International Journal of Education and Practice
2024 Vol. 12, No. 2, pp. 381-390
ISSN(e): 2310-3868
ISSN(p): 2311-6897
DOI: 10.18488/61.v12i2.3688

Difficulties in studying the scientific concepts from the view point of 10th grade students at Irbid governorate

Shaimaa Yahya *Educational Science Department, Al- Balqa Applied University, Jordan.*
Email: yahyashaimaa@yahoo.com

Article History
Received: 27 January 2020
Revised: 5 January 2023
Accepted: 19 October 2023
Published: 26 March 2024

Keywords
Irbid governorate
Scientific concepts
Technology
Tenth grade students
Technology.

ABSTRACT

This study sought to identify the difficulties of studying the scientific concepts among the tenth-grade students in Irbid governorate. In order to achieve the objectives of the study, a questionnaire was used to measure the students' view point about difficulties they faced in learning scientific concepts. The questionnaire contained three areas: content, teachers and students. The sampling method involved selecting tenth-grade students from the first Irbid Directorate of Education at the end of the 2018-2019 academic year. A total of 415 students were included in the study; the gender distribution was nearly equal, and they were grouped according to their GPA. The results of the study showed that these three domains were a source of determining the difficulty levels. The students' domain came first, followed by teachers, and content ranked last. The results also showed that there were statistically significant differences in the sources of difficulty due to gender differences in males, and due to the average difference in the benefit of students whose grades were less than 84%. In light of the results, the study framed a set of recommendations, including the need to emphasize the activation of technology in teaching, and holding lectures showing the importance of science and scientists.

Contribution/Originality: The study contributes in elucidating the difficulties of high school students in Irbid governorate regarding scientific topics, in three domains: content, teachers, and students. It is first study of its kind in the Jordanian context that discusses the prevailing norms of gender and academic level in determining the difficulty level of science students.

1. INTRODUCTION

In the age of science and technology with rapid and continuous changes in the domain of knowledge, scientific education is receiving great attention. A great challenge is faced to cope with these developments, adapt and assimilate their concepts in proportion to the needs of the individual and society. The emphasis in education has become the motivation and reason for the continuity of learning, and to make the learner constantly inquire and search, consequently generating his knowledge instead of receiving it (Zaytoon, 1999). The scholars of education have stressed that knowledge can be one of the solutions that may be effective to meet the challenges of the age. The emphasis on knowledge basics means emphasizing the concepts and principles that constitute knowledge of a particular domain (Balbisi, 2006).

There is however no difference in the importance of teaching and learning concepts for all who study science. The research on education emphasizes that scientific concepts represent one of the most important levels of knowledge building on which other levels of knowledge construction are based. The principles and generalizations, laws, theories and other concepts are considered important learning outcomes through which scientific knowledge can be organized into learning in a meaningful way (Maher & Ibrahim, 2000).

In view of the importance of concepts in teaching various subjects, it is crucial to understand them correctly. Researchers and specialists conduct studies to uncover how these concepts form in learners' minds. They also explore various teaching methods, models, and strategies. These efforts reveal that students enter classrooms with pre-existing ideas and perceptions about natural phenomena. Often, these perceptions clash with correct scientific understanding. Such misconceptions can hinder a student's grasp of concepts in their true scientific context (Al-Asmar, 2008).

Faced with the importance that scientific concepts occupy, and the need to acquire them correctly, educational researchers investigated the reality of concepts and methods of learning. These efforts prove that mental images that children form for one concept vary according to their experiences, their way of thinking and perception. The process of conceptual formation is the result of an impression or an individual perception that varies according to the individuals themselves (Saadeh & Alyousef, 1988).

Concepts are vital characteristics of thinking. They play a significant role in organizing experiences and retaining knowledge. Concepts also assist in observing phenomena, associating them with their origins, and easily accessing them. On the other hand, scientific concepts form the foundation of science curricula in the basic stage. Most students in this stage align with Piaget's first sensory stage. This alignment highlights the need to choose scientific concepts that match the learner's cognitive level. It's essential to present these concepts through diverse experiences. After all, a concept is the fundamental unit of constructing scientific knowledge (Qatami & Qutami, 1998).

The acquisition of concepts and their formation needs to exercise thought processes in interacting with natural and sensory experiences, as well as an experienced and interactive teacher who is able to develop and direct (Al-Khalili, 1996). In order to achieve the learning of concepts, the teacher must play his role in terms of preparation, implementation, evaluation and follow-up of the learner, for the teacher is the key to the educational process and it is the responsibility of advancing the different levels of thinking of his students, and he must direct the ideas of his pupils in the right direction (Al-Hailah, 2001).

The various strategies in teaching scientific concepts have offered numerous contributions and benefits. These strategies serve as an incentive to explore other tools that can be utilized in the educational learning process. Such tools are connected to variables like acquiring scientific concepts and mastering science operation skills. Given this background, this study aims to address the challenges primary stage pupils in Jordan encounter in acquiring scientific concepts and science process skills.

1.1. The Study Problem and its Questions

The study seeks to answer the following questions:

1. What are the sources of the difficulties of studying the scientific concepts among the tenth-grade students in Irbid governorate?
2. Are there differences of statistical significance, in the sources of the difficulties of studying the scientific concepts of the tenth-grade students due to the difference in gender or the student rate?

1.2. Significance of the Study

Scientific concepts are among the most important products of science through which scientific knowledge is organized; they are the elements and principles that guide learning acquired in a classroom, laboratory or any other

place (Nussbaum, 1989). Scientific education has eternally emphasized the necessity of learning scientific concepts and directing the methods of learning them in the right direction. It has focused on students' acquisition of scientific concepts a major goal set by educators, and curriculum designers.

There is unanimous agreement on the importance of teaching and learning concepts for science students. Educational literature underscores that scientific concepts are foundational in knowledge-building for science. Upon these concepts, other levels like principles, generalizations, laws, and theories are built. Furthermore, these concepts are paramount learning outcomes. Through these concepts, scientific knowledge can be structured in a meaningful way during the learning process (Sabri & Taj Al-Din, 2000).

Given the importance of concepts and their role in teaching various subjects, it is vital to learn them correctly. Researchers and specialists undertake studies to delve into how concepts are perceived, their structure, and their true essence in learners' minds. They also explore various methods, models, and strategies for teaching these concepts. These investigations have revealed that pupils enter classrooms with pre-existing ideas and perceptions about natural concepts and phenomena. Often, these perceptions differ from the correct scientific understanding they are expected to attain. This discrepancy leads to the formation of alternative views on natural concepts and phenomena. As a result, it hinders students from grasping these concepts in a scientifically accurate way (Al-Asmar, 2008).

With a view to establish importance of scientific concepts and the necessity of acquiring them in a correct way, educational researchers have explored the reality of concepts, their reality, and the methods of their learning. These efforts have found that mental images that children constitute for a single concept differ according to the experiences they are going through. This difference is also seen in their way of thinking about the concept, and their perception of it, the process of forming the concept resulting from an impression, or an individual perception that differs according to the individuals themselves.

1.3. Procedural Definitions of Terms

Difficulties in learning practical concepts: - All obstacles to the achievement of the desired objectives from studying and understanding scientific concepts.

Scientific concepts: - What constitutes an individual's perception, expressed in a word or term.

Science Books: - Physics, Chemistry, Biology, and Earth Sciences learnt by 10th grade students in the Hashemite Kingdom of Jordan since (2017).

1.4. Study Limits

Time Limits: - The study was conducted in the second semester of 2018/2019.

Spatial limits: - The study was limited to the tenth-grade students who studied in 2019.

2. LITERATURE REVIEW

Eric and Gale (2012) conducted a study on the challenges of teaching and studying science in the 21st century from the point of view of middle school students. The results showed that non-community content and its issues formed the greatest challenge from the point of view of the study sample. Beyessa (2014), in his study, attempted to identify the factors affecting academic performance for 10th grade science students in Ethiopia. The results reveal that the use of traditional methods in teaching adversely affects the performance of the sample and specifically the non-activation of charitable work.

A case study conducted by Mtsi and Maphosa (2016) revealed the challenges faced in the teaching of science by teachers in East Africa. The first was the lack of teachers to make one review in teaching, the students themselves ranked second, and the lack of parents' support was the last challenge. The study of Shabib (2017) aimed to identify the point of view of physics teachers and difficulties in applying modern teaching trends in teaching physics for the

secondary stage in the province of Baghdad. The main results of the study included were inadequate teaching content not applicable to these trends and that the overcrowding of students in classrooms was a great obstacle to it.

Sharab, Al-Furra, Al-Khatib, and Al-Aqqad (2017) aimed at identifying the difficulties of learning physics for the tenth-grade students in the Kamal Nasser High School for Boys (108) students. The study concluded that the students agreed that physical concepts were difficult, and that the content was not related to the student environment. The teachers also did not use teaching aids to teach scientific concepts. Camarao and Nava (2017) conducted a study aimed at identifying the difficulties of studying physics from the point of view of middle school students in a school. The results showed that content was the largest source of difficulty in the study of physics from the perspective of students.

The study of Alwani (2018) was about the difficulties of teaching physics from the point of view of teachers in Anbar province of Iraq. The results showed that the preparation of educational aids was a greater difficulty from the point of view of teachers, while their challenge to the goals came in the last place. The study did not show any differences due to gender differences or years of teaching experience.

Daoud and Sawalha (2018) in their study aimed to investigate the impact of the measurement strategy on learning the concept among the second-graders basic science students. The researchers used the design of experimental and control groups with a pre- and post-test. The researchers also prepared a set of lessons according to the measurement strategy. This strategy included a series of comparisons were made between new and previous concepts among students. This approach aimed to make new concepts more relatable, simplifying their learning process. Meanwhile, the control group studied the unit in the traditional manner. To gauge students' understanding of these concepts, researchers developed an achievement test based on concepts from the Environment Unit in the science course for the second basic class. The study revealed a statistically significant difference at the significance level ($\alpha \leq 0.05$) between the two average scores on the post-test, with the experimental group outperforming. However, no significant difference was found at the significance level ($\alpha \leq 0.05$) between the average scores on both the pre and post-tests within the experimental group.

Rawashdeh and Al-Qadri (2019) explored the effects of the new Science-NexGen Ready compact program model on sixth-grade students' grasp and retention of scientific concepts. To accomplish this, a test for acquiring scientific concepts was created, and its reliability and validity were confirmed. An intentional sample of 41 sixth-grade students from the Southern Mazar Education Directorate for the 2015-2016 academic year was chosen. These students were randomly divided into two groups. The experimental group, consisting of 20 students, was taught using the Science-NexGen Ready compact new generation model. On the other hand, the control group, with 21 students, followed the conventional teaching method. After the two-month-long experiment, data was collected and analyzed. The study's findings revealed statistically significant differences at the significance level ($\alpha = 0.05$) between the two groups in both acquiring and retaining scientific concepts, both physical and abstract. The experimental group members outperformed their peers in the control group.

The study recommended adopting the new generation compact model for science education (Science-NexGenReady) in teaching science, and conducting more studies about the effectiveness of the mentioned model in new research variables, and on other classes.

Al-Harasha (2019) aimed to investigate the impact of the Web Quest strategy on acquiring scientific concepts and developing creative thinking skills among sixth-grade students in the Kasbah of Al-Mafraq. To achieve the goal of the study, a test was used to gain scientific concepts and a test for creative thinking skills, in addition to preparing a teacher's guide that helps in teaching the unit according to the Web Quest strategy. The study sample was chosen intentionally, as the number of the sample individuals reached (65) students from the sixth primary class students in Al Rabeeh Elementary Mixed School in the Directorate of Mafraq Education, in the first semester of the year 2015/2016. It was divided into two groups, the first consisted of (33) students who studied using the

Web Quest strategy, and the second consisted of (32) students who studied in the usual way. The results of the study showed that there is a statistically significant difference between the mean scores of female students in the two study groups on the test of acquiring scientific concepts for the benefit of female students who studied in the experimental way. The study also found that there is a statistically significant difference between the average female students' scores in the test of creative thinking skills for the benefit of the experimental group.

3. METHODOLOGY OF THE STUDY

3.1. Population of the Study

The study population comprised students of the tenth grade, in the first Irbid Directorate of Education, at the end of the academic year 2018-2019.

3.2. Tool of the Study

The researcher used a questionnaire to measure the students view point about difficulties they face in learning scientific concepts. Its validity and reliability were also verified.

3.3. Reliability of the Study Tool

To ensure the reliability of the study tool, the test-retest was verified by applying the questionnaire, and reapplying it after two weeks to a group outside the sample of the study of (30), and then Pearson correlation coefficient was calculated between their estimates for both times. The validity coefficient was also calculated with the internal consistency method according to the equation of Cronbach Alpha. Table 1 shows the internal consistency coefficient according to the Cronbach alpha equation and the regression coefficients for the domains and the tool as a whole. These values are considered appropriate for the purposes of this study.

Table 1. Internal consistency coefficient, alpha Cronbach and return reliability for fields and total grade.

Domain	Repetition reliability	Internal consistency
Teachers	0.87	0.75
Content	0.89	0.81
Students	0.90	0.79
Difficulties as a whole	0.90	0.85

3.4. The Study Sample

The sample of the study was as shown in Table 2:

Table 2. Frequency and percentages by study variables.

	Categories	Frequency	Ratio
Gender	Male	216	52.0
	Female	199	48.0
General point average (GPA)	3.5 and above	183	44.1
	Less than 3.5	232	55.9
	Total	415	100.0

3.5. Study Variables

The study included the following independent and dependent variables:

Independent variables:

1. Student gender: male, female.
2. General Point Average: 3.5 and above, 3.4 and lower.

Dependent variables:

1. Content, teachers, and students.

4. RESULTS AND DISCUSSION

Results related to the first question: What are the sources of the difficulties of studying the scientific concepts from the point of view of the tenth-grade students from Irbid Governorate?

In order to answer this question, the arithmetical averages and standard deviations of the sources of the difficulties of studying the scientific concepts were extracted from the point of view of the students of the tenth grade of Irbid governorate, and Table 3 illustrates this.

Table 3. The arithmetical averages and standard deviations of the sources of difficulties of studying the scientific concepts from the view point of 10th graders at Irbid in descending order.

Rank	N0 of items	Domain	Mean	Standard deviation	Level
1	10	Teachers	3.03	0.393	Moderate
2	14	Content	2.97	0.295	Moderate
3	7	Students	3.29	0.527	Moderate
Difficulties as a whole			3.06	0.255	Moderate

Table 3 shows that the arithmetic averages ranged from (2.97-3.29), where the domain of students themselves ranked first with the highest average (3.29) while the content came in last place with an average of 2.97, the arithmetic average of the difficulties as a whole was 3.06.

To explain the result, the arithmetical averages and the standard deviations were calculated for the estimates of the individuals of the study sample for each field separately.

4.1. The First Domain: Teachers

Table 4. The arithmetic averages and standard deviations related to the teachers' domain are arranged in descending order according to the arithmetic averages.

Item number	Items	Mean	Standard deviation	Level
1	Not allowing students to do laboratory work and only watching.	3.80	1.314	High
2	Teachers are keen to accomplish the greatest of the material at the expense of students' understanding.	3.68	1.333	High
3	Teachers feel that scientific concepts are difficult to understand.	3.43	1.337	Moderate
4	Teachers focus on teaching rather than learning.	3.40	1.351	Moderate
5	The teacher's tone makes it difficult to understand scientific concepts.	3.07	1.516	Moderate
6	Teachers do not focus on developing practical attitudes.	3.03	1.274	Moderate
7	Teachers don't encourage students to search and investigate.	2.84	1.262	Moderate
8	Teachers do not vary in their teaching methods.	2.63	1.431	Moderate
9	Science teachers do not activate labs in teaching.	2.62	1.526	Moderate
9	Teachers do not vary in evaluation methods.	2.62	1.247	Moderate
10	Teachers do not activate modern technology to understand scientific concepts.	2.25	1.276	Moderate
Teachers		3.03	.393	Moderate

Table 4 shows that the mathematical averages ranged from (2.25 --3.80) where item (01), which states that "not to allow students to practice laboratory work and watch only" in the first place with an average of (3.80), while item (10) and its text "Teachers do not do modern technology to understand scientific concepts" at the last rank with an average of 2.25. The arithmetic mean for the teachers' domain as a whole was 3.03. The result may be due to the insufficient availability of materials for all students, or to the desire of teachers to achieve the greatest amount of

scientific material at the expense of students' understanding (which was referred to in item 02 of the study). Also, although modern technology has become a language of this era but it is not activated at the desired level, either to the lack of learning environment or to the beliefs of some teachers that guide them to traditional methods of teaching.

4.2. The Second Domain: Content

Table 5. The arithmetic averages and standard deviations related to the content field are arranged in descending order according to the arithmetic mean.

Item number	Items	Mean	Standard deviation	Level
11	Practical content is limited to the application of steps and not to exploration.	3.67	1.195	Moderate
12	There is a great deal of scientific concepts within one lesson.	3.49	1.198	Moderate
13	Science books focus on abstract concepts.	3.40	1.162	Moderate
14	Figures and drawings do not facilitate understanding.	3.29	1.347	Moderate
15	Lack of interest in the practical aspect of the evaluation.	3.28	1.239	Moderate
16	Content does not focus on developing practical trends.	3.09	1.209	Moderate
17	Scientific concepts are higher than students' mental abilities.	3.07	1.233	Moderate
18	There is no link between the content provided in successive classes.	3.00	1.401	Moderate
19	There is no link between content and everyday life.	2.79	1.234	Moderate
20	Science content is not introduced in an interesting way.	2.64	1.411	Moderate
21	There is no integration between the scientific concepts in the various science books of the tenth grade.	2.58	1.334	Moderate
22	I find it difficult to understand the items of science books linguistically.	2.47	1.264	Moderate
23	The content is not directed to the use of scientific concepts in new situations	2.46	1.053	Moderate
24	The content is not ranked from much easy to difficult	2.42	1.219	Moderate
Content		2.97	0.295	Moderate

Table 5 shows that the arithmetic averages ranged from (2.42-3.67), where paragraph (11), which states that "Practical content is limited to the application of steps and not to exploration" in the first place with an average of (3.67) while paragraph (24), which reads "does not arrange the content easier to harder" at the last rank with an average of (2.42). The arithmetic average for the content area as a whole was (2.97). The result may be attributed to limiting the content of science books to the presentation of scientific presentations that prove legally the relationship between scientific concepts. This does not give students the opportunity to experiment and engage mind and hands, because it is better to build the student's knowledge of himself.

4.3. The Third Domain: Students

Table 6. The arithmetic averages and standard deviations related to the students' domain are ranked in descending order.

Item number	Items	Mean	Standard deviation	Level
25	I think science is very difficult	4.38	0.970	High
26	I do not find science important.	3.96	1.179	High
27	The difficulty of mathematical concepts makes science difficult.	3.39	1.195	Average
28	I do not have basic concepts that enable me to understand practical concepts.	3.09	1.252	Average
29	I'm not trying to understand what's hard to understand	2.52	1.165	Average
30	I do not study scientific concepts on a daily basis.	2.37	1.158	Average
31	The students themselves	2.29	0.527	Average

Table 6 shows the mathematical means and standard deviations of the students' opinions on different parts of science education. Students strongly agreed that "I think science is very difficult" (mean score: 4.38, standard deviation: 0.970). Other highly scored statements included "I do not find science important" which had a standard deviation of 1.179 and a mean of 3.96. On average, people gave answers ranging from 2.37 to 3.29 when asked about how often they study scientific concepts, how difficult it is to understand difficult content, how little they understand basic concepts, and how difficult it is to understand mathematical concepts in science. There was less variation in responses to the question regarding students' personal role ("The students themselves"), which had a mean of 3.29 and a significantly smaller standard deviation of 0.527.

Results related to the second question: Are there statistically significant differences in the sources of difficulties in studying the scientific and mathematical concepts due to the difference in gender, and the GPA?

To answer this question, the arithmetical averages and the standard deviations of the sources of the difficulties of studying scientific and mathematical concepts by gender and rate variables were extracted, and the table below shows this

Table 7. Arithmetical averages and the standard deviations of gender variable.

		Arithmetic average	Standard deviation	Number
Gender	Male	3.09	0.268	216
	Female	3.02	0.234	199
GPA	85 and over	3.00	0.239	183
	Less than 85	3.10	0.259	232

Table 7 shows an apparent variation in the arithmetical averages and standard deviations of sources of difficulties in studying scientific and mathematical concepts due to different categories of gender variables, and GPA, to illustrate the significance of the statistical differences between the arithmetic averages; the binary variance analysis was used in Table 8.

Table 8. Analysis of the two-way analysis of variance of the effect of sex, and the rate on the sources of difficulties in studying scientific and mathematical concepts.

Source of contrast	Total squares	Degrees of freedom	Average squares	Value P	Statistical significance
Gender	0.591	1	0.591	9.610	0.002
GPA	0.979	1	0.979	15.910	0.000
Error	25.356	412	0.062	-	-
Total	26.930	414	-	-	0.002

Table 8 shows the following:

- There are statistically significant differences (α= 0.05) due to the effect of gender, with a value of 9.610 and a statistical significance of 0.002, and the differences are in favor of males.
- There are statistically significant differences (α = 0.05) due to the effect of the GPA, with a value of (15.910) and a statistical significance of (0.000), and the differences come in favor of less than 85.
- The result has been attributed to the impact of sources of difficulty of scientific concepts in male schools than to female schools, and because the high achievement of the student is linked to a large form with his view of the difficulty or ease of concepts, or the belief of students that science is not important and this may reflect lack of interest in the community and media on the scientists and their achievements compared to athletes.

4.4 Discussion of the results

The study's results provide a complex picture of the educational obstacles, with an emphasis on the problems encountered by tenth graders in Irbid Governorate when trying to grasp scientific ideas. The fact that students

themselves were named as the main problem, suggests that they may not have enough confidence in their own abilities or intrinsic drive to succeed in science classes. This is in line with the difficulties associated with conventional methods of instruction, which may fail to adequately interest students or communicate intricate scientific ideas. These learning difficulties are made worse by the complexity of the content, especially when it comes to the presentation of scientific ideas and their relevance to real-world applications. In light of the study's findings, which address the pedagogical and student-centered components of science education, it is imperative that educators adopt a more comprehensive stance in the classroom, one that considers students' individual learning styles, goals, and the real-world applications of scientific concepts. This all-encompassing perspective emphasizes the necessity for a change in educational practices towards more participatory, student-focused learning approaches that may meet the varied learning requirements and increase students' interest in scientific ideas.

4.5 Conclusion

The study concludes that elements pertaining to students, teachers, and material are the root causes of the difficulties that 10th graders in Irbid Governorate have when trying to understand scientific topics. Improving the alignment of information with students' cognitive skills, using more engaging and interactive teaching methods, and emphasizing the value of practical, exploratory approaches are all highlighted. The study adds to the body of knowledge in the field by shedding light on the need for individualized approaches to science education in order to overcome various learning obstacles. This can help educators and policymakers improve scientific education by guiding the development of more effective science curricula and teaching approaches that meet the requirements of diverse students.

5. RECOMMENDATIONS

It is crucial to emphasize the activation of technology in teaching to foster a modern and interactive learning environment. Additionally, holding lectures that showcase the significance of science and the contributions of scientists can inspire and motivate students. Furthermore, placing emphasis on the practical side, including hands-on research and experimentation, can enhance students' understanding and engagement. Lastly, diversifying assessment methods is essential, encouraging students to stay consistent and engage daily in their learning.

Funding: This study received no specific financial support.
Institutional Review Board Statement: The Ethical Committee of the Al- Balqa Applied University, Jordan has granted approval for this study.
Transparency: The author states that the manuscript is honest, truthful, and transparent, that no key aspects of the investigation have been omitted, and that any differences from the study as planned have been clarified. This study followed all writing ethics.
Competing Interests: The author declares that there are no conflicts of interests regarding the publication of this paper.

REFERENCES

Al- Asmar, R. (2008). *The impact of the learning cycle on modifying the alternative perceptions of the scientific concepts of the sixth grade students and their attitudes towards them.* Unpublished Master Thesis, Islamic University, Gaza.

Al- Khalili. (1996). *Teaching science in general education.* Dubai: Dar Al Qalam.

Al-Hailah, M. (2001). *Teaching methods and strategies.* Al-Ain: University Book House, United Arab Emirates.

Al-Harasha. (2019). The impact of the Web Quests strategy on teaching science in acquiring scientific concepts and developing creative thinking skills among primary school students in Jordan. *The Educational Journal, 33*(130), 265-304.

Alwani, M. (2018). *Difficulties of physics teaching in secondary stage from teachers´ Point of view in AL Anbar Governorate/Iraq.* Unpublished Master Degree, Middle East University, Jordan.

Balbisi, E. (2006). *The impact of using the paradigm strategy in modifying the alternative perceptions of some scientific concepts among 10th grade students.* Unpublished Master Thesis, Islamic University, Gaza.

Beyessa, F. (2014). Major factors that affect grade 10 students' academic achievement in science education at Ilu Ababora general secondary of Oromia Regional State, Ethiopia. *International Letters of Social and Humanistic Sciences, 32*, 118-134. https://doi.org/10.18052/www.scipress.com/ilshs.32.118.

Camarao, M., & Nava, F. (2017). *High school students' difficulties in physics*. Paper presented at the National Conference on Research in Teacher Education, University of the Philippines Diliman Quezon city the Philippines.

Daoud, Y., & Sawalha, M. (2018). The effect of the measurement strategy on learning the concept of the second basic class students in science. *An-Najah University Journal for Research and Humanities, 32*(8), 1452-1482.

Eric, M., & Gale, M. (2012). The challenges of teaching and learning about science in the twenty-first century: Exploring the abilities and constraints of adolescent learners. *Studies in Science Education, 48*(1), 89-117.

Maher, S., & Ibrahim, T. (2000). The effectiveness of suggested strategy based on some structural learning models and learning methods maps in modifying alternative thoughts on quantum mechanics and their impact on learning methods of pre-service science teachers in Saudi Arabia. *The Message of the Arabian Gulf, Saudi Arabia, 1*(77), 5619-5622.

Mtsi, N., & Maphosa, C. (2016). Challenges encountered in the teaching and learning of natural sciences in rural schools in South Africa. *Journal of Social Sciences, 47*(1), 58-67. https://doi.org/10.1080/09718923.2016.11893544.

Nussbaum, J. (1989). Classroom conceptual change: Philosophical perspectives. *International Journal of Science Education, 11*(5), 530-540. https://doi.org/10.1080/0950069890110505.

Qatami, Y., & Qutami, N. (1998). *Classroom teaching models* (2nd ed.). Amman: Dar Al Shorouk.

Rawashdeh, A., & Al-Qadri, S. (2019). The impact of teaching using the new science-nexGenReady built-in paradigm on sixth-graders' acquisition and retention of scientific concepts. *Dirasat of Educational Sciences, 46*(1), 589-603.

Saadeh, J., & Alyousef, J. (1988). *Teaching concepts*. Beirut: Dar Al-Jamil.

Sabri, M., & Taj Al-Din, I. (2000). A proposed strategic event based on some structural learning models and maps of learning methods in modifying alternative ideas about quantum mechanics concepts and their impact on the learning styles of science teachers before service in the Kingdom of Saudi Arabia. *The Arabian Gulf Magazine, 77*(1), 2343-2349.

Shabib, A. (2017). Difficulties in the application of modern trends in physics in middle schools of the province of Baghdad, from the perspective of teachers of physics. *Baghdad University, Iraq, 14*(52), 471-490.

Sharab, R., Al-Furra, J., Al-Khatib, A., & Al-Aqqad, F. (2017). *Difficulties in learning the physics of the 10th grade students at Kamal Nasser secondary school for boys*. Paper presented at the Third Annual Student Conference (Towards Preparing a Promising Research Generation).

Zaytoon, M. (1999). *Methods of teaching science*. Amman, Jordan: Dar Al Shorouk Publishing and Distribution.