academic year 2021/2022.

Topic delimitations: This study deals with teachers' attitudes towards the use of virtual laboratory in teaching science and the challenges they face from their point of view.

Terminology of study:

Attitudes of science teachers for gifted students procedurally: It is the total score obtained by the examinee through his answers to the items of the scale used in the current study.

The virtual laboratory procedurally: It is the place where scientific experiments are conducted electronically through special applications and programs so that they are simulated to reality and where new components and innovative experiments are added, without risk and helps to save time and effort.

Procedural challenges that teachers face: It is the total score that the examinee obtains by answering the items of the scale used in the current study (which is represented in a set of obstacles that hinder science teachers for gifted students from using laboratories, whether they are traditional or virtual, in performing scientific experiments).

The concept of attitude:

(Shawamrah, 2014: 243) mentioned the concept of attitude, as stated in the Encyclopedia of Psychology and Psychoanalysis, that it means "an acquired motive that is evident in a mental and emotional readiness that has a degree of stability that determines the individual's feeling and colors his behavior in relation to certain topics in terms of preference or lack of preference, then the individual loves them. He tends to love such behaviors (if his attitude

towards them is positive) or hates them (if his attitude towards them is negative).

Kinds of attitudes:

The opinions of researchers about attitudes, their types and classifications have varied, based on several criteria, and these criteria included comprehensiveness, severity, purpose, positivity and negativity. The following is a statement of the different types of attitudes according to the aforementioned criteria. Here, the researcher is limited to mentioning them in terms of positivity and negativity; that is, the attitudes are divided according to the positive and negative criterion into two parts: as in (Shawamrah, 2014).

1- Positive attitudes: These are the attitudes that build in the person positive thoughts that enable him to view things positively, and he rushes towards working effectively to achieve his goals. An example of them is the positive attitude towards preserving the environment, which stimulates the call to protect the environment and its various elements.

2- Negative attitudes: In contrast to positive attitudes, they are negative thoughts about things; that is, the individual avoids doing them. An example of them is the attitude of hating voluntary work.

Ways to express direction:

Attitude is expressed by the individual in two ways (Siddiq, 2012), being referred to in (Al-Momani, 2017):

1. Verbal method: It is of two types. a) The automatic verbal attitude, where the individual expresses his attitude openly and publicly in his speech. b) The advisory verbal direction, in which the individual expresses his attitude when a question is directed to him.

2. Practical Method: Here, the individual expresses his attitude by his behavior and practical actions.

The Virtual Laboratory:

The use of computers and technology is one of the most important educational means in overcoming many problems facing the usual methods of teaching in general as well as in teaching science in particular. Thus, this is based on the role of computers and technology in helping the learner to interact with the educational material to a high level. This is what distinguishes the use of computers and different technological applications from other educational devices. Its application also permits the learner to gain self-learning opportunities, which can effectively be achieved by expanding training, practice and feedback (Al-Ajlouni, 2007). Furthermore, based on the fact that the science curricula contain abstract concepts and experiments that can take extra time and effort as well as the lack of necessary tools, the use of computers, software, technological applications and virtual laboratories in teaching scientific material contributes to the embodiment of concepts in an interactive and sensory manner. In this respect, Rawashdeh and Al-Momani (2004) emphasized the great role played by the computer and its various augmentative and virtual applications in science education, as they contain many abstract concepts that require time and effort for sensory understanding. That is, teaching in laboratories is a fundamental and distinctive pillar of science teaching, whether in schools or universities, and the use of the laboratory in the study of scientific experiments is one of the most important features that distinguish teaching scientific sciences from human sciences. Therefore, laboratory work is considered an essential element in teaching science at all educational levels, as it provides the learner with the skills of laboratory work (Zaytoun, 2007). Scientific subjects are considered complex subjects concerning their teaching, because they reflect the intangible world, in which it is difficult to apply some experiments due to their danger and financial cost. Due to the rapid technological progress in the educational field, advanced computer simulation applications have been designed to simulate real laboratories in their functions (Al-Hafiz and Amin, 2013).

The concept of virtual laboratories:

Virtual laboratories are defined as e-learning as well as teaching environments through which real science laboratories are modeled and simulated, and scientific experiments are applied virtually in such a way that simulates and parallels the real application. They are available for use through CDs, or through websites (Al-Ghashem and Al-Hammadi, 2017). In this context, Brinson (2015) indicated that these laboratories

contribute to the development of basic science processes such as sensation, perception, observation, acquisition of the skill of scientific thinking, and the development of higher mental skills such as analysis, synthesis, and evaluation. (Al-Radi, 2008) defined virtual laboratories as programmed laboratories that simulate real laboratories, through which the learner can conduct and repeat experiments by substituting for laboratory equipment. They can also be modified to include doing ideas in virtual experiments that are difficult to conduct in reality due to the lack of equipment, the number of laboratories and the practical time devoted for that. The virtual laboratory can be applied distinctively in the field of science education, which is considered a fertile environment for activating the uses of the laboratory in the educational process, due to the great diversity of educational experiences and skills that should be given to the learner. This is what these laboratories provide in terms of realistic and tangible experiences, and capabilities to overcome practical application problems in schools, such as: danger, high cost, insufficient class time to perform the experiment and observe its results, and the lack of laboratory equipment suitable for the quality of the buildings, most of which are rented for teaching and school purposes (Salah, 2017).

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Advantages of using a virtual laboratory:

It is true to state that an important virtual laboratory's feature is not to be restricted to the number of students who perform the experiment at the same time as long as the capacity of the communication channel is sufficient to transfer data, and the possibility of restructuring the groups of students who are doing the experiment with high flexibility in order to increase interdependence and cooperation between users of the virtual laboratory to consolidate the concept of working as a team. This is very important to help with adaptation in future work, and the possibility of recording everything that the student has done in the laboratory and then analyzing it through specialized computer programs. This is considered one of the very important matters, as following up on the work of groups of students in traditional laboratories, knowing and recording the actual capabilities of each student, and following up on the progress made in the students' skills is very difficult and requires a great effort in terms of supervisors necessary to follow up the work of each group and follow up their work during the semester, especially with the great increase in the preparation of students. Moreover, one of the most important features is that the barrier of time and place has been canceled (Al-Bayati, 2006).

The benefits of virtual laboratories in science education:

Al-Shehri (2009) mentioned some of the advantages of virtual laboratories as they reduce the learning time spent by the student in the traditional laboratory, and enable the implementation and conduct of experiments that are difficult to implement in the traditional laboratory, either because they are dangerous, expensive or time-consuming. Virtual laboratories also add fun and excitement to the traditional laboratory, in addition to the fact that the student can carry out experiments according to his individual capabilities and at the time, speed and place that suits him. It also provides an opportunity to follow up on the work accomplished by the student and provide immediate feedback, as it contributes to reducing the high material cost required by traditional laboratories in terms of devices and equipment.

The importance of the virtual laboratory in science education:

It is noted that there is a great importance for virtual laboratories in our practical life in general and science teaching in particular, as one of the innovations in educational technology, among which it provides skill experiences very close to direct experience and is characterized by the selection of risk factors resulting from the practice of some experiments in direct ways. And it contributes to overcoming the obstacles that prevent the practice of realistic experiments, such as: lack of equipment, factors of time and space, and the extreme accuracy of the material

being studied. Moreover, virtual laboratories are modern technologies that can yield good results during the implementation of laboratory experiments and the development of laboratory skills for the student, and contribute to overcoming some of the problems and obstacles facing teachers and students in teaching science subjects, especially in conducting practical experiments. It also contributes to the development of positive attitudes among teachers and students towards science and the experiences it contains in general and towards technology and the importance of integrating it into the educational process in particular (Al-Radi, 2008; Al-Shehri, 2009).

Levels of applying virtual laboratories in science teaching:

The levels of applying virtual laboratories in science teaching can be classified into three levels, as indicated by Abdel Razek (2015), which are as follows:

1. Enrichment level: This means using the virtual laboratory as an additional source of information so that the learner can benefit from it in supporting achievement and acquiring skills, a level based mainly on the learner's desire to develop and enrich his knowledge or information.

2. Basic level: This means relying completely on the virtual laboratory in learning as an alternative to the usual laboratory, where a system is built for the virtual laboratory and its requirements are provided in the school, then the courses, teaching tools and interaction methods are designed to suit this level.

3. Integration level: This level means the integration between the use of the virtual laboratory and the usual laboratory in teaching science, and each laboratory has its function and role so that neither of them can be dispensed with in the educational process.

The teacher's tasks in the virtual laboratory environment:

The following are some of the teacher's tasks in the virtual laboratory environment (Khaled, 2008; Tracey & Stuckay, 2007):

1. Researcher: His role as a researcher is to search within electronic libraries and databases spread on the network to bring what is suitable for his students.

2. Designer: He must consider the audience, the educational objectives, and the content provided through the virtual lab.

3. Technician: It is important to have skills related to the use of the Internet, operating systems, network connection requirements, and some technical problems.

4. Coordinator: His role is to support communication and interaction between users and each other as in traditional educational situations and supports interactive and competitive learning.

5. Mentor: Here the teacher's task is to guide learners while they deal with the content or with each other.

6. Facilitator of the learning process: The teacher is responsible for creating the process of collective and individual learning, and for creating a safe environment worthy of respect for learners.

7. Orienteer of the educational process: It is to define a detailed framework for the agenda of the educational session.

8. Assessment of learners' work: Assessment takes many forms. If teaching takes place in a directive manner, the teacher can evaluate the exercises, discussions and interactions that take place during the live session.

9. Director of online sessions: The process of good management of sessions is one of the roles of special importance for the teacher.

Literature review:

Based on the survey of the previous studies, some studies have been found relevant. In this list is a study which was conducted by Akl and Azzam (2019). It aimed to employ virtual laboratories in teaching science in schools of Gaza and to develop prospects for development and solutions to the problems facing teachers in employing it. It adopted the mixed approach that combines the quantitative and qualitative approaches. The sample consisted of (20) teachers, and an interview with (15) science teachers. Moreover, the results of the study reflected that problems related to the learning environment got the highest percentage of (80%), followed by problems related to teachers

with a percentage of (73%), then problems related to learners with a percentage of (72%). The results of the interviews also indicated that the teachers had no experience with the mechanism of employing this technique.

Another study was conducted byRajendram's(2016). It mainly aimed at finding out teachers' attitudes and perceptions of using virtual chemistry laboratories in secondary schools in England. The study sample included (156) male as well as female secondary school teachers in Southampton. Moreover, the descriptive approach was used, and they sample members were chosen randomly. The results reflected the need to improve the reality of using the virtual laboratory and its optimization compared to the traditional laboratory. Moreover, the virtual lab also lacks realism compared to traditional lab offerings, in addition to the need to expand the design of virtual labs to meet the needs of teachers.

Moreover, a study was conducted by Al-Thubaiti (2016) and it aimed at effectively examining the attitudes and perceptions of secondary schools' science teachers concerning the effectiveness of employing the virtual laboratory in teaching science in Al-Qurayyat Governorate. The sample included (105) male as well as female teachers. Moreover, the results reflected that the degree of secondary school science teachers' perceptions concerning the effectiveness of employing the virtual laboratory in teaching science was high, where the dimension of the positives of the virtual laboratory came in the first place and at a high degree, while the negatives of the virtual laboratory came in the last and medium degree. Besides, the results reflected that there were ultimately statistically significant differences in teachers' perceptions of the tool and all its dimensions that can be attributed to the gender variable and in favor of females. Furthermore, the results also reflected that there were no obvious differences in teachers' perceptions due to experience, with the exception of (negatives of the virtual laboratory), which were in favor of the experience category (10 years and more) compared to the experience category (less than 5 years). The results also reflected that there were no clear differences in teachers' perceptions of the tool as a whole, and all its dimensions, due to the variables (academic qualification, educational qualification, specialization).

Theqah (2011) conducted another study that mainly aimed at effectively finding out the attitudes of science teachers and chemistry supervisors towards the use of virtual laboratory technology and some of its demands in Mecca. The study sample consisted of 97 secondary school chemistry teachers, and (14) chemistry supervisors who were chosen randomly. Besides, the results showed that the teachers' responses towards the concept of virtual laboratories and their characteristics in teaching chemistry were positive and at a very high degree.

Another significant study was conducted by Flowers (2011). It ultimately aimed to reveal students' perceptions as well as attitudes about the use of the virtual laboratory in teaching biology. The study sample included (13) female students and (6) students studying the biology laboratory course in the first year, where they studied the first part of the experiments in the usual way, and the second part using the virtual software. The results showed that students prefer to participate in virtual laboratories and acquire higher skills through them compared to real laboratories.

Furthermore, Tuysuz conducted a study in (2010) and it mainly aimed to investigate the impact of applying the virtual laboratory on students' achievement as well as their attitudes towards science education. Moreover, it used the quasi-experimental approach. Besides, the study sample consisted of (341) high school students studying in Turkish public schools. They were divided into two group's; the control group which includes (167) students who are taught in the usual way, while the experimental group has (174) members for whom a number of (16) experiments were designed using the virtual software. The results of the study obviously reflected an improvement concerning the achievement of the experimental group students, and the formation of positive attitudes towards the use of virtual laboratories in science teaching.

Another important study was done by Yaseen and Hamza in 2010. This study aimed to reveal the attitudes and perceptions of teachers about the use of virtual laboratory software in science teaching. The study sample

consisted of (164) teachers working in Texas schools. The results showed that (91%) of the teachers believed that the main objective of the science lab is to motivate students to develop an understanding of scientific concepts compared to memorizing facts. Moreover, (70%) of them agreed that virtual lab programs enhanced students' learning of basic concepts, and (64%) of them believed that using interactive programs in scientific experiments improves students' achievement, while (55%) of them consider that software simulation is safer than traditional science laboratories. Concerning the obstacles to using the virtual laboratory, the results showed that (97%) of the teachers indicated the lack of adequate equipment and supplies for laboratories, while (42%) of them indicated poor administrative support, difficulty in managing class, lack of technology, and lack of teacher training on implementation of technology in science laboratories.

METHODOLOGY:

Study Approach:

To answer the questions of the present study and achieve its main objectives, the researcher applied the descriptive analytical approach since it effectively suit the nature of the present study, which ultimately aims to reveal the attitudes of science teachers for gifted students in government schools affiliated to the Directorate of Education of the Southern Mazar District in Karak Governorate towards the use of virtual laboratory in teaching science and the challenges they face from their point of view.

Population:

The study population generally includes all science teachers for gifted students affiliated with the Directorate of Education in government schools in the Southern Mazar District in the Karak Governorate, for the year (2020/2021). Their total number was (185). Moreover, the study sample included (56) male as well as female teachers. They were chosen randomly. Table (1) shows the division of the study sample.

Table (1): *Description of the study sample's characteristics*

Variable	Variable category	Number	Percentage
Sex	Male	**17**	**30.4**
	Female	**39**	**69.6**
Academic qualification	Bachelor Degree	**29**	**51.8**
	Master Degree	**8**	**14.3**
	Ph. D.	**19**	**33.9**
Job experience	Less than 5 years	**13**	**23.2**
	5-10 years	**28**	**50.0**
	11 years or more	**15**	**26.8**
Total		**56**	**100.0**

Study instrument:

There are of course many scientific study instruments that can effectively be used to collect information and data. Moreover, based on the nature of the data to be collected and the method used in the present study, it appeared that the most appropriate tool to achieve its objectives is the questionnaire. The questionnaire was designed after reviewing the related literature, scientific research methods, and field studies related to the subject of the study. Moreover, the tool consisted of (29) items. It is concerned with knowing the science teachers' attitudes concerning the use of virtual laboratory in teaching science and the obstacles they face from their point of view. Paragraphs (1-14) were concerned with knowing the science teachers' attitudes towards the virtual laboratory, and in front of each paragraph there are five alternatives, which are: (always, often, sometimes, rarely, never). The following scores were given in order (1, 2, 3, 4, 5), respectively. The scale was divided into five categories: (highly negative, and its category ranges between (1-1.8), negative and its category ranges between (1.81-2.60), neutral and its category ranges between (2.61-3.40), positive

and its category ranges between (3.41-4.20), and finally, highly positive and its category ranges between (4.21-5). Furthermore, the paragraphs (15-29) measure the challenges of using the virtual laboratory from the science teachers' point of view, and in front of each paragraph there are five alternatives: (strongly agree 'five scores', agree 'four scores', neutral 'three scores', disagree 'two scores', strongly disagree 'one score'). The scale was divided into five categories, which are: (very weak score and its category ranges between (1-1.8), weak score and its category ranges between (1.81-2.60), medium score and its category ranges between (2.61-3.40), high score and its category ranges between (3.41-4.20), and finally very high score and its category ranges between (4.21-5).

Instrument validity

The questionnaire was presented to (8) experienced and specialized arbitrators to know their opinions about its consistency, clarity, and comprehensiveness. This included the items belonging to the scale as a whole. The questions were modified and reworded as per the recommendation of the arbitrators. Based on the arbitrators' suggestions for editing, the modifications agreed upon by the arbitrators were made. A number of the questionnaire's paragraphs were modified and deleted, in addition to reformulating some paragraphs to refer directly and briefly to what the paragraph aims for, which achieved its apparent validity.

Instrument Stability:

To verify the stability of the internal consistency of the instrument, the Cronbach's Alpha coefficient was calculated on a survey sample similar to the study sample consisting of (15) male and female teachers. The value of the stability coefficient of the scale was (.810), which indicates a high stability of the questionnaire. Thus, it is a suitable value for the purposes of the study.

Results and Discussions:

Results related to the answers to the first question: What are the attitudes of science teachers for gifted students in the Directorate of Education of the Southern Mazar Brigade in the Karak Governorate towards the use of virtual laboratory from their point of view?

To answer this question, the arithmetic means and standard deviations of the responses of the sample members were calculated. This is shown in Table (2).

Table (2): *The arithmetic mean and standard deviation of the responses of the sample members towards the virtual laboratory*

No.	Paragraphs	Arithmetic mean	Standard Deviation	Level
1	I see that the use of the virtual laboratory contributes to the development of methods of teaching science.	2.91	1.11	Neutral
2	I am good at designing experiments included in virtual laboratory applications.	2.94	1.01	Neutral
3	I feel that using a virtual lab increases my motivation towards science education.	3.07	1.23	Neutral
4	I regularly follow courses on virtual lab technology.	3.25	1.14	Neutral
5	I think that the virtual lab can be a substitute for the real lab.	3.28	1.31	Neutral
6	I motivate students when they use the virtual laboratory in preparing experiments.	3.44	1.29	Positive
7	I think that the virtual laboratory is one of the most important and good alternatives for the development of education.	3.50	0.99	Positive

8	I use the virtual laboratory on a regular basis.	3.55	1.02	Positive
9	I think that the use of the virtual laboratory contributes to the dissemination of science and knowledge.	3.58	0.94	Positive
10	I assign students scientific assignments through the virtual lab.	3.62	1.16	Positive
11	I use the virtual laboratory continuously in the educational process.	3.67	1.14	Positive
12	I allow sufficient time to discuss the results of the hypothetical lab work.	3.80	0.99	Positive
12	I see that the virtual lab is stressful and tiring when teaching science.	3.91	0.87	Positive
13	I encourage the use of software and websites linked to the virtual lab.	4.07	1.14	Positive
Total score		3.47	0.57	Positive

Table (2) shows that the arithmetic means of the responses of the study sample members concerning the teachers' attitudes towards the virtual laboratory ranged between the positive and neutral levels, with an arithmetic mean that ranged between (2.91- 4.07). The total score for the tool recorded a positive level, with an arithmetic mean (3.47), and a standard deviation (0.57). The paragraph "I encourage the use of programs and websites related to the virtual lab," received the highest score followed by the paragraph "I see that the virtual lab is stressful and tiring when teaching science, while the paragraph "I see that the use of the virtual lab contributes to the development of science teaching methods" recorded the lowest arithmetic mean (2.91), with a deviation of (1.11). The current study agrees with the Tuysuz study (2010), which showed a positive level towards the use of the virtual laboratory, and differs with the study of Theqah (2011), which showed a high degree of positivity. The results showed that teachers' attitudes towards the virtual laboratory recorded a positive level. The researcher attributes the result to: the teachers' awareness of the requirements of teaching science using the virtual laboratory, and their experience in this field to facilitate the learning and teaching process. Besides, the spread of technology increases and encourages the use of the virtual laboratory, which indicates an agreement, with a (positive) degree, on the importance of the virtual laboratory in teaching science.

Results related to answering the second question: What are the challenges that science teachers for gifted students face in the Directorate of Education of the Southern Mazar Brigade in the Karak Governorate in using the virtual laboratory from their point of view?

To answer this question, the arithmetic means and standard deviations of the responses of the sample members were calculated. This is shown in Table (3).

Table (3): *The arithmetic mean and standard deviation of the responses of the sample members to the challenges facing teachers*

No.	Paragraph	Arithmetic mean	Standard deviation	Level
1	The scarcity of Arabic-language software used in the virtual laboratory.	3.32	1.41	Acceptable
2	Weakness of students in using virtual laboratories.	3.46	0.97	High
3	Weak interaction between teachers and students.	3.64	1.22	High

4	Teachers are not convinced of the feasibility of the virtual laboratory in implementing practical lessons.	3.83	1.05	High
5	I see that the virtual lab simulates the visual pattern only for students.	3.85	0.79	High
6	The lack of trainers to give training programs to science teachers for gifted students on how to use the virtual laboratory.	3.94	0.69	High
7	It is difficult to use senses such as touch to distinguish the properties of matter.	4.00	1.14	High
8	The cost of special software in the virtual laboratory is high.	4.01	0.98	High
9	Lack of computers for students to use the virtual laboratory.	4.03	1.02	High
10	Class time is not enough to use the virtual lab in teaching science.	4.05	0.67	High
11	The lack of experience of teachers and students using the virtual laboratory.	4.10	0.82	High
12	Low effectiveness of educational devices and technologies available in schools.	4.16	0.75	High
13	The lack of the financial capabilities necessary to secure the needs of the virtual laboratory.	4.21	0.90	Very High
14	Weak internet when using virtual lab.	4.23	0.63	Very High
15	The density of scientific material in science curricula hinders the use of the virtual laboratory.	4.30	0.60	Very High
Total score		3.94	0.36	**High**

Table (3) shows that the arithmetic means of the responses of the study sample members to the challenges facing science teachers for gifted students ranged between a high and a very high level, with an arithmetic mean that ranged between (3.32-3.94). The overall score of the questionnaire recorded a high level, with a mean of (3.94), and a standard deviation (0.36), where the highest score was in favor of the paragraph "the density of the scientific material in science curricula hinders the use of the virtual laboratory", followed by "the slowness of the Internet when using the virtual laboratory", while the paragraph "the scarcity of software in the Arabic language used in the virtual laboratory" obtained the lowest mean of (3.32), with a deviation of (1.41). In this respect, the current study agrees with the study of Rajendram (2016), Akl and Azam (2019), which showed a high degree of virtual laboratory obstacles. The results reflected that the obstacles facing science teachers for gifted students in the virtual laboratory from their point of view were high. The researcher attributes this result to the fact that teachers are not sufficiently trained to use the virtual laboratory. It is also attributed to their low ability to use the virtual laboratory, or their lack of awareness of the importance and features of the virtual laboratory. Moreover, the increase in the number of students in one class hinders the use of the virtual laboratory, and the courses may cause obstacles that cannot be covered by the virtual laboratory. In this respect, the lack of specialists in technical support for laboratories inside schools, and the slow Internet are major challenges. For these reasons, the challenges recorded high levels.

Results related to the third question: Do science teachers' attitudes toward the use of virtual laboratory in science teaching in the Directorate of Education of the Southern Mazar Brigade in

the Karak Governorate differ according to the variables: (gender, educational qualification, and job experience)?

To answer this question, a t-test for two independent samples was used to know the teachers' attitudes towards the use of virtual laboratory in science teaching according to the gender variable (male/female).This is shown in Table (4). In order to find out the teachers' attitudes towards the use of virtual laboratory in science teaching according to the educational qualification variable (Bachelor / Masters / Ph.D.) and the job experience variable (less than 5 years / from 5 to 10 years / 11 years and more), the One Way ANOVA was used. This is shown in Table (5).

Table (4) *Results of the t-test for the sex variable*

Variable		Arithmetic mean	Standard deviation	T value	Sig value
Gender	Male	3.51	0.42	0.36	0.112
	Female	3.45	0.62		

Table (4) clearly shows that there are no statistically significant differences in teachers' attitudes towards the virtual laboratory according to the gender variable. The significance value was greater than (0.05). Thus, the null hypothesis was accepted, that is, there is no difference, and this result differs with the Al-Thubaiti study (2016), which resulted in statistically significant differences according to the gender variable and in favor of females. The researcher attributes the result to the equality of opportunities available between male and female teachers in dealing with the virtual laboratory in teaching science, in addition to their interest in what saves time and effort and at the same time brings joy to students, achieves the desired goals, and creates opportunities to repeat the experiment more than once and in an interesting manner. Therefore, the answers of the male and female teachers were similar.

Table (5) *Results of One Way ANOVA for the two variables: educational qualification and job experience*

Variable	Source of variance	Total squares	Freedom scores	Squares' mean	F value	Sig value
Academic qualification	Between groups	0.90	2	0.45	1.407	40.25
	Within groups	17.02	53	0.32		
	Total	17.93	55			
Job experience	Between groups	0.65	2	0.32	**1.004**	**0.373**
	Within groups	17.27	53	0.32		
	Total	17.93	55			

Table (5) shows that there are no statistically significant differences in teachers' attitudes towards the virtual laboratory according to the variables of educational qualification and job experience. Moreover,the significance value was greater than (0.05). Hence, the null hypothesis was accepted. This result differs with Al-Thubaiti study (2016), which showed a statistically significant difference according to the variable of experience and in favor of (10 years or more). The researcher attributes this result to the teachers' full conviction in the virtual laboratory, its importance and its requirements, and their interaction with the technological development imposed by the information and communication revolution. This encouraged teachers to keep pace with the development regardless of their experience and scientific qualification.

Recommendations:

On the basis of this study's findings, the following points are highly recommended:

1. Holding specialized courses as well as workshops for teachers and students to develop their attitudes towards the virtual laboratory, and to train them on how to use it.

2. Providing virtual laboratories to include all schools, linking all schools to the service of Internet as well as providing computers to all the students in schools.

3. Modifying science curricula to match its application in the virtual laboratory.

4. Removing all obstacles that challenge the application of the virtual laboratory, in terms of providing Internet labs in schools in proportion to the number of students and academic courses.

5. Conducting more educational studies on attitudes and the virtual laboratory in terms of dimensions and applications in educational and other institutions.

6. Conducting a study entitled: A counseling program's effectiveness in developing the attitudes of students and teachers towards the virtual laboratory, and a comparative study between teaching in the traditional laboratory and the virtual laboratory.

Reference

[1] Al-Momani, Ibrahim Ali (2017). Attitudes of preparatory year students at King Saud University towards the counseling programs offered to them. The Arab Journal of Science & Research, Volume (1), Issue (8).

[2] Shawamra, Nader (2014). Social Psychology. Amman, Jordan, Al-Shorouk House for Publishing and Distribution.

[3] Al-Baltan, Ibrahim (2011). Using Virtual Laboratories as Means of Teaching Science for the Secondary School Students in KSA (Reality and Development Ways). (Unpublished Master's Thesis), Umm Al-Qura University, Mecca.

[4] Al-Bayati, Mohannad (2006). E-Learning's Practical and applied dimensions, the Arab Network for Distance Learning. Amman, Jordan: The Arab Network for Open and Distance Education.

[5] 5.Al-Thubaiti, Abdullah (2016). The perceptions of science teachers for the secondary school concerning the effectiveness of employing the virtual laboratory in teaching science in Al-Qurayyat Governorate. (Unpublished Master's Thesis), Yarmouk University, Jordan.

[6] Thiqa, Iman (2011). Attitudes of chemistry teachers and supervisors towards the virtual laboratory technology's use and some of its demands in Mecca. (Unpublished M.A. Thesis). Umm Al Qura University, Mecca.

[7] Al-Juhani, Abdullah (2013). Obstacles to the use of virtual laboratories in the process of teaching science at the secondary school in Medina region from the point of view of supervisors and their attitudes towards it. Journal of Arab Studies in Education and Psychology. 2(44), 325-368.

[8] Al-Hazmi, Doaa (2010). Virtual labs in science learning. Riyadh, Saudi Arabia, Al-Rushd Library Publishers.

[9] Al-Hafiz, et al. (2013). The virtual laboratory for physics as well as chemistry experiments: its impact on developing the power of observation for middle school students and their cognitive achievement. Specialized International Educational Journal, 1(8), 459-478.

[10] Khaled, Jamila (2008). A virtual learning environment's effect in science education on the achievement of sixth grade students

- UNRWA schools, Nablus Governorate. (Unpublished Master's Thesis), College of Education, An-Najah National University, Nablus.
[11] Dar Ibrahim, Yasmine (2014). The virtual laboratory's effect in teaching science experiments and developing science processes as well as acquiring concepts for fifth grade female students in Palestine. (Unpublished Master's Thesis), An-Najah National University, Nablus, Palestine.
[12] Al-Radi, Ahmed (2008). Virtual labs are an e-learning model. A research paper that is presented to the e-learning forum in general education, the Ministry of Education, the General Administration of Education in the Riyadh region, 19-21 Jumada Al-Awwal 1-14.
[13] Al-Radi, Ahmed (2009). The effect of using virtual lab technology on the third year secondary students' achievement - Department of Natural Sciences- in a chemistry course in Al-Qassim Educational Region. (Unpublished Master's Thesis), KS University, Riyadh, Saudi Arabia.
[14] Rawashdeh, et al. (2004). The effect of a computerized educational program on tenth grade students' learning of chemical concepts and their retention. Yarmouk Research, Humanities and Social Sciences Series. 3(20), 1377-1403.
[15] Zeitoun, Ayesh (2004). Science teaching methods. (4). Amman, Jordan, Al-Shorouk House for Publishing and Distribution.
[16] Al-Zahrani, Jamaan (2010). Obstacles to conducting practical activities in teaching physics at the secondary school from the point of view of physics teachers in Al-Baha educational region. Master's Thesis - College of Education - Umm Al-Qura University.
[17] Zeitoun, Ayesh (2007). Science teaching strategies: A Constructivist theory. Amman, Jordan, Al-Shorouk House for Publishing and Distribution.
[18] Al-Shehri, Ali (2009). Virtual laboratories' effect on acquiring laboratory skills related to the biology course - third grade secondary students, Jeddah (Unpublished Ph.D. Thesis), College of Education, Umm Al-Qura University, Saudi Arabia.
[19] Sheikh, Hani (2015). The effect of the different design of providing electronic training support in simulation experiments in virtual laboratories on the laboratory skill performance of university students. The Fourth International Conference: E-Learning and Distance Education, Riyadh, KSA.
[20] Salah, Wisam (2017). The effectiveness of employing the reflective classroom environment based on virtual laboratories in developing Arduino design and programming skills in the technology course for eleventh grade students - Unpublished Master's Thesis - College of Education at the Islamic University, Gaza.
[21] Abdel Razek, Ahmed (2015). The effective role of a program based on modern educational technologies in science laboratories in developing the achievement of middle school students and their attitudes towards science. (Unpublished PhD thesis), Al-Madinah International University, Kuala Lumpur, Malaysia.
[22] Al-Ajlouni, et al. (2007). Computer assisted teaching. Kuwait, Arab Open University.
[23] Akl, et al. (2019). Employing virtual laboratories in teaching science in schools in Gaza (prospects for development and solutions). International Journal of Lrarning Management Systems, 7(1), 15-27.
[24] Al-Ghashem, et al. (2017). The effect of using virtual lab technology in developing the skills of creative thinking among outstanding students in the secondary school. The Arab Journal for Scientific and Technical Education, 1(6), 42-74.
[25] Al-Mannai, Abdullah (1995) Computer-assisted education and its educational software. Yearbook of the College of Education, Qatar University, 12, 431-474.
[26] Nasah, Enas (2014). Teaching techniques from originality to modernity. Riyadh, Saudi Arabia, Al-Rasheed Library.
[27] Al-Wadani, Nayef (2014). Effective use of the real and virtual laboratory according to the demands of the developed chemistry curriculum in the secondary school in Mecca. (Unpublished Master's Thesis) - Umm Al-Qura University, Mecca, KSA.
[28] Alexiou, et al. (2008). "Virtual Laboratories In Education: A cheap way for all schools to get laboratories for all courses, using the Computer Laboratory".
[29] Babateen, M. (2011). The Virtual Laboratories' Role in Science Education. International Proceedings of Computer

Science & Information Technology. 12, 100-104.
[30] Brinson, B. (2015). Learning achievement's outcome in non-traditional (virtual as well as remote) versus traditional laboratories: A review of the empirical research - Computers & Education journal, 87(9), 2018-237.
[31] Flowers, O. (2011). Investigating the Effective Role of Virtual Laboratories in an Undergraduate Biology Course. The Journal of Human Resource and Adult Learning. 7(2). 110-116.
[32] Keller, et al. (2005). Making Real Virtual Labs. The Review of Science Education. 4(1). 2-11.
[33] Liu, D. et al. (2015). Merging of Virtual Labs into Science E-learning Procardia Computer Science. 75, (95-102).
[34] Rajendram, R. (2016). Perceptions of Teachers concerning Virtual Laboratory Use in Secondary schools Chemistry Education in England. [A paper presented to the conference at University of Southampton, April, England].
[35] Tracey, et al. (2007). Virtual labs' use in the online biology course student's perceptions of effectiveness and usability". MERLOT Journal of Online Learning and Teaching., 3(2). June 12-45.
[36] Tuysuz, C. (2010). The Virtual Laboratory's effect on Students Achievement as well as Attitude in Chemistry. [International Online Journal of Educational Sciences]. 2(1). (37-53).
[37] Wooddfield, et al. (2004). The virtual ChemLab project: A realistic as well as sophisticated simulation of inorganic qualitative analysis. Journal of Chemical Education, 81(11), (1672-8).
[38] Yaseen, et al. (2010). Perception of Teachers concerning the use of software simulations in Science Laboratories. Nationals Social Science Association.