Effect of Hot Seat Strategy on Eighth Graders' Achievement in Wave Motion and Sound Unit in Qalqilya City

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Abstracts

This study sought to find out the effect of the Hot Seat Strategy on eighth graders' achievement in Wave Motion and Sound Unit in their Life and Science textbook. The researcher used the quasi-experimental design to achieve the aim of the study. The population of the study was all eighth graders (No=934) in Qalqilya public schools. The study sample, randomly chosen, was 208 students in the eighth grade. Of five eighth-grade sections, the researcher randomly chose two sections: one experimental and another control. After data collection, it was obtained that the Hot Seat Strategy positively impacted students' achievement. There was a statistically significant difference at $\alpha = 0.05$ in students' achievement level as well as level of knowledge, memorization, understanding, and application in favor of the experimental group.

Keywords: Hot Seat Strategy; life and science; wave motion and sound.

Introduction

The educational process, especially at the school level, depends on various pillars and influences that can contribute either positively or negatively to it. This process requires diligent effort to advance and achieve success, which in turn demands great attention to all its elements.

Science is the foundation upon which both scientific and educational aspects of life are built. It is important to note that education today is influenced by several variables, with one of the most significant being the information revolution across various fields and specializations. Science and Life have had the largest share of these developments. There is no doubt that the subject of Science and Life has become a distinguished place among other subjects. As it includes many subjects, such as physics, chemistry, and biology (Alauna, 2021).

Modern teaching strategies are considered effective tools, and their development is crucial for achieving desired educational outcomes and overcoming the negative aspects that may arise in the learning situation. Traditional teaching methods, characterized by rote memorization and

passive learning, often limit the student's ability to engage actively in the process of educational (Mousa, 2021).

Teachers can use various teaching strategies during lessons to help students develop and enhance their cognitive structures, increasing their knowledge and educational skills. Modern teaching strategies serve as the initial impetus for teachers to adopt innovative methods that enhance their own expertise and stimulate students' motivation, interests, and academic achievement (Ramadan, 2021).

In the context of active learning strategies, the hot seat strategy has emerged as one of the modern methods. This approach focuses on constructing questions and exchanging information on a specific topic, which helps reinforce the material in the student's mind and consequently improve their achievement in that subject. At the Center for Applied Linguistics, Sarah Young introduced a strategy involving conversational and listening activities known as the "hot seat" strategy. In this strategy, a student sits in the "hot seat" while the rest of the HSS (Hot Seat Strategy) surrounds them and asks questions. The teacher acts as a guide, helping students concentrate on their questions. Through this strategy, students are able to generate numerous questions, and the teacher corrects their responses. This strategy helps to enhance academic achievement (Young, 2008).

The hot seat strategy aims to give students opportunities to formulate and ask questions, develop their skills in the targeted content, and develop team spirit among students in constructing topic questions. It is used during or at the end of a lesson after students have studied the targeted topic, enhancing their understanding and connections with other subjects. It also motivates learners to play roles, interact with each other through practice and working as a group, and exchange expressions and creative or innovative ideas. Even shy children benefit greatly from the hot seat strategy, as it allows them to imagine themselves in the role of the person being questioned, thus engaging in a new role (Abu Saree, Zaghoul, & Abdul Malik, 2020).

Since the hot seat is an active learning strategy involving all students in the learning process, learners are actively engaged in the educational process. Students participate in activities related to the studied material, such as asking questions, reading, and experimenting. These exploratory introductory activities help identify students' levels and teach them concepts, knowledge, and skills in a manner that aligns with their abilities (Hung, 2015). They assist in enhancing students' deductive and achievement levels in the subject of Science and Life.

The primary stage is crucial for establishing the learner's foundation, shaping their personality, and equipping them with various skills. Teachers at this stage face several challenges in instilling the necessary behaviors and values in students as the learning process lacks learning based on practice (Olisah & Mohmed, 2015).

This strategy aids in exchanging ideas, develops various skills such as thinking and discussion, and provides opportunities for problem-solving, exploration, experimentation, and role-playing. This, in turn, highlights its significant importance and impact on the educational stage. It is considered an effective method for instilling values and beliefs in students. It progresses a range of skills like question formulation, reading, idea and information exchange, brainstorming, and

intelligence enhancement. The teacher can apply this strategy across all curricula and subjects in engaging and straightforward ways (Al-Atrebi, 2019).

Despite the various strategies provided by schools to facilitate learning and their impact on student achievement, including active learning strategies such as the hot seat strategy, there is a notable lack of similar studies, particularly in the subject of Science and Life—according to the researcher's knowledge. This has led her to investigate the impact of the hot seat strategy on the achievement of eighth-grade students in Science and Life subjects.

Study Problem and Questions

Many studies, such as the one by Afouna (2014), have highlighted the low levels of student performance in Science and Mathematics in international and national exams like TIMSS. Recommendations from studies such as those by Al-Shadifat and Zu'bi (2020) and Alauna (2021) emphasize the need to activate the hot seat strategy and examine its effects across all educational stages and subjects. Through the researcher's teaching experience and observations of low achievement levels in Science and Life, particularly among eighth-grade students, and given her role as an eighth-grade teacher at a public school in Qalqilya. She noticed that science teachers rely heavily on traditional methods, especially for eighth-grade students. Since the hot seat strategy is a motivational approach that could help students better understand science and life subjects, it has identified a problem prompting this study. Therefore, the study's problem can be summarized in the main question that emerged:

What is the impact of the HSS on the academic performance of eighth-grade students in Science and Life Subjects (SLSs) in schools in Qalqilya?

From this main question, the following sub-questions emerged:

1. How does the hot seat strategy impact eighth-grade students' memorization achievement in SLSs in Qalqilya City schools?

2. How does the hot seat strategy impact eighth-grade students' achievement in understanding SLSs in schools in Qalqilya city?

3. What impact does the hot seat strategy have on eighth-grade students' achievement in the application level of SLSs in schools in Qalqilya city?

Study Objectives

1. Determine the impact of the HSS in teaching eighth-grade students SLSs on their academic achievement.

2. Determine the impact of the HSS on eighth-grade students' achievement in SLSs at the memorization level.

3. Determine the impact of the HSS on eighth-grade students' achievement in SLSs at the understanding level.

4. Determine the impact of the HSS on eighth-grade students' achievement in SLSs at the application level.

Study Importance

The importance of this study lies in the topic it addresses, which is the benefit of using the "Hot Seat" strategy in teaching SLSs on academic achievement. The significance is evident from theoretical, practical, and research perspectives, as follows:

First: Theoretical Importance

This study enriches theoretical knowledge as it contributes to alleviating the problems faced by eighth-grade teachers in teaching Science and Life through the hot seat strategy and its impact on student achievement. It also aims to provide a theoretical framework for it as one of the modern variables in the field of curricula and teaching methods.

Second: Practical Importance

This study is expected to assist students in Palestinian schools by providing support from specialists and professionals in curricula and teaching methods. It aims to reduce students' anxiety and distress due to their poor understanding of SLSs.

Assist decision-makers in the Ministry of Education by providing information on the types of services schools offer teachers to implement modern strategies. This helps them develop plans to reduce the problems faced by many students in Palestinian schools, especially in understanding SLSs.

Study Hypotheses

1. There are no statistically significant differences at the level (α=0.05) between the mean scores of eighth-grade students on the achievement test in SLSs, attributable to the teaching strategy (Hot Seat vs. traditional).

2. There are no statistically significant differences at the level (α=0.05) between the mean scores of the students of eighth-grade on the knowledge level achievement test, attributable to the teaching strategy (Hot Seat vs. traditional).

3. There are no statistically significant differences at the level (α=0.05) between the mean scores of the students of eighth-grade on the understanding level achievement test, attributable to the teaching strategy (Hot Seat vs. traditional).

4. There are no statistically significant differences at the level (α=0.05) between the mean scores of the students of eighth grade on the application-level achievement test, attributable to the teaching strategy (Hot Seat vs. traditional).

Study Limits and Limitations

Human limits: Eighth-grade female students

Spatial limits: Qalqilya city/Palestine.

Temporal limits: 2021-2022.

Substantive limits: The subject of this study is to know the "effect of the Hot Seat strategy on the achievement of eighth-grade students in Science and Life subjects, specifically in the unit on wave motion and sound."

Methodological limit: Hot seat strategy in teaching the unit of wave motion and sound.

Study Terminology

The study relies on the following definitions for its terms:

Active Learning: A learning and teaching method in which students actively participate in carrying out activities, proposing solutions to problems, and working on projects. This approach involves constructive dialogue, positive listening, continuous analysis, and deep contemplation. It is implemented collectively in a rich learning environment for all the educational content that has been read or written. The teacher's role is to continuously encourage students to achieve educational content goals and build their personalities (Al-Thabit, 2020).

Achievement (Terminology) is the learner's possession of intellectual mental skills in a specific field as a result of practicing certain activities (Gharibah & Kawash, 2018).

Achievement (Procedurally): It is defined as the number of grades students receive based on their acquisition of knowledge, information, and concepts in Science and Life subjects.

Hot Seat Strategy (HSS): This strategy involves a series of steps: arranging students in a circle, placing the "hot seat" in the center of the circle, presenting the activity (which includes choosing a topic to be discussed), selecting the student for the hot seat, asking questions about the topic and its main elements, exchanging roles in sitting in the hot seat. Then, the teacher provides assistance in directing the conversation about the topic and the sequence of discussing its various elements (Al-Bari, 2021).

The researcher defines the HSS procedurally as follows: After providing a specific objective or at the end of the practical activity of the wave motion and sound unit, a student is chosen to sit in the center of a circle surrounded by five other students. These students ask questions to the student in the HS, who responds to them. This process stimulates their motivation and encourages them to formulate questions, form answers, assess themselves, and build their personalities.

Science and Life: The Palestinian Ministry of Education approved science for the eighth grade (Palestinian Ministry of Education, 2021).

Wave Motion and Sound Unit: It is a unit in the Science and Life textbook for the eighth grade in Palestine in the second part that contains topics on wave motion and sound.

Conceptual Framework

Hot Seat Strategy:

Al-Atrebi (2019) defines the Hot Seat Strategy as a method that effectively reinforces and solidifies values and beliefs among students. It is based on developing diverse and many skills,

forming questions, and exchanging information, ideas, and experiences. It is preferable to use it in topics and concepts that the teacher explains in detail. Al-Harbi (2019) defines the HSS as part of active learning. It involves several procedural steps, starting with role-playing and determining which student will answer the questions, while other students are assigned roles to ask questions after selecting a specific topic.

The Hot Seat idea is based on the principle of having a student, teacher, or expert in a specific topic sit in the center of a group of students. The students then ask questions about the topic, with the condition that the questions must be open-ended rather than answerable with a simple "yes" or "no." This strategy can be implemented during or at the end of a lesson as a form of review (Ambo Saidi & Huda, 2016).

Hot Seat Strategy Objectives

According to Al-Harbi (2019), the Hot Seat Strategy aims to:

1. Provide opportunities for learners to ask questions.

2. Develop skills such as reading, reviewing texts, and acquiring storytelling and analytical skills.

3. Enhance students' collaboration in formulating questions.

4. Increase the learner's understanding of the topic when used in the middle or at the end of the lesson.

5. Encourage learners to interact and engage in role-playing.

6. Motivate learners to participate in activities, work collaboratively, share creative experiences, and overcome shyness.

Hot Seat Strategy Pillars

Within the HSS, seating is organized in a circle, and the hot seat that the student sits on is in the middle to answer the questions of those sitting in the circle. Seating may be organized in several circles in large classes. The students take turns sitting in the hot seat, and each student has a role regarding his section in the lesson. He answers the questions of the rest of the students and listens to the visions and ideas that come to their minds about it. One of the most essential pillars of this strategy is asking questions and listening to the opinions of other students. All students participate in asking questions and discussions. This strategy allows non-interactive students to immerse themselves in thinking. While interactive, students are given the opportunity to present their topics and ideas from various perspectives and provide as many details as possible about them. In this strategy, the student takes on the role of the teacher, addressing certain aspects of the lesson, which improves their ability to respond to questions from both students and the teacher and manage discussions. The student takes the role of the main axis in education. This is what modern trends in education focus on (Attia, 2016).

Al-Shammari (2011) outlined some rules for the HSS:

1. The student sitting in the HS is asked a series of questions by other students and must either answer them or pass on the question. Afterward, the seat is taken by another student, and the process continues.

2. It reinforces values, principles, and beliefs while being used in the lesson.

3. Provide an introduction to the lesson and then use open-ended questions and ask "why?" to understand the reasons behind concepts.

An example of this would be: While walking down the street, you found a bag, opened it, and discovered a large sum of money inside. This money is connected to someone whose identity and address you don't know. What would you do? And why?

Another example: You saw a friend writing on the school walls, and they asked you to write on the walls as well, or he would break up with you. What would you do? And why?

Advantages and Benefits of the Hot Seat Strategy

It develops a spirit of collaboration in formulating questions, enhances individuals' sense of responsibility and principles, creates and strengthens the desired competition among students to answer questions, increases the vitality and activity of learning, breaks down their fear barriers, and motivates students to produce more and diversify their production. It also increases their self-confidence and their ability to express ideas and opinions and develops their ability to research and think. It increases the desire to learn until mastery, accustoms the student to following work rules, and works to develop positive attitudes and values. It also helps create positive interaction between learners, which contributes to treating the problem of academic delay (Rushdi, 2020). It encourages students to express their ideas, helps them to get to know their personalities, creates interest, stimulates participation in the class, and helps them assess and examine students' understanding of the material. (Abid, 2020).

Disadvantages of the Hot Seat Strategy

It requires good preparation as the teacher must spend more time preparing it. It requires schools that want to develop and accept new ideas. It may create a sense of selfishness in students or appear exaggerated in front of their colleagues (Al-Saady, 2014).

Hot Seat Strategy Skills

The hot seat strategy develops several skills, including cognitive skills, questioning skills, exchanging ideas skills, and communication skills with others (Naji, 2017).

Rushdi (2020) mentioned methods for using the HSS:

(a) Hot Seat for the Student:

The teacher selects a student who is proficient in a specific objective, content, or skill to sit in the HS. HS is placed in the middle of the classroom, and other students surround it. The student in the Hot Seat answers questions from their colleagues, and the answers should not be limited to single words.

(b) Hot Seat for the Teacher:

The teacher sits in the HS to support students in generating and asking questions. Similarly, the HS is placed in the center of the classroom, with students surrounding it. The teacher encourages students to pose open-ended questions.

(c) Hot Seat in Group Systems:

The teacher divided the class into groups of 5-6 students after they had read the lesson or divided the lesson into several sections, with each student responsible for a specific section or objective. The students sitting in the hot seat from each group are placed in the center, with the rest of the group members surrounding them. They ask open-ended questions related to the lesson or the specific section assigned to that student. The students rotate roles among themselves with encouragement from the teacher, who observes and guides them during the activity.

A sample of questions for a lesson based on the hot seat strategy.

Abdul Karim (2016) presents the following sample of some questions that stimulate the learner's thinking and which are asked of the hot seat owner from the sixth-grade science curriculum about vital processes in plants. Such questions can be asked after bringing a plant and asking the following questions from his colleagues:

- What makes the plant green? It is due to the presence of chloroplasts.

- Why are chloroplasts present? They contain chlorophyll, which aids in the process of photosynthesis.

- What is the benefit of photosynthesis for the plant? It helps in producing food.

- What is the importance of food for the plant? It provides the necessary energy.

- Why do plants need energy? To perform vital processes required for survival.

Uses of HSS

Zayer, Turki, Issa, Faisal, and Farhan (2017) indicated that the HSS is used to stimulate students' thinking when discussing a general issue from several aspects and listening to various points of view. It falls within the active strategies in education. The teacher plays the role of facilitator for the learner by identifying the learner to carry out the discussion task and make it successful, distributing them into groups, and asking questions to stimulate their thinking or guide them.

Zembal, Krajcik, and Blumenfeld, (2016) indicate that the hot seat strategy is an easy and exciting strategy that can be used in learning and teaching any subject. It is an effective way to instill values and beliefs and has the ability to develop good reading skills, ask questions, have constructive discussions, and exchange ideas and opinions. The strategy is preferred by many teachers who want to elaborate on a particular topic or provide students with certain concepts. As for asking questions in this strategy, it is from student to student and from student to teacher so that the topic of the questions is agreed upon. Hence, the HSS has become effective in enhancing dialogue skills and mental interaction among students.

Flower (2016) states that the HSS is used to investigate the roots of the problem, meet the student's need for deep understanding, and activate his higher mental skills. This occurs when

defining the problem or concept. It begins after the student sits in the chair, and his colleagues have an important role in formulating the questions. As at least three questions are directed to him. The student may answer some or all of the questions or pass some or all to the next student. The teacher then poses questions after providing an appropriate introduction, using open-ended questions to guide the discussion.

Steps of the Hot Seat Strategy

Abdul Karim (2016) outlines six steps for the Hot Seat strategy, which are arranging the chairs in a circular formation with the hot seat placed in the center and dividing students into small groups. Then, presenting an activity that could involve reading a text, discussing a specific concept, or exploring the roots of a problem. After that, have one of the students ask a question to his colleague who is on the hot seat, starting with why, then asking in the same form five times after each answer and the number of these questions may decrease or increase, and exchanging roles, in the same way. The teacher may also assist students by using an organizational outline, which could be in writing, drawing, or another form.

Foundations of the Hot Seat Strategies

Students should be familiar with the lesson content before it is taught using this strategy so they are fully aware of the tasks they need to perform. The teacher should then clarify the procedures of this strategy and what the student sitting in the hot seat is expected to do, as well as explain the roles of the other students in the discussion and dialogue (Al-Shammari, 2011).

Previous Studies:

First: Arab Studies

Al-Mu'adidi and Al-Shahwani (2021) conducted a study to examine the impact of integrating flipped classroom strategies with the Hot Chair technique on the biology achievement and critical thinking skills of fourth-grade students in Iraq. To achieve the study's objectives, the researchers used an experimental method with a sample of 84 students. The control group comprised 40 students, while the experimental group included 44 students. Researchers developed both an achievement test and a critical thinking test. The results indicated statistically significant differences favoring the experimental group, which utilized the flipped classroom and hot seat strategies, in terms of Biology achievement and critical thinking development among fourth-grade science students.

The study conducted by Al-Bari (2020) aimed to examine the impact of the Hot Seat Strategy on enhancing oral expression skills among seventh-grade female students. The researcher employed a quasi-experimental research design. The sample consisted of 32 seventh-grade students from Rawdeh Al-Amirah Bassma First Essential School for Girls, located in the Western Northern Directorate of Education. These students were divided into two groups: an experimental group of 16 students and a control group of 16 students. To meet the objectives of the study, a checklist scale was created to enhance oral expression skills, comprising 12 items that addressed both content and performance skills. Additionally, a situational test for oral

expression was developed. A pre-and post-test was conducted for both groups. The results indicated a statistically significant difference favoring the experimental group that utilized the hot chair strategy.

The study by Al-Shadifat and Al-Zu'bi (2020) aimed to examine the effect of the Hot Chair strategy on the understanding of jurisprudential concepts among eleventh-grade students in Kasbat Al-Mafraq, Jordan. To achieve the study's objectives, the researchers employed a quasi-experimental design. The sample comprised 46 eleventh-grade students selected through a purposive sampling method. The students were divided into two groups: an experimental group of 21 students and a control group of 25 students. An achievement test was administered, and the results indicated statistically significant differences favoring the experimental group, which used the hot seat strategy for learning jurisprudential concepts, compared to the control group that followed the traditional method.

Al-Omar (2020) conducted a study to examine the effects of the Listening Triangle and Hot Seat strategies on listening comprehension skills in Arabic among ninth-grade students. To achieve the study's objectives, the researcher employed a quasi-experimental design. The study's population comprised 67 female students from the ninth grade at Al-Mazraa Comprehensive Secondary School for Girls, part of the Directorate of Education for the Northern Mazar District in Jordan, during the 2018/2019 academic year. The participants were divided into two groups: experimental and control. A listening comprehension test was developed, encompassing four levels: literal, interpretive, critical, and creative. This test was administered to both groups before and after the study. The results indicated statistically significant improvements in listening comprehension skills for the experimental group.

Second: Foreign Studies

Abid's study (2020) aimed to reveal the Effect of the HSS on Reading Comprehension for Middle School Students in Iraq. In order to achieve the study, the researcher used the experimental method. The sample consisted of (63) students distributed into two groups of intermediate school students in the Anbar Education Directorate in Iraq. To achieve the study, the researcher prepared a pre-and post-test. The results showed improvement in favor of the experimental group that studied according to the hot seat strategy. The results showed the importance of the strategy in increasing students' motivation and making the lesson more enjoyable and effective.

The study conducted by Dewi, Sofian, and Riyanti (2020) investigated the effectiveness of the HSG (Hot Seat Game) for teaching vocabulary to ninth-grade students in Pontianak, Indonesia. The research involved a pre-test and post-test and included a sample of 34 students selected through cluster sampling. The results indicated statistically significant improvements in vocabulary mastery for the experimental group. The researchers concluded that the Hot Seat Game has a significant positive effect on students' vocabulary acquisition.

Afifah (2020) conducted a study to assess the effectiveness of the HSS in improving English speaking skills among students (eighth-grade) in Indonesia. The sample included 31 students, comprising 12 boys and 19 girls. Data was collected through pre- and post-tests, as well as an oral examination. The results indicated a significant improvement in the students' speaking skills.

In 2020, Al-Alia investigated the impact of the HSS on academic achievement and emotional intelligence development among the science students (second-grade) in Nineveh Governorate, Iraq. During the 2019/2020 academic year, the experimental group, consisting of 32 students, was taught using the Hot Seat Strategy, while the control group, with 30 students, received traditional instruction. The researcher administered a pre-test to assess emotional intelligence and utilized two assessment tools: one to measure the academic achievement of middle and second-grade students and another emotional intelligence scale consisting of 40 items. The results indicated that the HSS positively affected both achievement and emotional intelligence.

Comment on previous studies

This study aligns with previous research, specifically examining the impact of the hot seat strategy on student achievement. For instance, Al-Mu'adidi and Al-Shahwani (2021) investigated the effects of integrating flipped classroom strategies with the hot seat approach on fourth-grade students' biology achievement and their critical thinking development. The study conducted by Al-Shadifat and Al-Zu'bi (2020) investigated the impact of the Hot Chair strategy on the understanding of jurisprudential concepts among eleventh-grade students in Kasbat Al-Mafraq. Similarly, Al-Omar (2020) examined the effects of the Listening Triangle and Hot Seat strategies on listening comprehension skills in Arabic for ninth-grade students. Additionally, the research by Dewi, Sofian, and Riyanti (2020) assessed the effectiveness of the Hot Seat Game in enhancing vocabulary learning for ninth-grade students in Pontianak. Afifah's (2020) study examined the efficiency of the Hot Seat Game in improving speaking skills among students of eighth grade. Abid's (2020) research investigated the impact of the HSS on reading comprehension in middle school students in Iraq. Al-Alia's (2020) study focused on the effects of the Hot Seat Strategy on academic achievement and the development of emotional intelligence in second-grade science students in Nineveh Governorate.

It is noted from the previous studies mentioned above that they all confirmed the importance of employing the hot seat in raising achievement, treating learning difficulties, and improving the level of education, such as the study of Al-Amairah (2020), the study of Al-Mu'adidi and Al-Shahwani (2021), Al-Alia (2020), the study of Afifah (2020), Dewi, Sofian & Riyanti (2020), and Abid (2020). The current study differed in its study (the Effect of the z Seat Strategy on the Achievement of the Wave Motion and Sound Unit among Eighth Grade Students in Qalqilya).

What Distinguishes the Current Study

The current study is distinguished from previous studies by examining the impact of the hot seat method in teaching eighth-grade students. This study has benefited from previous studies and the theoretical framework in constructing its methodology, developing its tools, and selecting appropriate statistical methods. The most important thing that distinguishes the current study from other previous studies is the topic that was identified in the science subject, as previous studies did not address this topic. The researcher chose eighth-grade students as the focus of the study and its effect on academic achievement by employing the hot seat strategy. This study is also distinguished by the spatial and temporal circumstances of its implementation in Palestinian schools for the academic year 2021/2022 AD.

Study Methodology

The researcher relied on the experimental method and a quasi-experimental design in this study. This method is more appropriate to the study's nature, which is based on studying the effect of the hot seat strategy on the achievement of the wave motion and sound unit among eighth-grade students in the city of Qalqilya.

Study Population

The study population included all eighth-grade students in the 10 schools of Qalqilya city that offer this grade level, six school for girls and four for boys. According to the Qalqilya Directorate of Education's 2021 statistics, were 934 students in these schools (Education, 2021).

Study Sample

The sample was selected by randomly choosing the Girls' Qalqilya Basic School from among the ten schools with eighth-grade classes. Within this school, two sections were randomly selected: one section was assigned to the experimental group. The wave motion and sound unit were taught using the HSS. The other section was a control group that was taught the usual way. The control group members were (42) students, while the number of members of the experimental group was (40) students.

Study Tool

The study's objective is to examine the impact of the HSS on the achievement of eighth-grade students in the wave motion and sound unit in Qalqilya, compared to the conventional teaching method. A test was prepared to measure the hot seat strategy's effect on eighth-grade students' achievement in the wave motion and sound unit in the second part of the 2021-2022 academic year. The test items were based on the wave motion and sound unit content from the eighth-grade science curriculum for the second part of the 2021-2022 academic year, as taught in schools under the Palestinian Ministry of Education (government schools). The curriculum outlines were written, and the content was analyzed (Appendix G). A specifications table was created (Appendix I), leading to the development of the initial version of the post-test (Appendix D). The final test comprised ten questions: two recall questions worth 4 marks, four comprehension questions worth 8 marks, and four application questions worth 8 marks, covering the first three levels of Bloom's cognitive taxonomy. According to the analysis of the content of the wave motion and sound unit, the test was corrected based on the model answers so that the mark is calculated when the student answers correctly. Table (1) displays the difficulty level and discrimination indices for each of the test items. After correcting the students' answers to the pilot sample on this test, the difficulty level and discrimination indices for each of its items were found. Thus, the number of items in the final version of the test is (10) items.

Table (1) Difficulty level and discrimination indices for each item of the final form of the scientific concepts' detection test

Q	Difficulty level	Discrimination indices	Q	Difficulty level	Discrimination indices
1	9.5	0.048	6	52.4	0.214
2	40.5	0.190	7	52.4	0.262

3	42.9	0.238	8	50.0	0.333
4	64.3	0.310	9	54.8	0.214
5	64.3	0.476	10	21.4	0.095

First: Test Validity

In order to verify the validity of the test content, it was presented in its initial form (Appendix C) to a committee of seven arbitrators to work with their guidance on a number of paragraphs and their linguistic and scientific accuracy, the extent to which they represent the educational content and the study units to be measured, and their suitability for the level of eighth-grade students, and to record the most appropriate notes. Appropriate modifications were made based on the opinions, observations, and suggestions provided by the arbitrators.

Second: Test Reliability

The test was administered to a pilot sample of (40) female students from one of the eighth-grade sections. This sample was randomly selected from the Girls' Qalqilya Primary School, which is part of the Qalqilya Directorate of Education. After correcting the responses of the pilot sample to the test and modifying it to its final form, the test was re-administered to the same pilot sample. The time taken for the first and last student to submit their test papers was monitored, and the average time was recorded as one class period (40 minutes). After that, the reliability coefficient was calculated using the Cronbach Alpha equation for the purposes of this study, and its value was (0.83). Thus, the test has a high degree of reliability, which confirms the clarity of the questions and the understanding of the content of the questions (Al-Kubaisi, 2008, p. 32).

Study Procedures

The study procedures included the following steps:

a. Reviewing the theoretical literature and previous studies to determine the following:

1. The foundations of the educational guide include the characteristics of eighth-grade students, the objectives of this stage, and the principles and conclusions of the hot seat method.

2. Identifying the educational guide's components, including objectives, content (the study unit to be taught), classroom activities, and educational media and techniques.

b. Identifying the individuals selected for the study, who are eighth-grade students in schools within the Qalqilya Directorate of Education.

c. Identifying the topics within the study units, including wave motion and sound, as part of the eighth-grade science curriculum.

d. Presenting the initial version of the educational guide to a group of science specialists, including science teachers and supervisors, to assess the effectiveness and appropriateness of the "Hot Seat" strategy for eighth-grade students from several aspects: presentation method, sequence of models, clarity of ideas, and suitability of educational resources, ensuring alignment with the study's objectives.

e. Applying the strategy with a group of eighth-grade students as a pilot (exploratory) group to gather feedback and observations for adjustments and teaching the study units according to the "Hot Seat" strategy.

f. Obtaining official permission from the school administration to implement the study.

g. Analyzing the data and presenting the results.

h. Discuss the results, compare them with previous studies, and write recommendations.

Study Design

The study design can be outlined as follows:

- G1R: X O

- G2R: – O

Where: G1: Experimental group, X: Treatment using the "Hot Seat Strategy", G2: Control group, O: Achievement test in Science and Life on wave motion and sound unit, and R: Random selection.

Study Variables

The study variables are defined as follows:

Independent Variable: The teaching method has two levels: the Hot Seat Strategy and the traditional method.

Dependent Variable: Academic achievement in the Science and Life test for eighth-grade students on the unit of wave motion and sound.

Statistical Analysis

The current study statistically processed the data collected from the field study using the SPSS. The next statistical methods were employed:

- Measures of central tendency; arithmetic means (AM).

- Standard deviations (Sd.).

- Independent samples t-test.

Study Results

Results related to the first main question:

What is the impact of the HSS on the academic performance of eighth-grade students in Science and Life Subjects (SLSs) in schools in Qalqilya?

The main question can be addressed by formulating the following hypotheses:

First hypothesis: There are no statistically significant differences at the level (α=0.05) between the mean scores of eighth-grade students on the achievement test in Science and Life subjects, attributable to the teaching strategy (Hot Seat vs. traditional).

To test the hypothesis, AM and Sd of eighth-grade students' achievement were calculated for both pre-test and post-test, according to both groups. An independent samples t-test was used, as shown in Table (2).

Table (2) AM and Sd of eighth-grade students' achievement and the independent samples t-test for both groups

Group	No.	AM	Sd	t value	DF	Sig.
Experimental	40	14.03	4.76			
Control	42	8.04	6.23	4.87	80	000

Table 2 demonstrates noticeable differences in the AM of eighth-grade students' achievements between the experimental and control groups. To determine if the observed differences were statistically significant, a t-test was performed on two independent samples. The previous table indicated that there were statistically significant differences at the α = 0.05 level, attributed to the use of the hot seat strategy in teaching Science, affecting the achievement of eighth-grade students in both groups. The t-value was 4.87, with a significance level of 0.000, indicating statistical significance. This suggests that the strategy positively impacts the achievement of eighth-grade students.

Results Related to the Sub-Questions

Sub-Question 1:

• How does the hot seat strategy impact eighth-grade students' memorization achievement in SLSs in Qalqilya City schools?

This sub-question can be addressed by formulating the following hypothesis:

Second Hypothesis: No statistically significant differences at the (a=0.05) significance level between the mean scores of eighth-grade students in the experimental and control groups on the achievement test at the memorization level, attributed to the teaching strategy (traditional vs. Hot Seat).

AM and Sd were calculated to test the second hypothesis, and a t-test for two independent samples for using the hot seat strategy on memorization level achievement among eighth-grade students according to both groups, as shown in Table No. (3).

Table (3) AM, Sd, and t-test for two independent samples for using HSS among eighth-grade students according to the memorization level for the group (experimental, control)

Group	No.	AM	Sd	t value	DF	Sig.
Experimental	40	3.4	0.93	4.338	80	0.001
Control	42	2.1	1.22			

Table (3) shows statistically significant differences at the 0.05 significance level for using the "Hot Seat" strategy in teaching Science on memorization level achievement among eighth-grade students, according to group (experimental vs. control). The t-value was (4.338) with a

significance level of (0.001), which is statistically significant. This indicates that using the HSS in teaching science affects the achievement of memorization levels among eighth-grade students.

Results Related to the 2nd Sub-Question:

• How does the hot seat strategy impact eighth-grade students' achievement in understanding SLSs in schools in Qalqilya city?

To answer this sub-question, the next hypothesis was formulated:

Third Hypothesis: There are no statistically significant differences at the 0.05 significance level between the mean scores of eighth-grade students in the experimental and control groups on the achievement test at the understanding level, attributed to the teaching strategy (traditional vs. Hot Seat).

To test the third hypothesis, AM, Sd, and tests were calculated for two independent samples to determine the use of the HSS for teaching Science in the understanding level achievement among eighth-grade students according to both groups, as shown in Table (4).

Table (4) AM, Sd, and independent samples t-test for the use of the "hot seat" strategy for teaching Science in understanding levels according to group (Experimental, Control)

Group	No.	AM	Sd	DF	t value	Sig.
Experimental	40	5.28	2.30			
Control	42	2.18	2.72	80	5.549	0.0001

Table (4) shows apparent differences between the AMs using the HSS for teaching science and the understanding level achievement of eighth-grade students, according to both groups. To find out whether these apparent differences were statistically significant, a t-test was used for two independent samples to use the HSS for teaching Science in the understanding level achievement among eighth-grade students according to both groups

Table (4) shows statistically significant differences at (α=0.05) for using the HSS for teaching Science in understanding level achievement among eighth-grade students according to the (experimental and control) groups. The value of (t) reached (5.549) with a statistical significance of (1.0000). This means that using the hot seat strategy for teaching science has an effect on understanding level achievement among eighth-grade students.

The results in the previous table show that the differences were in favor of the experimental group, which was exposed to using the hot seat strategy to teach Science to the understanding level, compared to the members of the control group, who studied according to the traditional teaching method.

Results related to the 3rd sub-question:

• What impact does the hot seat strategy have on eighth-grade students' achievement in the application level of SLSs in schools in Qalqilya city?

To address this sub-question, the following hypothesis was formulated:

Hypothesis 4: There are no statistically significant differences at (α=0.05) between the mean scores of eighth-grade students in the experimental and control groups on the achievement test at the application level, attributed to the teaching strategy (traditional, hot seat).

To test Hypothesis 4, the arithmetic means and standard deviations were calculated, and an independent samples t-test was conducted to assess the use of the HSS for teaching Science at the application level of eighth-grade students, according to (experimental and control) group, Table (5).

Table (5) AM, Sd, and independent samples t-test for the use of the "Hot Seat" strategy for teaching Science on achievement at the application level according to group (Experimental, Control)

Group	No.	AM	Sd	DF	t value	Sig.
Experimental	40	3.78	1.750			
Control	42	2.46	2170	80	3.003	0.0004

The previous table shows apparent differences between the means for using the HSS for teaching science on achievement at the application level for eighth-grade students, according to both groups. A t-test was employed for two independent samples using the hot seat strategy for teaching science in the achievement at the application level among eighth-grade students according to both groups to determine whether these apparent differences were statistically significant.

The previous table displays that there are statistically significant differences at (α = 0.05) for using the hot seat strategy for teaching Science in the achievement at the application level among eighth-grade students according to the group (experimental, control). The value of (t) reached (3.003) with a statistical significance of (0.004), which is a significant value. This means that the hot seat strategy for teaching science has an effect on achievement at the application level among eighth-grade students.

The results in the previous table show that the differences were in favor of the experimental group, which was exposed to using the hot seat strategy to teach Science at the application level, compared to the members of the control group, who studied according to the traditional teaching method.

Discussion of Results

Discussion of the Main Question Results: To discuss the results of this question, the results of the 1st hypothesis formulated about it were examined as follows:

Discussion of the Results for 1st hypothesis: There are no statistically significant differences at (α=0.05) between the mean scores of eighth-grade students in both groups on the achievement test, attributed to the teaching strategy (hot seat, traditional).

The results displayed statistically significant differences at the significance level (α=0.05) regarding the use of the "hot seat" strategy for teaching Science in the achievement of eighth-grade students, according to the group (experimental, control). The differences were in favor of

the experimental group, who were exposed to the HSS, compared to the members of the control group, who were taught using the traditional method.

This result can be interpreted by suggesting that the “hot seat” strategy may place the learner at the center of the educational process by constructing questions and formulating answers, which likely enhances their knowledge and achievement.

It may also be significant for teaching students and motivating them to explore new areas of learning and scientific facts. The “hot seat” strategy enhances educational performance by making learners more attentive to the educational content that the teacher aims to teach and elaborate on. Consequently, students achieve better results compared to their peers who are taught using traditional methods, demonstrating greater academic success.

The results of this study are consistent with the findings of Al-Mu’adidi and Al-Shahwani (2021), which showed that the experimental group, which studied using the flipped classroom and “hot seat” strategies, outperformed in biology achievement and critical thinking development among fourth-year scientific students.

Discussion of the Results for the 1st Sub-Question: To discuss the results of this question, the results of 2nd hypothesis were examined:

Discussion of the Results for 2nd hypothesis: There are no statistically significant differences at (α=0.05) between the mean scores of eighth-grade students in the experimental and control groups on the achievement test at the memorization level, attributed to the teaching strategy (traditional, hot seat).

The results indicated statistically significant differences at (α=0.05) regarding the use of the "hot seat" strategy in teaching Science on achievement at the knowledge and memorization levels for eighth-grade students, according to the group (experimental, control). This means that using the “hot seat” strategy in teaching Science on achievement at the memorization level among eighth-grade students has an effect. The differences were in favor of the experimental group, who were exposed to the “hot seat” strategy for teaching science at the memorization level, compared to the control group members who were taught using traditional methods.

The interpretation of this result is that the student, by playing the role of discussant in this strategy, may create a dialogic environment where they receive and discuss information, thereby enhancing their memorization ability. This is achieved by making the student the central focus in the classroom through formulating and answering questions. This positively impacts academic achievement as the student exerts personal effort by taking on the role of discussant in interactive dialogue and answering questions. This process involves researching, observing, comparing, classifying, and generating ideas rather than simply receiving information provided by the teacher. It signifies a shift from traditional rote learning to a broader learning process.

This result is consistent with the findings of Dewi, Sofian, and Riyanti (2020), which showed that the “hot seat” game significantly impacts students’ mastery and knowledge of vocabulary.

Discussion of the Results for the 2nd Sub-Question: To discuss the results of this question, the results of 3rd hypothesis, which was formulated as follows, were examined:

Discussion of the Results for 3rd hypothesis: There are no statistically significant differences at the significance level (α=0.05) between the mean scores of eighth-grade students in the experimental and control groups on the achievement test at the understanding level, attributed to the teaching strategy (traditional, hot seat).

The results indicated statistically significant differences at (α=0.05) regarding the use of the "hot seat" strategy in teaching Science on achievement at the understanding level for eighth-grade students, according to both groups. The differences were in favor of the experimental group, which studied using the "hot seat" strategy for teaching science at the understanding level, compared to the control group members, who were taught using traditional methods.

This result suggests that this method may develop the student's curiosity and thus provide him with a high level of understanding of the facts that are being discussed with others.

This is achieved through the activity and competition that this strategy provides during learning, engaging the student's senses. This makes learning more enjoyable and stimulating by offering numerous opportunities for active interaction between learners and educational components. It ensures the development of curiosity and enjoyment in completing assignments, breaks the daily routine of traditional teaching, and increases interaction among students, thereby raising optimism and self-confidence.

This result is reliable compared to the results of the Al-Amairah study (2020), which showed the effectiveness of employing the hot seat strategy to teach reading texts in improving the sixth grade's reading comprehension and developing critical thinking skills.

Discussion of the Results for the 3rd Sub-Question: To discuss the results of this question, the results of the 4th hypothesis that was formulated were discussed:

Discussion of the results for 4th hypothesis: There are no statistically significant differences at (α=0.05) between the mean scores of eighth-grade students in the experimental and control groups on the achievement test at the application level, attributed to the teaching strategy (hot seat, conventional).

The results revealed statistically significant differences between the means for using the HSS in teaching Science at the application level for eighth-grade students, according to both groups. The differences were in favor of the experimental group, which was exposed to the "hot seat" strategy, compared to the control group members who experienced traditional teaching methods.

This result may be interpreted as meaning that when the student becomes the focus of discussion with the teacher through the hot seat strategy, their knowledge application levels increase.

This strategy involves linking the lesson topic to the learner's real life, thus transitioning from merely receiving knowledge to applying it. It develops several skills through this strategy, including reading educational material, constructing and asking questions, and exchanging ideas. These activities enhance learners' abilities, stimulate their curiosity, encourage research and inquiry, and promote the development of practical scientific behavior.

This result is consistent with the results of Abid's study (2020), which showed the importance of the strategy because it increases students' motivation and makes the lesson more enjoyable

and effective. It is also consistent with the results of Al-Alia's study (2020), which showed the effectiveness of the experimental group in achievement and emotional intelligence.

Recommendations and Suggestions

Based on the results reached by the study, the following is recommended:

1. Encourage researchers to conduct broader studies in the Sciences and Life on the hot seat and other active learning strategies due to their impact on improving achievement.

2. Encourage teachers to adopt such strategies across various educational levels due to their positive impact on enhancing student achievement and improving academic levels.

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