



## **The Effect of Technology-Oriented Differentiated Instruction on Motivation to learn Science**

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Integrating technology into teaching approaches has become one of the most effective strategies in teaching development. Therefore, this study aimed to investigate the impact of technology-oriented Differentiated Instruction on third-grade students' motivation to learn science. In order to achieve the goal of the study, the quasi-experimental approach was used, the motivation scale for science learning was prepared, consisting of (29) items, distributed on four dimensions, which are: the academic dimension, the social dimension, self-organized learning, the challenge and curiosity preference, and an instructional plan was prepared according to the Technology-oriented Differentiated Instruction strategy. The study sample was chosen by the intentional method, as the number of the sample reached (58) students of the third grade at the Al-Hussein Bin Talal University Applied School in Ma'an Governorate, in the first semester of the academic year 2020/2021. Male and female students, who studied using the technology-oriented Differentiated Instruction approach, and the other was a control, consisting of (28) male and female students, who also studied using the regular method. The results of the study showed the effectiveness of technology-oriented differentiated instruction in motivating students to learn science with a significant difference compared to traditional instruction.

Keywords: technology-driven differentiated instruction, science learning motivation

### **INTRODUCTION**

The modern era is characterized by changes as it accelerates technical and scientific discoveries, and is characterized by an explosion of knowledge and openness to all aspects of an individual's life. Therefore, educational institutions considered the science subject an important priority because it is more related to technology and the concepts, principles, and skills it produces. Consequently, the teaching and learning process of science has witnessed continuous development, to keep pace with technical and scientific developments. The usual teaching methods and models used in science learning can no longer keep pace with these challenges and developments to bring about

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meaningful learning (Alkhatib, 2017). In order for the learner to deal with the outcomes of the cognitive and technological revolution, it is the responsibility of education to develop his skills and develop his abilities by caring for him and changing his way of thinking from the early stages of his life. Therefore, it is necessary to shift the curricula from an interest in knowledge to developing students' minds, their ability to criticize, analyze and create, and their ability to practice and activate their mental skills positively in life (ALTantawi, 2007).

The science teacher uses modern strategies that do not achieve the desired goals. This is because he presents it in one context that does not suit the needs of the students. Therefore, the need has become urgent for modern teaching strategies, and the use of technology to cope with the change and acceleration taking place in various aspects of life that suits the needs, desires and preferences of students. The challenge that faces the teacher is how to teach his students. Each student has different capabilities, interests, and motivations, and the knowledge of any effective technological instrument to support the needs of students in their classrooms in order to increase their motivation towards learning, and how to implement and implement technology.

Ismael (2009) believes that there is a need to use various educational strategies to teach science in all grades, and the teacher seeks to elevate his students to the stage of solving the problem by understanding the material to help them employ knowledge and generate it. In addition, there is no effective strategy that is suitable for all teaching situations, from here a new style of teaching according to the needs of learners in the classroom has emerged, known as differentiated teaching.

Kojak et al. (2008) stated that the idea of Differentiated Instruction began to take its place, when the Children's Rights Document (1989), which recommended differentiated teaching for all, was announced and the World Education Conference held in Jomtienu in (1990), followed by the Dakar Conference in (2000), which also recommended taking into account the differences between the learners when students learn in different ways that enable them to obtain an education commensurate with their characteristics, and that each of them achieves the highest levels of success and achievement within the framework of their potential.

One of the characteristics of Differentiated Instruction is its dependence on the teacher's knowledge of each student, and his knowledge of appropriate teaching strategies (Obaidat & Abu Al Semeed 2007; Ginja, & Chen, 2020; Al-rsa'i, 2021). The student, and their developmental stage, depend on the available educational means. As Zeitoun (2007) points out, there is no single educational style that can effectively teach science. It has improved learning, and thus the achievement of goals in science curricula and its teaching groups that share the needs to meet the needs of each student to create a spirit of cooperation between them.

Therefore, the teacher had to know the levels of the students in order to be aware of their needs. To present the content in various forms and activities according to Bloom levels, such as: graphics, sound, and computer programs, and to also diversify the means

and strategies commensurate with the student's desires and capabilities, all of this lead to raising the level of motivation and developing innovation that reveals their creativity.

Al-Najjar, Walharsh, Ghazzawi, and Al-Najjar (2002) indicate that the educational software directs the learner's mind directly, helping him to interact with it as a special teacher living in an atmosphere full of enthusiasm and seriousness. Because it contains sound, static and moving images, and video clips that support the main ideas, and that have an impact on stimulating the student's motivation to learn self.

Al-Maghribiu (2016) stated that some scientific studies have emphasized the necessity of adopting Differentiated Instruction in the educational process and integrating technology that provides possibilities for achieving differentiation. And learning opportunities are opened to all learners by providing different experiences and activating the role of technology to meet the needs of the learner, so the role of technology must be activated positively in the educational process in general and in differentiated education in particular; To serve the desired educational goals.

Hence, the current study came to reveal the effect of technology-oriented Differentiated Instruction on the motivation of third-grade students to learn basic science, which takes into account students' learning styles, their diverse needs and desires. Also, activating the positive role of the student, and making him an effective and active element during teaching.

So this study may be characterized by the fact that it may be the first study to test the effectiveness of technology-oriented differentiated instruction, while most of the previous studies examined the effect of differentiated teaching in its usual form.

### **The Problem of Study**

Through the researcher's experience in the educational field, it became clear that students of basic grades face problems, including: their lack of motivation towards learning science, and this is evident in the low levels of students' achievement of scientific concepts contained in the sciences. This may be due to the usual teaching that the teacher follows in presenting scientific concepts in a manner. Just without taking into account the needs and interests of the students, and their motivations for learning.

The results of the TIMSS study (2015) indicated that the performance of Jordanian students in science was low, as the mean percentage of their correct answers was (57%) (Abu tayeh., Al-Rsa'i, & Al-Shugairat,2018).On the one hand, the performance of Jordanian students ranked second to last between Portugal mean (63%) and Brazil means (52%), and on the other hand, the mean Jordanian student's performance was significantly lower than the student's performance in all the participating countries (with a difference of 10.5%),(National Centre for Human Resources, Development, 2015).

Accordingly, it is evident that there is an urgent need to keep up with everything that is modern in teaching strategies, methods, and methods, and to employ technology to meet the requirements of the educational and educational process, as it has become important to be familiar with everything in teaching and their status to implement in the field of educational work, especially since the world today is witnessing qualitative and

quantitative leaps in All Areas. This, in turn, requires the use of teaching methods that push the learner and teacher together to renew their knowledge that suits their desires, preferences, and trends.

Specifically, the Study Tried to Answer the Following Question:

What is the effect of technology-oriented Differentiated Instruction on the motivation of third-graders to learn science?

### **Aims of the Study**

The Study Aimed to: Determine the Effect of Technology-Oriented Differentiated Instruction on the Motivation of Third-Grade Students to learn Science.

### **Theoretical Framework and Previous Studies**

To achieve the goal of teaching science effectively, attention must be paid to both sides of the communication process between the teacher and the student in a balanced way. We may notice in regular teaching that he focused on the teacher as the main element in the educational process, as he is still responsible for imparting information to the learners without regard to their abilities and aptitude giving them a role in the learning process (Elsayed, 2005).

Therefore, the difficulties and challenges put educators at all levels facing the responsibility of improving the educational process. The teacher should keep abreast of everything new to improve teaching and learning methods in our schools, taking into account the different and diverse needs of students, and realizing that the learner is the focus of the educational process (Rahmat, 2017).

In this field, Differentiated Instruction provides a great help, as it allows flexibility and instruction based on the individuality of the student and his own learning style. It is about the individual student's needs and tailors their learning to meet these needs. It seems that the Differentiated Instruction instructions today are more important than ever before and classes today tend to be made up of students who differ greatly in academic skills, and teachers need to teach at a level commensurate with students' skills and learning styles (Morgan, 2014).

In addition to all these tasks entrusted to the science teacher, who today faces more challenges due to modern technology in the field of information and communication, as it has imposed vast changes in all aspects of social, economic and educational life. These challenges are represented in the new roles and additional tasks in education, which make the science teacher adapt to the contributions of this technology in the development of education, and to employ it in the educational process through strategies and methods that give the learner real opportunities to participate, so that this technology becomes auxiliary instrument for the science teacher to achieve real and effective learning.

### **Differentiated Instruction**

The researchers believe that learners differ in different fields, and these differences are due to the methods, characteristics and abilities that they learn, and to meet the needs of the learners is a necessity of Differentiated Instruction. Its concepts were varied, as Tomlinson (2001) defined Differentiated Instruction as: a process whereby the teacher provides multiple methods and activities for learners to access information and learn effectively.

According to Code (Good, 2006), Differentiated Instruction is an educational approach that compensates for students' personal requirements by increasing learning and motivation.

Al-Shqirat (2009. P. 120) believes that: "Teaching that takes into account the capabilities and experiences of all groups of learners in the classroom, and works to increase their achievement and develop their abilities with an acceptable degree of performance by dealing with each level in a manner appropriate to its abilities and previous experiences."

In light of the foregoing, Differentiated Instruction can be considered an entry point to an educational strategy aimed at creating a suitable learning environment for all students, teaching them the same content in different ways, suiting their interests and abilities to achieve effective and productive learning, raising motivation towards learning, and may take different educational methods.

Differentiated Instruction requires the teacher to divide the learners according to their abilities and intelligence, as this takes into account the satisfaction and development of those abilities. This enhances the level of motivation and raises the level of challenge for them, which helps them to be creative (Drapeau, 2004). Tomlinson & Imbeau (2010) indicated that learning technology has become an important requirement in achieving the Differentiated Instruction, and perhaps the digital age that forced teachers to arm themselves while teaching their students with educational technology, in its various forms, starting from the smart board, the virtual labs, and the virtual laboratories. Computer-assisted learning, presentations and other presentation aids, and different teaching techniques that respond to the learning preferences of different groups of students.

The importance of Differentiated Instruction is evident in several aspects, as reported by Al-Halisi (Alhalisi, 2012; Turkey, Al-rsa'i, & Abu tayeh, 2021):

- Teachers can create learning opportunities for all students by providing different learning experiences that suit them, taking into account their attitudes and preferences. Students differ in several aspects: prior knowledge, characteristics and tendencies, and learning styles.
- Differentiated Instruction also provides an appropriate learning environment, to diversify activities that develop all aspects of the students' personality, and enhance their motivation and challenge to learn.

- Helping teachers focus on the basics of the curriculum by adding more than one new educational strategy.
- It helps learners to excel and create, because it takes into account the three learning styles: auditory, visual, and kinaesthetic.

### **Differentiated Instruction Forms**

Differentiated Instruction takes many forms as explained by Al-Ghamdi (2014):

- Teaching according to the styles of the learners: where the students are classified according to their learning styles, including auditory, visual, kinaesthetic, and teaching according to these patterns, in the sense that the student receives
- Teaching according to the theory of multiple intelligences: it means that the teacher classifies students according to their intelligence, and presents his lesson according to their preferences and desires. Tomlinson (2001) confirms that Differentiated Instruction is based on studies of intelligence carried out by educational and psychologists, and this theory is in line with the concept of Differentiated Instruction.
- Teaching according to cooperative learning: Students are classified according to groups with common denominators, as cooperative learning can be considered distinct education, if the teacher takes into account the organization and distribution of tasks according to the interests and desires of the students.

### **The Role of The Teacher in Differentiated Instruction**

The teacher is considered one of the pillars of the educational process, due to his knowledge of the characteristics of students and their learning styles, and his choice of teaching method and strategies that meet the needs of students to prepare generations of productive and creative students, and among these strategies is the strategy of Differentiated Instruction, and the teacher must realize several things:

First: educational objectives: as Tomlinson (2005) emphasized that differentiated teaching achieves a set of goals, namely: responding to the differences between students in their educational needs, working to achieve learning goals for each student, and preparing educational tasks based on the content of basic concepts and skills, Offer challenging assignments suitable for each student.

Second: Teaching Strategies: The process of choosing a strategy in light of the diversity of teaching is subject to a set of scientific controls that reflect the thinking and experience of the teacher, and show the extent of his knowledge of the characteristics of students and their learning styles, clarity of educational goals, specifying the appropriate time, and the use of differentiation between teaching methods, which is the basis of the Differentiated Instruction system. Because the teacher assigns some students tasks in self-education, such as: doing self-study and project work.

Third: Outputs: The diversity of methods of presenting assignments depends on the varying levels of students, their orientation, and their desires, in order to reach the learning objectives.

### **The Role of the Learner in Differentiated Instruction**

As for the role of the learner in the Differentiated Instruction, it can be summarized as follows (Kojak et al, 2008): Participation and positive interaction, through carrying out the roles assigned to them, and providing information that helps the teacher define the learning styles of each of them, and the types of his intelligence and preferences. The students also get used to the large number and diversity of assessment processes, and its methods, and it helps the student to know the objectives of learning and what is going on in the class in terms of procedures, and is convinced that everything that is going on is for his benefit, and accepts the idea of the different activities that the teacher introduces to each group, in addition to enhancing students' confidence in themselves and in their abilities. , And accept the challenge, and make an effort to achieve what is asked of them.

### **Instructional Technology in Teaching Science**

The most diverse academic subjects in terms of the techniques and educational methods used in teaching them are the subject of sciences, some of which are audio, visual, or kinaesthetic, with many subjects and varied fields, which touch many aspects of the learners' life.

Technology-enabled classrooms have the potential to support constructive learning environments that focus on the student, which in turn may offer students advantages for student learning. Although many educators are critical of the implementation of technology, and question whether they need to use digital resources on the basis of scientific evidence, recent brain research supports the idea that these resources benefit students and that exposure to technology affects learning positively (Bookheimer, 2009).

### **Educational Technology Development Stages**

The most important stages that the concept of educational technology went through can be presented, as mentioned by Al-Toudri, 2009) as follows:

- The visual teaching movement: It is the beginning of educational technology. It depended on the transformation of abstract concepts into tangible things. This movement used visual materials in teaching and made them a component of the curriculum.
- The audio-visual teaching movement: It was concerned with the sense of hearing, and its role in education, and this led to the use of the sound component and its addition to educational materials, where animated films appeared.
- Communication: It is considered one of the basics of educational technology. By adopting it in education, several concepts have been added, such as: the process concept, the concept of models, and communication.
- The behavioral sciences movement: its inception coincided with the emergence of Skinner's theory of immediate reinforcement in learning, whereby the role of the machine was transformed from a tool during teaching to a tool for enhancing behavior,

and the adoption of the behavioral goals achieved as a measure of the learner's evaluation.

- Education design: It is the process of preparing educational programs and materials. It is concerned with determining the entrance behaviour of the learner.
- Systems approach: the concept of educational technology has shifted from being an instrument to being practical and seen as an organized method in designing, implementing, evaluating, and developing the educational system. Emphasis was placed on the importance of using educational systems linked by reciprocal and complementary relationships that affect and are affected by each other.
- Educational development: Focus on the systems approach and its concept in terms of the design, implementation, and development of the education process.
- Individualization of teaching: Focusing on the individuality of learners in terms of their individual differences, as each of them has special characteristics and abilities, and it led to the emergence of new teaching methods that diverted interest from the academic subject and the teacher to the learner to encourage him to learn individually, such as: programmed teaching and computer-assisted learning.

### **Technology-Oriented Differentiated Instruction**

Differentiated Instruction can be achieved through technology by providing tasks and activities that meet the students' desires, and by presenting the same content in more than one way, such as a video, audio recording, and PowerPoint presentation. They can help educators create an effective learning profile and experience, and be creative in a way that is so attractive that they spark the desire for new knowledge and the transition from one task to another.

Shwahn (2014) shows that the use of technology increases the integration of students in the educational process more actively, and there are many learning resources that use multimedia applications that combine video, audio, and interactive programs that deal with different types of learning, and this appears as follows:

- Providing learning for the learner according to his own style of learning, whether it is aural, visual, or sensory-kinaesthetic.
- Allowing the learner to express himself by allowing him to choose how he uses it in creating projects or presenting the information.
- A sense of ownership, as the learner can devise a method that suits him/her in dealing with the information he has learned.
- Providing a positive educational atmosphere that encourages the learner to participate and think.

Abbitt (2011) stated that most teachers use technology in the classroom, either by creating online lessons or by using lessons created by others, so technological prowess affects a teacher's ability to be creative in presenting content to students.

Technology is used to increase efficiency and support an active learning environment, and teachers must engage students with technology, rather than just using it as a reward such as: watching a movie, playing a file, or viewing information. Moreover, the integration of technology should be more than a paperless activity, or an alternative means of presenting information through a digital screen or device. Approved technology should be integrated to promote active learning for students and enhance the skills of the twenty-first century (McGrail, 2007). Technology is often used as a way to simplify the curriculum rather than the realization of learning capabilities and should enhance it, and it should support the students learning and their desires (Hughes, 2005).

### **Motivation to Learn**

The learner's responses and reactions vary according to the influences that push and motivate him to do so, as they control the responses of the internal or external influences, and influence his behavior, learning, and thinking. Motivation is one of the pillars of effective learning because it motivates the learner to exert more effort and energy to learn about new situations or solve problems faced Soliman, (2005).

Because educators have realized the importance of motivation being an educational goal pursued by educational systems, they sought to raise it among students (ALbitar, 2004). ; In order to prevent them from being distracted, and their commitment to school systems and instructions, Litchfield & Newman (1998) see that motivation is the main influence to exert the effort to reach educational and educational outcomes; to carry out their duties inside the classroom. The positive impact of motivation appears through the student's preoccupation with tasks, activities and procedures for the longest possible time and commitment to the educational process (Ames, 1992).

The motivation was internal influences that drive the learner in the learning activities to the end of achieving his intended goals, and the learning does not occur without them (Benny Yunus, 2004). Also, It increases the desire to achieve the desired goals of education and the energy that drives the student's behavior toward learning (Samawi & Assaf,2013).

It is evident that motivation is of great importance for the teacher and the learner, as it is a factor in achieving knowledge and skills to be achieved or acquired by students. Effective learning coupled with stimulating and unavailable motivation create a classroom problem, represented by forming a source of inconvenience for the class, providing conditions, and creating classroom situations are the teacher's duties To increase students' motivation to reach learning objectives (Sharia, 2006).

Motivation is provoked by internal or external stimuli, whereby the internal stimuli push the learner to learn based on an inner desire to satisfy himself, and this motivation stems from the learner himself according to his needs, inclinations, and desires. As for external stimuli, the learner rushes to learn to obtain a high mark or to satisfy his parents and teachers (Saadani, 2000).

And because motivation has a role in learning, science learning needs an individual's motivation towards it, when it needs activity, interpretation, classification, and

generalization. Therefore, the student's motivation must be stimulated during the science class to learn and continue to search and learn.

Motivation is the main means of arousing students' interest and encouraging them to complete the tasks and activities presented by the educational position. This is positive, by using various strategies and methods of teaching that work to raise students' motivation towards learning.

The concept of motivation is linked to other concepts, so it was necessary to distinguish between these concepts as follows, as mentioned by Khalifa (2000):

- 1- The need, which is the starting point for stimulating the learner's motivation, which stimulates his energy and pushes him in the direction that achieves its satisfaction.
- 2- Motivation: is the motivating influence of the learner, in order to carry out an activity, in order to achieve a specific goal.
- 3- Motivation: It refers to the actual goal in the external environment, which the learner seeks with a strong motivation to reach it, such as: seeking food in the case of hunger motive, and success in the case of achievement motives...etc.
- 4- The instinct is: an innate psychological and physical readiness that pushes the learner to realize and pay attention to a certain type and feel its direction emotionally, and then behave towards it a certain behaviour or at least try to do so.
- 5- Emotion: an acute disorder that includes the entire learner, and affects his behavior, emotional experience, and internal physiological functions. Stimuli are a consequence of the emergence of emotions and vice versa.
- 6- Desire: it is defined as: a state of stress that occurs through the experience that he lives, and it cannot be clearly perceived except in a state of feeling this desire. The idea of stress does not appear directly but is inferred from observations that show the close relationship between activity and desire.

"The importance of motivation on the educational side is evident in that it is an educational goal, so stimulating students' motivation, directing them and generating specific interests in them, makes them accept cognitive, emotional, and movement activities outside the scope of school work and in their future lives, which are among the important educational goals that the educational system seeks. The importance of motivation in terms of learning is also evident in that it is a means that can be used in order to achieve specific educational goals effectively, by considering it as one of the determinants of the student's ability to attain and achieve, because motivation is related to the student's inclinations, so he directs his attention to some activities without Others, which are related to his needs, make some stimuli as reinforces that affect his behavior and encourage him to persevere and work actively and effectively "(Nshwaty, 2003. p. 206).

### Previous Studies

The study of Hafez (2019)) aimed to know the effect of Differentiated Instruction on the inverted grade on the motivation and attitudes of tenth-grade female students to learn in the subject of life sciences, and their attitudes towards it. The study was conducted during the first semester of the 2017/2018 academic year on tenth-grade students in schools and Riyadh. The special Islamic renaissance in Zarqa Governorate in Jordan, and the study applied the quasi-experimental approach to the study individuals who were intentionally chosen and their number reached (49) students, divided into two groups, the first experimental, which was taught in a Differentiated Instruction method in the reverse class, and the number reached (25) students and the second A female officer who was taught by the usual teaching method and numbered (24) students. To achieve the objectives of the study, two questionnaires were prepared for the purpose of collecting data, in order to answer the study questions. Whereas, the first questionnaire aimed to measure the motivation of the tenth graders to learn life sciences, while the second questionnaire aimed to measure the attitudes of the tenth graders towards the Differentiated Instruction in the opposite class. The validity and stability of the two study instruments were verified by the well-known scientific method. The results of the study showed that there were no statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) in the learning motivation of tenth grade students in the subject of life sciences due to the differentiated teaching method in the flipped grades, while the study results indicated that there are statistically significant differences at the level of significance ( $\alpha \leq 0.05$ ) in the attitudes of the tenth graders towards differentiated teaching in the reverse class and in favor of the experimental group.

The study of Almuqarin, (2018) aimed to know the impact of an educational program based on Differentiated Instruction in increasing the educational attainment of female students of the teacher of the elementary grade at Princess Noura Bint Abdul Rahman University, and to answer the research questions, the researcher prepared an educational program based on Differentiated Instruction and prepared an achievement test that was confirmed from his sincerity and steadfastness. The sample of the study consisted of (39) sixth-level students in the Department of Curricula and Teaching Methods, and in order to achieve the research objectives, an educational program was prepared, in which a set of Differentiated Instruction strategies were employed, and a number of activities and exercises, some of them individually and the other collectively, showed the results of the study to the presence of significant teams A statistic at a significance level ( $\alpha \leq 0.05$ ) in the achievement test, attributed to the educational program based on Differentiated Instruction.

Johnson's (2010) study used Tomlinson's theory in Differentiated Instruction with the aim of exploring the effect of Differentiated Instruction in increasing knowledge and application through educational attainment among middle school students. This study is quantitative and qualitative, as it used the experimental method, by selecting two samples of students from one of the schools The intermediate government in Chicago, the experimental group, consists of (30) students, and the control group consists of (30) students. The researcher prepared the study instrument, which are the reading test, and

the interview to find out the students' responses towards the Differentiated Instruction. The results of the study showed that there were no statistically significant differences between the two groups. As for the qualitative part through the interview, it showed that differentiated teaching has a direct effect on student development, through Apply what they have learned in their lives.

Al-Tuwairqi (2009) study aimed to investigate the impact of the Differentiated Instruction strategy on developing motivation, academic achievement and mathematical thinking among first-grade female students in Saudi Arabia, as the study followed a quasi-experimental approach, in which the first group of (58) students were selected, and two students were selected. And the other was a control group, and within each group, they were divided into three categories: the category of female students with high, medium, and low achievement. The results of the study revealed statistical differences between the mean scores of the experimental and control groups as a whole in favor of the experimental group in the post-application of the study instrument and all their variables. In addition to the existence of differences in the degrees of the different achievement groups in the experimental and control groups, in favor of the experimental group groups in the post-application of the study instrument.

The Koeze study (2007) aimed to determine whether differentiated education had an effect on student achievement. The researcher sought to answer two research questions, "Does differentiated education have an effect on student achievement?" And "Are there components of differentiated education that have a greater impact on student achievement than others?" He used a mixed design method that consisted of: Quantitative analysis of tens of tests from the Michigan Teaching Assessment Program, and the results of the teacher and student questionnaire were analyzed. The results concluded that the use of differentiated education strategies by teachers leads to improving the academic achievement of elementary school students in various academic content areas.

Through a review of previous studies that looked at Differentiated Instruction on a set of variables, it was found that some previous studies aimed to know the effect of the Differentiated Instruction on academic achievements, such as: Al-Tuwairqi study, (2009), and Koeze (2007). And Johnson (2010) study, some of which aimed to know the impact of an educational program based on Differentiated Instruction on increasing educational attainment, such as: Almuqarin, (2018). Some studies also aimed to improve the level of motivation, such as: Al-Tuwairqi, (2009).

The sample of the study varied in the previous studies that were taken up by researchers: Most of the studies focused on the basic stage, with the exception of Al-Tuwairqi, (2009). It was applied to the secondary stage, and the university study Almuqarin, (2018) focused on the university stage.

In addition to the difference of the study instrument, some of them prepared a test such as: the study of Almuqarin, (2018), Al-Tuwairqi study (2009), Johnson's study (Johnson, 2010), and some of them prepared a questionnaire such as: Al-Tuwairqi, (2009), and Al-Tuwairqi, (2009). Hafez, (2019)), and some of them used the interview, such as:

Johnson's study (2010), and some of them used an educational program such as: the study of Almuqarin,( 2018).

In addition, the results of previous studies reached the superiority of the Differentiated Instruction over the usual method of developing academic achievement, such as: the study of Al-Tuwairqi, (2009) showed the lack of differentiated Instruction in increasing motivation. As for Al-Tuwairqi (2009), the results revealed that Differentiated Instruction was superior in increasing motivation. The results of previous studies revealed the superiority of an educational program based on a Differentiated Instruction in increasing educational achievement, such as: the study of Almuqarin, (2018). The results of Johnson's study (Johnson, 2010) concluded that Differentiated Instruction did not exceed the usual method of developing academic achievement.

The current study was distinguished from its predecessors by being one of the first Arab studies to the best of the researcher's knowledge that combined the Differentiated Instruction with technology for the motivation of third-grade students to learn science.

## METHOD

The quasi-experimental approach was used, to suit the nature of the goal of the study, and the method of designing the control and experimental groups was used, so that the experimental group studied using the technology-oriented Differentiated Instruction approach, and the control was studied in the usual way, where the study adopted the quasi-experimental design.

### Study Community

The study community consisted of students of the third basic grade in the schools of the Directorate of Education in the Ma'an region, whose number reached (1133) students for the first semester of the academic year 2020/2021.

### The Study Sample

Al-Hussein Bin Talal University Applied School in Ma'an Governorate was intentionally chosen, this is due to the availability of appropriate equipment in the school, especially technological devices, and the teachers in the school are well-qualified and experienced, and they have expressed a desire to carry out the study. In the aforementioned school, the number of students reached (56) students, divided into two groups, one of which represented the experimental group, and the other represented the control group, and Table No (1) shows the number of the study sample.

Table 1  
Distribution of the study sample

| Section | Groups       | Sample Size |
|---------|--------------|-------------|
| A       | Control      | 28          |
| B       | Experimental | 28          |
|         | Total        | 56          |

**Instrument of the Study**

To achieve the objectives of the current study, the following research instrument were built:

1- The teaching plan.

2- motivation to learn scale.

1- The Teaching Plan:

An instructional plan was prepared using the technology-oriented Differentiated Instruction approach, explaining how to teach the two units of matter and their changes and the plant parts from the science book for the third grade of the first semester, applied on 1-9-2020, where the following steps were followed:

- An analysis of the two units of matter, their changes, plant parts and their functions from the science book for the third grade; To define the basic concepts, and to define the educational objectives.

- Consequently, the teaching plan was prepared according to the technology-oriented Differentiated Instruction approach, where the differentiation was in content, activities and evaluation. Some instructional activities for the teacher on how to apply the principles of Differentiated Instruction were included at the beginning of each unit, oriented by general principles of differentiation by dividing students, distributing roles and differentiating content, process and product. According to their readiness and interests, as the content was presented in the form of educational videos, audio recordings, and PowerPoint presentations, where each category is presented in a different way from the other category, in a way that suits their learning style, as each student was interviewed to know their learning style, and the operations are distinguished by providing various activities The student chooses what suits him and the differentiation of the product so that the students present the result of what they have learned in more than one medium according to their desire.

**Validate the teaching plan:**

The teaching plan was presented to a group of experts and specialists, and the specialized experts made a set of observations, and he took into account the comments of the referees.

2- Motivation towards learning science scale:

A Sciences learning motivation scale is developed by the researchers; to appreciate the motivation of third-grade students towards learning science, as it is answered by the teacher, and the following are some of the procedures that were followed in preparing the scale:

- The educational literature and previous studies related to the issue of motivation towards learning the sciences were reviewed.

- The motivation scale towards learning science was prepared using Likert's method, with a five-point gradient (applied to a very large degree and given (5) degrees, applied to a large degree and given (4) degrees, applied with a medium degree and given (3) degrees, applied to a small degree and given (2) A degree, which does not apply, and is given (1) degree), and consists of (32) statements, distributed over four dimensions.

**Validity of motivation to learn science scale:**

The validity of the content of the scale was verified by presenting it to a group of judges in the disciplines of educational psychology, measurement and evaluation, supervisors, and science teachers. In order to judge the statements in terms of their measurement of the motivation for learning sciences, and whether they belong to the dimension under which they were placed, in addition to the clarity of the meaning, some arbitrators have suggested deleting some statements as a result of their overlapping in meaning with other statements, and most of the observations were taken and reached (29) a statement.

**Reliability of motivation to learn the science scale:**

**The scale was confirmed by:**

**Reliability of internal consistency:**

The reliability (internal consistency) between the statements was checked using the Cronbach alpha equation for the dimensions of the tool, and the tool as a whole after it was applied to the exploratory sample, and the stability value for the four tool dimensions ranged between (0.85-0.77), while the overall stability reached (0.88), and these values were counted Acceptable and appropriate to conduct the study. Table (2) illustrates this.

Table 2

The internal consistency factor of the Cronbach Alpha for the dimensions and the instrument as a whole

| Dimension               | Alpha Cronbach |
|-------------------------|----------------|
| Academic                | 0.845          |
| Social                  | 0.772          |
| Structured learning     | 0.850          |
| Challenge preference    | 0.782          |
| The instruments a whole | 0.882          |

**Reliability over time:**

The reliability of the scale was also calculated by the method of stability through time by applying it to an exploratory sample from outside the study sample, consisting of (24) students of the fourth grade, using the method of applying the scale and re-applying the scale to the sample after three weeks, as shown in Table (3) 1) That all the correlation coefficients were of acceptable scores and statistically significant, and therefore none of these statements was deleted. As for the correlation coefficients between the dimensions and the tool as a whole, they were all statistically significant.

Table 3

The values of the Pearson correlation coefficients between the dimensions of the instrument to each other and the instrument as a whole

|                      |                    |            |             |         |
|----------------------|--------------------|------------|-------------|---------|
| 2Academic            | second application | 2Challenge | 2Structured | 2Social |
| Academic             |                    |            |             | .845**  |
| Social               |                    |            |             | .772**  |
| Structured learning  |                    |            | .850**      |         |
| Challenge preference |                    | .782**     |             |         |
| First application    | .882**             |            |             |         |

### FINDINGS

This study aimed to uncover the effect of technology-oriented Differentiated Instruction on third-grade students' motivation to learn science. After collecting the data using the motivation scale, the results were analyzed according to the SPSS program, and the data were tabulated and commented on, and according to the arithmetic means and standard deviations of the performance of the members of the study, pre-and post, on the scale of motivation to learn the sciences, as shown in Table (4).

Table 4

Arithmetic means and standard deviations of the study's performance on the motivation to learn science scale

| Groups       | Pre mean | S.D   | Post mean | S.D    |
|--------------|----------|-------|-----------|--------|
| Control      | 91.392   | 9.314 | 103.821   | 16.790 |
| Experimental | 89.571   | 9.142 | 123.857   | 22.546 |

Table (4) shows that there is an apparent difference between the two arithmetic means of the estimates of the post-study sample on the scale of motivation to learn the sciences according to the teaching method, where the mean of the control group was (103,821) while the mean of the experimental group was (123,857), the accompanying one-way analysis of variance (ANCOVA) to achieve statistical control, the results of which are shown in Table (5).

Table 5

The results of the one-size-fits-all analysis accompanying the examination of the differences between the performance of the control and experimental groups on the motivation scale to learn the sciences

| Source of variance | Effect size | Sig  | F value | Mean squares | D.F | Sum of squares |
|--------------------|-------------|------|---------|--------------|-----|----------------|
| Motivation (pre)   | .431        | .000 | 40.169  | 9209.042     | 1   | 9209.042       |
| Group              | .368        | .000 | 30.915  | 7087.300     | 1   | 7087.300       |
| Error              |             |      |         | 229.255      | 53  | 12150.949      |
| Total              |             |      |         |              | 56  | 751627.000     |

By looking at the results of the accompanying one-way analysis of variance (ANCOVA) in Table (5), it is evident that there is a statistically significant difference in favor of the performance of the experimental group students, which studied the technology-oriented

Differentiated Instruction, with arithmetic mean higher than the arithmetic mean of the performance of the control group students that studied, and the results of the analysis indicate the usual method. That the value of (P) is (30.915), which is a statistically significant value, and to find the effect size of differentiated technology-oriented teaching for students' motivation towards learning science, the Eta square was found, as it was found from Table (5), that it is equal to (0.368) This means that the use of technology-oriented Differentiated Instruction affected (improved) students' motivation to learn science for members of the experimental group by a percentage (36.8%).

## DISCUSSION

The result of the question was: There is a statistically significant difference at the level of significance ( $\alpha \leq 0.05$ ) in the motivation to learn the sciences in the mean means of experimental group students and the control group students in favor of the experimental group students. This result can be explained by the fact that the use of Technology-oriented Differentiated Instruction helps in increasing students' motivation towards learning science, which facilitates increasing their motivation to learn science by taking into account and satisfying the different tendencies and trends of the students. The level of their challenge to learning, reveals the creativity of the learners, and through the activation of cooperative work, where each student was given a role in the group by participating according to his abilities, which increased his motivation towards learning science. This was confirmed by Drapeau (2004), where he pointed out that Differentiated Instruction requires the teacher to divide the learners according to their abilities and intelligence, as this takes into account the satisfaction and development of those abilities. This enhances their motivation and raises their level of challenge, which helps them be creative.

The students interacted with the technology-oriented Differentiated Instruction approach, as it is a new method for students that meets the desires of all students, and differs from the usual methods of teaching, as it created a new interactive learning environment stimulating the learner's thought and imagination, in which the learner feels that he is an active participant, enthusiastic and motivated to learn. It also appeared to the researcher and teacher during the application of the study, and he learns through activity and has the opportunity to develop his logical thought and use group work. Is what Attia (2009) pointed out that Differentiated Instruction provides a suitable learning environment for all students because it is based on the diversification of activities, which enables each student to achieve the required goals in the manner that suits him.

The diversification of methods and methods of teaching, content, and evaluation by employing it with technology has attracted students' attention and interaction increased their motivation for learning and helped learners deal with the requirements of the times. This is what Tomlinson and Imbeau (2010) pointed out that learning technology has become an important requirement in achieving Differentiated Instruction.

The merging of differentiated teaching with technology gave a privilege to the department that studied in this way, as they acquired the characteristics of differentiated teaching and technology, increased students' focus and attention to educational

situations, and provided them with job opportunities according to different teaching methods that attracted students' attention and increased their motivation to learn. This is through differentiating the content and presenting it to suit the students' preferences and learning styles, which is what the Differentiated Instruction seeks, and this is what Abbitt (2011) mentioned that most teachers teach their classes with technology, either by creating online lessons or using lessons created by others. Therefore, technological prowess affects the teacher's ability to be creative in presenting content to students.

Also, Shwahn (2014) emphasized that the use of technology increases students' involvement in the educational process with greater activity and motivation, by providing many learning resources that use multimedia applications that combine video, audio, and interactive programs that address different types of learning.

The results of the current study are consistent with the study of Al-Tuwairqi, (2009), as this study indicated the effectiveness of differentiated teaching, and that it helps in increasing students' motivation towards learning science.

#### **CONCLUSION AND IMPLICATIONS**

- Distributing plans and guides for differentiated, technology-oriented teaching to schools, to enable teachers to use them and make use of them in science education.
- Conducting studies on the use of technology-oriented Differentiated Instruction in teaching subjects in different grades and stages.

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