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THE EFFECTIVENESS OF USING THE THINK–PAIR–SHARE STRATEGY IN ACQUIRING CHEMICAL CONCEPTS BY SORAN UNIVERSITY STUDENTS IN THE SUBJECT OF CHEMISTRY

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ABSTRACT

The research aimed to identify the effectiveness of using the Think-Pair-Share strategy in acquiring chemical concepts by Soran University students in the subject of chemistry. The researcher used the equally groups design, an experimental group studied according to the Think-Pair-Share strategy and a control group according to the Usual method. The population of the research are students in the second class at the General Science department, for the academic year (2020-2021), the research sample included (62) students divided into two groups, the experimental group, included (33) students, and the controlled group, included (29) students. The researcher prepared a test to acquire chemical concepts included (45) items of Multiple Choice. The results have shown that using the Think-Pair-Share Strategy in teaching the chemistry subject has a positive impact on increasing students acquiring chemical concepts the researcher recommended the importance of using the Think-Pair-Share, also procedures for some further future studies have been suggested.

KEYWORDS: THINK-PAIR-SHARE, STRATEGY, CHEMICAL CONCEPTS, TEACHING CHEMISTRY.

1. Introduction

Education is a torch that directs humanity in the right direction to rise. The aim of education is not just to make a student well-educated but makes them have self-awareness, good quality of thinking, and become independent person. For educational institutions to be able to develop, they must possess the confidence and a tendency to change. In the scholarly area, formal education and learning occur in the scholastic conditions on a persistent

premise. Most importantly, different degrees of education and realisation which incorporate both formal and casual learning require explicit abilities, strategies, or techniques to provide a sufficient amount of the fundamental data to the student. The objectives, points, and goals of education are for the student to learn. What is more, the proof that learning has been accomplished is the lasting change delivered in the students' knowledge (Amadioha, 2017).

Universal societies alter because of the effect of science, modern technologies and advancement in the economy. The electronic change alters each portion of science and technology in a however obscure rigid path. Shortly everyone will have access to practically unlimited information and facts. Universities play a significant role in making learners ready for a (labour market) which is certainly going towards the use of developing technologies. The last century's solutions and thinking are not going to get the job done in the 21st century (Kamp, 2019).

Positive interdependence within the framework of cooperative learning is fundamental to university education and other educational institutions; it is used to develop students' thinking and communication skills since it is based on making the most of what students have. In addition, in cooperative learning sessions, students formulate the problem or situation in their way to understand others and share their solutions with the class using social communication skills (Cindy E, 2013).

Research at universities showed that collaborative learning has two important roles which include raising the level of learning and increasing the outcome of students inside the classrooms, which

also became the reason for fastening the social ties between students and teachers (DiMarco, 2010).

Hence the need to use modern strategies and methods in teaching chemistry to move to teach Chemistry from the usual method to a modern method that aims to improve the student's thinking and make the student a centre in the educational process through his participation in the process of thinking and making decisions to solve problems.

Think-Pair-Share (TPS) is one of the cooperative learning strategies that include three basic components that give student time for thinking, time for sharing with a partner and time for sharing with the whole class, in other words, it gives the student an opportunity for reflection internally within himself, and externally with his colleagues, and to think and review before answering and then cooperation and participation in ideas and collaborative solution (Zaitoun, 2015).

The Think-Pair-Share strategy is characterized as a strategy that does not require a long time to implement, and its steps are specific and simple that can be applied easily as it supports improving students' communication skills through discussing their ideas with each other (Gunter, 1999).

In universities, a variety of teaching strategies have been used in teaching science. It is confirmed that it is anticipated of an educator to execute an expend of guideline procedure that will bring scholastic victory to all the science learners. The strategy that could have a positive outcome should emphasize strengthening the social relationship among the students and teachers and among the students themselves as well which causes increasing learning

levels. Researchers emphasize the necessity for the learners to be given a steady, open and collaborative atmosphere as this may assist them to find information extend because the most common strategy for teaching science is the lecture and presentation strategy (Aina, 2015).

Chemistry is an important branch of science that practically determines the structure of materials in a laboratory (Johari Surif, 2013) It is the science that systematically studies the composition, properties, and activity of organic and inorganic substances and various elementary forms of matter (Helmenstine, 2012).

The studies showed that chemistry is characterized by the presence of interrelationships between scientific concepts, many transformations, and multiple applications to chemical principles, which increases the difficulty of learning and decreases students' ability to solve their problems, and that there are limitations in students' achievement of some chemical concepts, whether they are tangible or abstract is much higher than the ability to apply it. Therefore, global trends and projects are calling for the importance of the main structure for designing the chemistry curriculum in the school around applied chemistry, and the importance of understanding concepts that show the benefits of chemistry and its connection to the student's life, and from the concepts associated with branches of chemistry such as analytical chemistry, organic, bio-environmental, industrial, etc. (El Sarayreh, 2017).

Concepts are the basic building blocks for building principles, theories and higher thinking processes, and they are considered of great importance not only because they are the threads that make up science, but because they provide the learner with a means helping to follow up the growth of the knowledge, in addition to

simplifying the tasks of education, and helps to store similar information effectively, and it helps us to deal with the knowledge as one structure instead of dealing with specific parts (Khader, 2006).

Normal development of acquiring concepts depends upon the capabilities to abstract, generalize, categorize and prove the relationships between symbols and referents. Students with disabilities often do not prove this usual development of concept formation. Personal experience or observation of the events is unable to learn concepts accurately due to external and internal difficulties. Students who are not self-sufficient, suffer from a lack of acquisition of concepts and skills in informal or naturally occurring situations (Prater, 1993).

Chemical concepts and their acquisition are the main goals of learning chemistry, as it is what gives scientific knowledge its flexibility and allows it to be organized, and is one of the most important aspects of learning science, as it helps learners to organize experiences, remember knowledge, realize perceptions, link them to their sources, and facilitate access to them, and that clarity of concepts and terms necessary for understanding and assimilation, and achieving scientific understanding and communication (El-Khatayba, 2005).

1.2 Research Problem

Teaching chemistry depends on methods that lead to the student's understanding of theoretical lectures, as well as scientific experiments taking place in the laboratories, and there has been a great development in the methods of education today, so it is necessary to deviate from the accepted pattern in education that

depends on indoctrination and resort to innovative methods to obtain a higher success rate among students. It is known that each subject has a method of teaching that differs from the method used for another subject, as the scientific subjects depend on thinking and obtaining solutions to problems, and chemistry is from applied sciences; therefore, the best way to teach it is to be based on scientific activity and the sequence in persuading the student piece of information, feels like it is discovered by this method in the experiment carried out.

Through working as teaching staff in a chemical laboratory in the faculty of education at Soran University, the researcher noticed the dominance of accidental methods in teaching chemistry despite their weak feasibility in teaching chemistry achieving the goals of teaching chemistry and a lack of students' in enquiring chemical concepts with the subject of chemistry, their lack of willingness for the material. Besides, the teachers of chemistry subject may suffer from a lack of time and the difficulty in completing the course, due to following the usual method (Traditional) to explain the scientific material to the students by the teacher, and then give questions and problems to solve at home however, students are often exposed to forgetting what the teacher has explained during the lesson, because they just memorize the information without thinking about what they do, or to reduce their ability to write notes during the teacher's explanation, because of depending on lecture methods. Because the effectiveness of teaching science in general and chemistry, in particular, depends on the use of teaching methods and strategies that encourage students to discover and discuss as well as practical activities, accordingly, achieving the objectives of teaching chemistry depends on developing scientific thinking, scientific trends and tendencies, developing practical skills and acquiring scientific concepts.

Hence, the researcher believes that teaching analytical chemistry using the Think-Pair-Share strategy can help students acquire chemical concepts and develop their scientific thinking skills.

The current research problem can be framed with the following question:

(What is The Effectiveness of Using Think-Pair-Share Strategy in Acquiring Chemical Concepts by Soran University Students in the Subject of Chemistry)?

1.3 Importance of the Research

The Current research derives its importance from the following points:

1 Providing support and assistance to the instructors of analytical chemistry for second class students in the Department of General Sciences to improve their teaching of chemistry and enrich the learning environment using the Think-Pair-Share strategy which depends on a student-centred approach.

2 The research may help benefit from various educational courses and all educational stages, with a realistic vision of the extent to which students benefit from the use of the Think-Pair-Share Strategy.

3 It encourages decision-makers at the university to develop training programs and materials based on the Think-Pair-Share strategy, and teacher training.

4 This research, according to the researcher's knowledge, is the first educational research that applies the effectiveness of using the Think-Pair-Share Strategy in acquiring chemical concepts at the university level in the subject of chemistry by 2nd class students in the subject of analytical chemistry in Iraq in general and Kurdistan region in particular.

Aim of the Research

This research aims to identify the effectiveness of using the Think-Pair-Share strategy in acquiring chemical concepts by Soran University students in the subject of chemistry.

1.5 Research Hypotheses

According to the aims of the research, the following hypotheses are formulated:

There is no statistically significant difference at the significance level (0.05) between the average degrees of the students in the experimental group in which the students have been taught according to the Think-Pair-Share Strategy and the average degrees of the students of the control group in which they were taught according to the Traditional Method in the Acquiring chemical concepts.

1.6 The scopes of the Research

This research is limited to:

1. 2nd class students in the general science department at Soran University.
2. The third semester of the academic year (2020-2021).

3. Subjects of analytical chemistry: (Analytical Chemistry and Chemical Composition, Units of Concentrations, Stoichiometric Relationship, Equilibrium - constant expressions (K), Relation between dissociation constants for conjugate Acid-Base pairs, Equilibrium constant for slightly salts and common ion, Buffer solution, Acid-base indicators, Precipitation titrations, Gravimetric methods).

1.7 Definition of Basic Terms

The following terms will be used regularly in the study according to these definitions:

1.1.1. 1.7.1 Strategy

- Zaitoun (2015) believes that the strategy is a set of teaching procedures chosen by the teacher that are planned to be used during the implementation of the lesson to achieve the desired teaching goals and as effectively as possible (Zaitoun, 2015).

- Haji and Aldershewi (2019) state that strategy is: a basic step that is planned by the teacher to achieve and reach the objectives of the lesson so that learners can perceive, understand and apply the content of the subject of the lesson (Haji, 2019).

The researcher defined the Strategy theoretically as: a plan which includes the desired educational goals, methods, techniques, styles, and procedures that are performed by the teacher to achieve the educational goals of students.

1.1.2 1.7.2 Think-Pair-Share strategy

- Allen & Tanner (2002) defined (The think-Pair-Share) strategy as a strategy in cooperative learning which it consists of three steps: allowing students time to think individually about a suggested question, forming pairs, invite the pairs to share their thoughts with the whole class (Allen, 2002).

- Obaid (2009) defines it as one of the collaborative learning methods that helps provide opportunities for individual thinking (without anyone interrupting), and everyone will present his opinion to his colleague, to collaborative participation, and peer exchange education, as it includes a contribution for all class students at work (Obaid, 2009).

- Rakha (2016) mentioned Guilford's (2002) definition which believes that the (think-pair-share) strategy is one of the collaborative learning methods, that allows students time to think individually about a question related to the topic of the lesson, and after that, they will become pairs with their mates to make them share their thought, and finally, the pairs will choose one main idea to share it to the whole class (Rakha, 2016).

The researcher defines the Thing-Pair-Share strategy procedurally as an educational strategy that aims to teach 2nd-year students at the general science department the topic of analytical chemistry collaboratively based on three steps: (think, pair, and share) that the researcher adopted in teaching the experimental group to acquire the chemical concepts and develop their scientific thinking.

1.7.3 Acquiring

- Abu Jadu (2000) stated that Acquiring is the first stage of education during which the individual represents the new behaviour to become a part of his/her behavioural outcome (Abu Jadu, 2000).

- Al-Atiya (2017) mentioned the definition of Darwaza (1995) as a process in which the student acquires the concept through his/her ability to define, apply and distinguish in new educational situations, and give examples of it (Al-Atiya, 2017).

The researcher defines Acquiring procedurally as students' ability of the research sample to define, distinguish and apply the concepts which include the chemistry subject in the research experiment, and this ability is measured by a test that is prepared for this purpose, as it is used to measure the number of chemical concepts that have been acquired and are applied at the end of the experiment.

1.1.4 1.7.4 Chemical concepts:

- Abu Zaidah (2006) defined it as "a mental perception expressed through a word, symbol, or group of objects and creatures, or accidents that share one or more specific characteristics while ignoring other characteristics" (Abu Zaida, 2006).

- Lynn Erickson defined it as a mental construct that is timeless, universal and abstract or a set of specific objects, symbols, or events that share common characteristics (critical attributes)

and can be referenced by a particular name or symbol (Kaur, 2016).

The researcher defines chemical concepts procedurally as the mental image formed by 2nd class students in the general science department at Soran University of abstracting the common characteristics of chemical phenomena in the subject of (analytical chemistry) and it consists of defining the concept, distinguishing the concept and applying the concept and it is measured by the degree obtained by the students in the acquiring chemical concepts test prepared for this purpose.

2. Theoretical background and related previous studies

First: Theoretical Background

2.١ Think-Pair-Share Strategy

In light of the science and technological revolution and the rapid and successive cognitive development that characterizes our time, it showed mankind has a clear interest in the educational learning process, so it has become imperative for the educational system with all its elements, to keep pace with this rapid change (Al-Najjar, 2013).

Collaborative learning is one of the most important active learning strategies with meaning, as an alternative learning process to the usual learning system where small learning groups are formed so that the learners work together to achieve the possible maximum educational benefit, because the more cooperation, the more reflected on its achievement (Zaitoun, 2003).

At this point, several strategies have appeared that use the modern teaching process; one of the main strategies is the Think-Pair-Share strategy.

Al-Ahmad and Youssef believe that the Think-Pair-Share strategy is one of the collaborative learning strategies that depend on the positive interaction between group members in light that they are all working to achieve required goals. Following this pattern in education is one of the important steps to enhance the educational process because it is dependent on students' group work, cooperation with each other, and the exchange of views and ideas to reach a better understanding of the educational material (Al-Ahmad, 2010).

Think-Pair-Share has been advanced by Frank Lyman (1981) and helps students taking part in classrooms. This strategy led to making all students answer the teacher's questions instead of using an essential recitation way in which the teacher asks a question and one learner gives the answer (Fisher, 2005) (Sejnost, 2009).

The teacher asks an inquiry, preferably one requesting examination, assessment, or formation, and gives learners 30 seconds or more to think through a suitable answer (Think). The thinking time can moreover spend writing down the answer. After this " hold up time", learners at that point turn to teammates and share their feedback, hence permitting time for both practice and quick feedback on their thoughts (Pair). During the third phase, learners' feedback can be shared inside learning clusters, inside bigger clusters, or with the whole class individuals amid a follow-up conversation (Share) (Millis, 2012).

Al-Deeb emphasized that after asking the question, some teachers will not give enough time to learners to think before answering, to enable the instructors to choose one of the students to offer a response, and then the rest of the students stop thinking about the query (Al-Deeb, 2006).

To overcome this problem, Frank Lyman concentrated on how to pose inquiries or questions cooperatively, and the outcome was the technique he called (think-pair-share), where he tracked down the sections that effectively utilize the strategy (think-pair-share) to invigorate a more profound degree of thinking. It builds students' answers and decreases the degree of dread, embarrassment, and fear among the students. Furthermore, numerous students feel that they are part of the educational process (Canady, 1996).

Think-Pair-Share strategy suits the conditions and capabilities of our available schools and is also compatible with the objectives of most subjects. Thus, this strategy is considered to have a logical sequence, and it is among the strategies that are adopted in the activity of the students, which is the focus of the educational process, and it consists of three steps or stages (individual thinking - bilateral discussion - group participation) so that a step does not begin without the completion of the previous step (Khalifa, 2016).

(Lutfullah, 2005), (Abu Ghaly, 2010), (Al Deeb, 2015) and (Abu Ali, 2016) decided that the Think Pair Share strategy is one of the effective collaborative learning strategies and consists of three steps:

1. Thinking about it: Each student thinks on his/her own about the problem or question posed to him/her.

2. Pairing: in which each student discusses one of his ideas to one of his colleagues.
3. Sharing: in which the students of the whole class (as groups) participate in what ideas they have come up with of ideas.

Stuever (2007) mentions that the Think-Pair-Share strategy gets students into a state of thinking about their answers first and then allows them to discuss their ideas with one of their classmates before sharing those ideas with the class as a whole (Stuever, 2007).

2.١.1 Characteristics of Think-Pair-Share Strategy

(Zeitoun, 2007), (Carss, 2007), (Al Deeb, 2015), (Al-Najjar, 2013), (Khalifa, 2016) (Abu Ali, 2016), (Allen, 2002), (Lutfullah, 2005) and (Abu Ghaly, 2010) mention some of these characteristics:

1. The (Think-Pair-Share) strategy is a simple and easy-to-use strategy that does not take long to prepare and implement, allows for meaningful interaction, and facilitates the process of understanding and the development of cognitive awareness.
2. It suits the conditions and capabilities of our available classes; It is suitable for use with large numbers of students, as it is compatible with the goals of most subjects.
3. It provides the opportunity for students to learn from each other and test their ideas in an environment without fear and anxiety before daring or adventuring by announcing their ideas in front of the class students, and then the learner's self-confidence increases.

4. It provides an opportunity for students to be active and effective in their learning process. It enables all students to participate effectively in the learning process in the classroom. This helps the learning effect to remain.
5. It helps students acquire and access information on their own. It also enables them to think critically, analyze information and reach a deeper understanding of the topic of the lesson.
6. The Think-Pair-Share strategy allows all students to co-discuss their ideas with a partner to find a solution, and this process is important because students' cognitive structure begins to form through those discussions.
7. Students' oral communication skills are developed by discussing ideas with each other, and it also provides opportunities for training in some desired social skills.
8. Sharing the student's answer in a public venue forces the student to organize the new information gathered from the dialogue with the peer in a comprehensible manner.
9. It develops multiple skills such as prediction, communication, reasoning and others among students.

2.١.2 Steps to implement the strategy:

This strategy should proceed according to the following steps:

First: The Thinking Step

The (think-pair-share) strategy begins when the teacher asks the whole class a question that provokes thought or a problem related to the topic of the lesson; to search for a solution to it, then the teacher asks the students to think of each of them individually to solve the issue or problem posed, and gives them a specific time

to think individually, and time for individual thinking is determined based on the students' knowledge and the nature of the question posed and the degree of its complexity (Al Deeb, 2015).

Stuever (2007) adds that the teacher can use cards in this step and distribute them to the students; to write in them their ideas that they have reached individually, and this often helps to maintain calmness in the class in this step and independence in thinking, and the teacher is thus able to check the level of knowledge of the students and thus evaluate them individually (Stuever, 2007).

Second: The Pairing Step

The teacher asks the students to divide into pairs, and discuss what they thought. Each student discusses and shares his ideas and his answer that he reached in the thinking step with his colleague sitting next to him, and each tries to clarify his point of view to his colleague and convince him of the correctness of his idea, as they exchange opinions and ideas until a common answer is reached that they agree on together (Stuever, 2007).

Third: The Sharing Step

This step includes two options, one of which the teacher can use:

a. Either the teacher invites the pairs to share their thoughts on the question posed with the whole class; each pair receives questions and inquiries from the students of the class, and they try to answer them and provide evidence and proof of the correctness of the answers they have reached, and one of the effective practices is to move easily from one pair to another and continue like that; so that a quarter of the pairs can present what they have thought and come up with, and

the teacher can record the answers on the board or the display.

b. Or for each pair of the disciples to share another pair; To make a square of students, and become a working group of four students discussing and thinking together until they reach one answer that they agree on is correct and presented to the rest of the groups in the class. This will also save time and effort for the teacher; For example, instead of the teacher discussing 20 pairs of students, he will discuss 10 groups at the same time (Al-Deeb, 2006).

From the above, it is clear that the Think-Pair-Share strategy proceeds according to sequential steps that make the learning environment full of what excites and motivates students to think about the questions and problems presented to them. It also helps in coherence and cohesion of all sides of the educational situation, from the teacher, student, and subject; This creates an integrated cooperative society that helps learners to think and express their ideas freely without shame or hesitation.

2.١.3 Problems that hinder the use of the (think-pair-share) strategy:

Despite the educational importance of this strategy in teaching chemistry, there are some difficulties and problems facing teaching with this strategy, after noticing it while implementing the strategy, we enumerate them as:

1. The domination of a limited number of outstanding students and the most collecting of posts and discussions, as a result, the rest of the class students might miss the chance to

participate actively, which reduces the effectiveness of this strategy in achieving the lesson objectives.

2. A misunderstanding occurs between students, especially in the pairing and sharing stages, as a result of the difference in viewpoints and the insistence of each on his opinion, which causes a quarrel among the students.
3. The teacher may not commit to the time specified for each step of the strategy, which affects the rest of the educational activities.
4. The problem of classroom management, where chaos can prevail in the classroom and there is a lot of noise, especially in the pairing and sharing stages, so the teacher must manage his class successfully so that the desired goals of this strategy are achieved.
5. The teacher may give up his role of follow-up and guidance during the discussions and thus not be able to know the wrong ideas of the students; which makes it difficult for him to amend them, and clarify the points that are still vague to them.

2.٢ Chemical concepts:

The knowledge pyramid in science consists of a set of components, including facts, scientific concepts, scientific principles and generalizations, scientific rules and laws, and finally scientific theories. Scientific concepts are the building blocks of science, they are the basis for learning science, as the rest of the components that represent the knowledge pyramid, depend on them (Araam, 2012).

The process of acquiring and developing scientific concepts during the various stages of education is one of the goals of science

studies, and the process of developing scientific concepts is one of the most difficult educational tasks assigned to science teaching (Mustafa, 2014).

Learning scientific concepts get into the heart of learning science, because concepts are the basic building blocks of knowledge and among the most prominent outcomes of science through which scientific knowledge is organized in a meaningful way, they are the organizing elements and principles guiding any scientific knowledge that is acquired in the classroom, laboratory or any other place. Chemical concepts represent a field of scientific concepts or what is known as concepts of science in general, as these concepts are related to chemistry, which as a branch of science is concerned with the study, analysis and interpretation of natural materials in the light of the principles, laws, and theories of this science (Ranellucci & et al, 2013).

The chemical concepts formation for students of different educational levels requires an appropriate teaching method that includes the integrity of their formation, growth, and retention, especially since the formation and growth of concepts do not stop at a certain limit, but rather increase in depth and breadth as the student grows and increases his knowledge and experience. Therefore, the concept must be formed according to a logical system in which new experiences are based on previous experiences, and pave the way for later experiences (Zhou, 2010).

Darwza (2005) defined chemical concepts as a group of subjects, symbols, elements, or incidents that have combined common distinct characteristics so that each part of them can give the same name. Concepts are the group of categories that fall within its framework are similar elements with common

characteristics, so that the student can classify these elements under the same name (Darwza, 2005).

Brunner defines it as a continuum of inference referring to a set of observed properties of an object or event that leads to the identification of a particular category that entails additional inferences about unobserved properties (Qurban, 2010).

2.٢.1 Characteristics of scientific concepts:

Scientific (chemical) concepts are characterized by a set of characteristics that distinguish them from other components of scientific knowledge, and among these characteristics, as identified by (Zaitoun, 2004) are as follows:

1. The scientific concept consists of two parts: the noun (symbol or term-density, cell, acid...), and the verbal connotation of the concept as in Ion: An atom or group that carries an electrical charge.
2. Concepts are constantly forming and growing, varying in difficulty from one stage to another more complex stage.
3. The meanings of the same concepts differ from one person to another, due to the different levels of experience.
4. Every scientific concept has a set of distinctive properties that all members of the concept category share and distinguish it from other scientific concepts (electrons revolve around the nuclei of matter), and it has other variables or secondary properties as in the material's difference in properties: number of electrons, protons and neutrons... etc. In practice, scientific concepts are formed through three processes: discrimination, organization (classification) and generalization.

2.٢.2 Importance of learning scientific concepts:

(Araam, 2012) summarizes the importance of learning scientific (chemical) concepts in the following points:

1. Understanding the main scientific concepts makes the subject easier to learn and assimilate.
2. It reduces the need to re-learn when encountering anything new.
3. It helps to remember when the particles of the subject matter are organized into a conceptual structure.
4. It helps in directing, forecasting and planning any activity.
5. It reduces the complexities of the environment, as it summarizes and categorizes what is in the environment from things or situations.
6. It allows the organization and linkage between groups of things and events.

2.٢.3 Factors affecting learning the scientific concepts:

There are many factors affecting the learning of the scientific (chemical) concepts as a result of the nature of the learning and teaching process itself. The factors are as follows:

1. **Factors related to the student:** Among these factors are the age of the student, his willingness and motivation to learn the concept, previous experiences, and his learning levels of previous concepts which are necessary for learning new concepts.
2. **Factors related to the educational situation:** They are related to the steps involved in organizing the concept learning, such as: testing students' knowledge of the desired concepts, conducting a pre-test to know students' previous

learning, choosing an appropriate teaching strategy, selecting suitable examples of assigned concepts, provision of training and practice opportunities, and test the extent of learning the desired concepts.

3. **Factors related to the concept itself:** Among the factors related to the concept that affect its learning: are examples and non-examples, mental and non-rational qualities related to the concept's qualities, the physical and abstract nature of the concept, or feedback that takes the place of reinforcement when the answer is correct.

Second: previous related studies:

2.3 Previous Studies related to Think-Pair-Share Strategy:

1.1.5 2.٣.1 Carss (2007)

This study was done in New Zealand (Hamilton), this research aimed to describe the effects of the Think-Pair-Share strategy, used during Guided Reading lessons, on reading achievement. The study took place in a Year (6) classroom with two groups, each containing six children. One group was reading above their chronological age and the other below. Control groups reading at these levels were also used. Three variations of Think-Pair-Share were utilised during the eight-week intervention period; Predict-Pair-Share, Image-Pair-Share and Summarise-Pair-Share, and the research centred on the effects of the intervention on reading comprehension. A quasi-experimental design was employed using a pre-test and post-test. The results confirmed the positive effects of the strategy on reading achievement, especially for those students reading above their chronological age, although an extended period of intervention may have had more significant

effects on those reading below. Positive effects on aspects of oral language use, thinking, metacognitive awareness, and the development of reading comprehension strategies were noted in both groups. They demonstrate the versatility of the Think-Pair-Share strategy as a tool to foster conversation and one that can be adapted to suit the learning focus and the needs of particular groups of students (Carss, 2007).

1.1.6 2.٣.2 El-Najjar (2013)

This study was done in Palestine (Gaza), Which aimed at identifying the impact of employing the strategy of (Think, Pair, Share) in developing the collection and mediative thinking in algebra the ninth-grade female students in Khan Younis governorate. The researcher followed the procedures of the experimental approach involving the choice of experimental design test related to experimental and control groups, the experimental group was studied according to the strategy of (think, pair, share) while the control group was studied according to the normal way. The researcher chose Ahlam AL-harazin basic school in an indiscriminate way she chose the sample of study which consisted of (74) students divided equally into (37) an experimental group and (37) a control group, the study tools were academic achievement test and test of mediative thinking. The results of the study showed that there were significant differences at the level indication ($0.05 \geq \alpha$) between average grades of the experimental group and average grades of female students in the control group in post-test grades application for the experimental group. There were significant differences at the level indication ($1.15 \geq \alpha$) between the average grades of the female students' experimental group and the average grades of the control group in the post-application of mediative thinking for the experimental group. The study

recommended the use of cooperative learning strategies in the basic learning stage and other stages, particularly the strategy of (think, pair, share) (El- Najjar, 2013).

1.1.7 2.٣.3 Pardeshi (2016).

This study was done in India, (Maharashtra). The study aimed to reveal the effectiveness of using the Think-Pair-Share (TPS) strategy. As the Operating System is a core subject of computer science engineering, therefore the activity was conducted for the third-year students to improve students conceptual understanding. In this paper, one group of Pre-Test and Post-Test models are considered. The experimental results and students' feedback related to the activity are also presented. The results showed that students' understanding of the topic was analysed using pre-post test marks indicating students performed better in the post-test as compared to the pre-test. the t-Test is used to determine if two sets of data differ significantly from each other. It compares the means of two groups. For the t-Test to be significant statistically, the t value must be (2.145) and the p-value must be less than or equal to (0.05) (Pardeshi, 2016).

Previous Studies related to acquiring Chemical concepts: ٤2.

1.1.8 2.٤.1 El Sarayreh (2017)

This study was done in Jordan, (Karak). The objective of the research was to examine the effectiveness of a brainstorming method to develop chemical concepts and scientific skills of the students in grade nine in Jordan. The sample of the research was (137) female and male students in grade nine in Jordan, they were distributed into two groups; an experimental group (70) students and a control group (67) students. The experimental group received

teaching using the brainstorming method, and to achieve the objectives of the research, the following research tools were built and used: a test of chemical concepts and an observation card for scientific skills. The results showed the effectiveness of using the brainstorming method in developing the chemical concepts, scientific skills and in the post-application in the experimental group (El Sarayreh, 2017).

1.1.9 2.٤.2 Ali, Ibrahem and Al atiya (2017)

This study was done in Iraq, (Karbala). Aimed at identifying the impact of the seventh learning cycle in acquiring chemical concepts to the students of the scientific fifth grade in chemistry, and the developmental tendency among scientific fifth-grade students about chemistry. The experimental design with partial precision was chosen for two equal groups one of them is experimental and the other is control. the number of research samples was 69 students and the actual number was 34 students for the experimental group who were studied according to the seventh learning cycle and 35 students were in the control group that was studied according to the usual method. The researcher equalized statistically between the two groups, and the researcher adopted to choose the main concepts which were 20 concepts to prepare for the chemistry concepts acquisition test. Three items were given for each concept according to the three cognitive processes (definition, distinguishing, and application). The second tool was the tendency development scale test, where the researcher adopted to build a tendency scale consisting of 32 items including two detective items and each item had three options for answering. The experiment was applied in the second half of the 2015-2016 academic year. After data analysis, the researcher found statistically that good results appeared for the experimental group who studied according to the

seventh learning cycle compared to the control group who studied according to the usual method in concepts acquisition and tendency scale tests towards chemistry (Ali, 2017).

3. METHODOLOGY OF THE RESEARCH AND PROCEDURES

3.١ Experimental Design

A suitable experimental design should be chosen before starting any experimental study, to test the validity of the results derived from the research hypotheses, and the choice of the experimental design provides a great benefit to the research which guarantees the proper structure and the appropriate strategy that controls the researcher's study and his reaching results that can be relied upon in answering the research questions and the verification of his hypotheses (Van Dalen, 2007).

Therefore, the researcher relied on the experimental design of equivalent groups as it fits the current research and achieves its objectives. As this design includes two equivalent groups in several variables (Beins & McCarthy, 2012). The main function of a research design is to explain how the researcher will find answers to the research questions. The research design sets out the specific details of the research inquiry (Kumar, 2011). One of which is an experimental study according to (The think-Pair- Share) Strategy, and the other control studies according to the usual method, and also includes a pre-and post-test for the dependent variable (Scientific Thinking), and only a post-test for the dependent variable (Acquiring chemical concepts) as shown in figure (3.1):

Group	Pre-test	Independent variable	Dependent variable (Post-test)
experimental	Scientific Thinking	Think-Pair-Share Strategy	▪ Acquiring chemical concepts ▪ Scientific Thinking
Control		Usual Method	

Figure 3.1 shows the experimental design of the research.

3.٢ Research Population and Sample

1.1.10 3.٢.1 Research population:

The research Population and its sample are represented by all the 2nd class students in the Department of General Science in the Faculty of Education at Soran University which reaches (62) students for the academic year (2020-2021)[1].

1.1.11 3.٢.2 Research sample:

The researcher chose the General Science Department to apply the research experiment due to the presence of the study materials related to the student's specialization and to know the head of the department. They showed their readiness and provided the researcher with the necessary facilities to conduct the research experiment. Also, because it contained more than one class for the second class and their distribution was not subject to any condition,

١ The researcher obtained these data from the registration unit in the faculty of education, and from the general science department itself.

it facilitated the researcher to fix some variables between the two groups for parity between them.

The researcher visited the General Science Department and found that the number of classes in the second class reached two groups, and the teaching method was distributed randomly between the two groups, so the choice fell to Group (A), which became the experimental group in which the number of students was (33) who were taught using Think, Pair, Share Strategy, and group (B), became the control group, in which the number of students was (29) students who were taught according to Usual Method. Thus, the number of students in the research sample became (62) students, as shown in Table (3.1).

Table 3.1 shows the distribution of the members of the research sample in the two groups

2nd Class	Group	Teaching Method	Number of students in each group
A	Experimental	Think-Pair-Share Strategy	33
B	Control	Usual Method	29
Total			62

3.٣ Equivalent Procedure of the Two Research Groups

The researcher conducted the equivalency between the two research groups in several variables that affected the dependent variables and thus the results of the research and its accuracy. The researcher in selecting these variables was based on some previous studies and related literature, and these variables are:

1.1.12 3.٣.1 Chronological age:

Chronological age means the student's age, calculated in months. The researcher obtained the data related to this variable from the registration unit at the faculty of education, and the students themselves (Appendix 1), then calculated the chronological age of the students of the two research groups in months until 10/4/2020. So the arithmetic means the age of the experimental group students was (237.18) months and for the control group students was (236.31) months. To find out the significance of the difference between the two averages, the researcher used the t-test for two independent samples, so the calculated T-value was (0.37), which is less than the scheduled T-value which is (2.000) at the level of significance (0.05), and the degree of freedom (60), this indicates that there is no statistically significant difference and thus the two groups are equivalent in the variable of chronological age, as shown in Table (3.2).

Table 3.2 shows the arithmetic mean, standard deviation, and the calculated and schedule T-value for two group research on the chronological age variable

Group	Number of students	Arithmetic mean	standard deviation	T-value		Significance at level (0.05)
				Calculated	Schedule	
Experimental	33	237.18	9.79	0.370	2.000	Not significant statistically
Control	29	236.31	8.58			

1.1.13 3.٣.2 Intelligence Degree:

The researcher applied the Raven test for intelligence that he developed (Raven, 1983) and which (al-Dabbagh, Taqah & Komaria, 1983) codified for the Iraqi environment. The test

consisted of (60) items which were distributed in (5) groups (A, B, C, D, E) at a rate of (12) items in each group, at a rate of (6) alternatives available for each item of the group (A, B), and eight alternatives for group items (C, D, E). His score was between (0-60) and after collecting the answers of the students of the two research groups, the results showed that the arithmetic means of the intelligence quotient (IQ) of the experimental group students was (26.30) and the control group students were (27.20). To find out the significance of the difference between the two averages, the researcher used the T-test for two independent samples, and it was found that the difference was not statistically significant, as the calculated T-value reached (0.55) less than its scheduled value of (2.00) at the level of significance (0.05) and the degree of freedom (60), and this means that the two groups were equivalent in IQ as shown in Table (3.3).

Table 3.3 shows the arithmetic mean, standard deviation, and the calculated and schedule T-value for two group research IQ test

Group	Number of students	Arithmetic mean	standard deviation	T-value		Significance at level (0.05)
				Calculated	Schedule	
Experimental	33	26.30	6.10	0.55	2.00	Not significant statistically
Control	29	27.20	6.91			

1.1.14 3.٣.3 General chemistry degrees for the first semester:

The researcher obtained the final degree of the students of each group in the general chemistry subject that they studied in the first semester of the academic year (2019-2020). Then the arithmetic mean was extracted for each group by using the t-test to compare the two research groups. It was found that there were no statistically significant differences, as the calculated T-value reached (1.29), which was less than its scheduled value of (2.00) at

the level of significance (0.05) and the degree of freedom (60). This means that the two groups were equivalent in prior knowledge of the subject of the experiment as shown in table (3.4).

Table 3.4 shows the arithmetic mean, standard deviation, and the calculated and schedule T-value for the two groups, in general chemistry degrees for the first semester

Group	Number of students	Arithmetic mean	standard deviation	T-value		Significance at level (0.05)
				Calculated	Schedule	
Experimental	33	60.09	7.06	1.29	2.00	Not significant statistically
Control	29	62.34	6.58			

1.1.16 3.3.4 The overall average of the degrees of the two research groups for the first grade:

The researcher obtained the general average of the degrees of the students of the two groups in the first semester and extracted the arithmetic mean of the students of the experimental and control groups, which amounted to (60.51) and (63.05) respectively, and know the significance of the difference between the two averages, By using the T-test for comparison between the two research groups, it was found that there were statistically significant differences between the students of the two groups, and in favour of the control group, as the calculated T-value reached (2.06), which were greater than its schedule value of (2.00) at the level of significance (0.05) and the degree of freedom (60), This means that the two groups were not equivalent in the overall average as shown in Table (3.5).

Table 3.5 shows the arithmetic mean, standard deviation, and the calculated and Schedule T-value for two groups in overall average degrees

Group	Number of students	Arithmetic mean	standard deviation	T-value		Significance at level (0.05)
				Calculated	Schedule	
Experimental	33	60.51	4.96	2.06	2.00	statistically significant
Control	29	63.05	4.73			

1.1.17 3.3.5 Parents' educational level:

The researcher obtained the information on the educational level of the parents of the students of the two groups of the research from the records of the registration unit of the faculty of education, and from the students themselves to verify the information recorded in the records. After collecting data on the achievement of the parents, the levels of achievement were as follows:

For Fathers:

the researcher conducted the statistical treatment using the chi-square ($\varkappa 2$), with the special data on the academic achievement of the parents of the two research groups, and the results showed that the calculated chi-square value reached (0.06), which is less than its schedule ($\varkappa^2$) value of (3.84) at the level of significance (0.05), and the degree of freedom was (1), which means that the two groups are equivalent in the educational level of the parents, as shown in Table (3.6).

Table 3.6 shows the educational level of the fathers of the two research groups and the calculated and Schedule chi-square value

Group	Number of students	Fathers' academic achievement level							Chi-square value		Significance at level (0.05)
		Illiterate[2]	Reading & writing	Primary[3]	Secondary	High school	Institute	College and higher	Calculated	Schedule	
Experimental	33	4	2	24	1	2	0	0	0.06	3.84	Not significant statistically
Control	29	6	0	7	5	5	1	5			

For mothers:

The researcher conducted the statistical treatment using the chi-square with the special data on the educational level of the mothers of the two research groups, and the results showed that the calculated value of the chi-square reached (0.19) which was less than its scheduled value of (3.84) at the level of significance (0.05) and the degree of freedom (1). This means that the two groups were equivalent in the educational level of mothers, as shown in Table (3.7).

Table 3.7 shows the educational level of the mothers of the two research groups and the calculated and Schedule chi-square value

Group	Number of students	Mothers' academic achievement level							Chi-square value		Significance at level (0.05)
		Illiterate	Reading & writing	Primary	Secondary	High school	Institute	College and higher	Calculated	Schedule	
Experimental	33	20	1	10	2	0	0	0	0.19	3.84	Not significant statistically
Control	29	16	0	12	1	0	0	0			

3.4 Research Tools

To achieve the goal of the research, two tools are required to be prepared: a test for acquiring chemical concepts, and scientific thinking test.

1.1.18 3.4.1 Acquiring of chemical concepts test:

Since one of the requirements of the current research is to prepare a test to measure the acquisition of chemical concepts of the members of the research sample in the experimental and control groups, the researcher prepared that test according to the following steps:

Preparation of test items:

The researcher formulated the test items of the multiple-choice type, to describe it with several features, in the foreground which are its comprehensiveness of the content, complete objectivity in assessing the degree and measuring it for multiple

types of objectives (Al-Smadi, 2004). In light of the analysis of the educational content and identification of the main and sub-concepts, which amounted to (15) main concepts, the researcher prepared test items that measure the extent to which students acquire chemical concepts within the three cognitive levels: (defining the concept, distinguishing the concept, applying the concept). So, the researcher prepared a preliminary version of the test, which included (45) items of the multiple-choice type, (15) items for each level, and each item had four answer alternatives along with instructions explaining how the student answered the test.

Validity of the test:

It is intended that the test measures what was prepared for measuring or achieves what was set for it (Lamprianou, 2009). To make sure that the test measures what was set for its measurement, the researcher used the apparent validity, which is reached through expert judgment on the degree of test measure of the measured characteristic (Allam, 2006).

Accordingly, the test was presented to experts who were specialists in the field of measurement and evaluation, teaching methods, educational psychology and the analytical chemistry subject, to determine their opinions about the validity of the formulation of the paragraphs, the logic of the alternatives, their attractiveness, and any other observations they see that improve the quality of the test. Their opinions were taken in reformulating some of its paragraphs, as well as some alternatives to the answer, and the researcher considered the paragraph valid if it was approved by (80%) and more. Thus all (45) items of the test were valid to measure the acquisition of the chemical concepts in the subject of

analytical chemistry for the second class students in the General Science department.

Statistical analysis of the test items:

To know the level of difficulty of the test items, their discrimination strength, clarity of the test, its instructions, and the time taken, the researcher applied the test on 16/11/2020 on an exploratory sample chosen randomly from the students of the General Science Department of the faculty of education at Salahaddin University amounted to (34) students. After correcting the answers, the scores were arranged in descending order and divided into two groups, the upper group (17) answers, and the lower group (17) answers, and through the analysis processes, the following was found:

Clarity of paragraphs and time were taken to answer:

After applying the test, it became clear to the researcher that the items of the test and the instructions for answering them were clear and understandable to the students, and that the time taken for answering is between (67-89) minutes, with an average of (78) minutes, which is an appropriate and acceptable time for those students at this stage of the study.

Difficulty and ease coefficient of items:

Difficulty coefficient means the ratio of the number of students who answer correctly for each item or who can solve a specific problem (Al-Zayoud et al., 2005). On this basis, the difficulty coefficient for each item of the test was found using the item difficulty equation (Odeh, 2002). The researcher extracted the level of difficulty of each paragraph of the test and found that it ranged

between (0.24 - 0.76), and since the best degree of difficulty for the item was accepted by the measurement, which falls between (0,20 - 0,80), (Samara, Issam & Ibrahim, 2000), the test items prepared by the researcher are good items and their difficulty factor is appropriate.

Discrimination strength:

The discrimination strength of the item means the extent of its ability to distinguish between students with higher and lower levels of the characteristics that the test measures (Stanly, 1970), and after the researcher extracted the discriminatory strength of the test items, he found that it ranged between (0.35 - 0.71) and it is considered distinctive because the discriminatory strength of the test items is distinctive if it reaches (0.30) and more (Al-Nabhan, 2004).

The effectiveness of wrong alternatives:

In the tests that contain multiple-choice items, it is necessary to examine the students' answers to each of the alternatives to the item, and for the wrong alternative to be attractive and valid, negative values must be obtained for the wrong alternatives (Al-Zobaie, Bakr & Al-Kinani, 1981). Odeh (2002) stated that the wrong alternative is effective when the number of those who are attracted to the wrong alternative from the higher group is less than the number of those who choose the wrong alternative from the lower group by no less than (0.05), and after using the equation for the effectiveness of the wrong alternatives (Odeh, 2002), the effectiveness coefficients of all wrong alternatives were found to be negative. Thus, all false alternatives were considered effective.

Reliability of the test:

The test is considered reliable if it gives almost the same results if it is repeated at two different times on the same individuals and under almost the same conditions (Linn, 2000). To extract the reliability of the test, the researcher applied the test on 16 November 2020 to a sample of 34 students selected from the General Science Department of the Faculty of Education at Salahaddin University. The researcher has relied on to extract the test reliability equation Kuder-Richardson formula 20 (KR-20) (Al-Kubaisi, 2007), which is used to calculate the internal consistency coefficient of the test and is applicable in cases where the student's answer is estimated to be (0-1), (Allam, 2006). And after the handling procedure answers (sample analysis of items) of (34), answers show that the stability coefficient has reached (0.83, which is a good reliability coefficient (Anastasi, 1997). After these measures, the test has been finalized and is ready for implementation.

3.5 Preparing Teaching Plans:

Planning is defined as a deliberate attempt to exploit the available resources and capabilities, to achieve certain objectives with a variety of means, and it is a teaching road map to know what students need to learn and how it will be achieved during class time (Haynes, 2010). In light of the content of the educational material to be taught during the third semester, and taking into consideration the duration of the experiment, (40) teaching plans were prepared in light of the specific behavioural objectives and the educational material for the two groups, experimental according to Think-Pair-Share Strategy, and the control according to Usual Method, a (20) teaching plan for each group, and a copy of each plan was

presented to several experts with specialization in the field of teaching methods, educational and psychological sciences, history, subject supervisors and teachers to indicate their views on it and the extent to which the content of the plan matches the steps of each of the two methods, and its suitability with behavioural purposes, the notes submitted by the experts were taken to be finalized.

3.6 Procedures for implementing the experiment:

After completing the requirements for experimenting, the researcher did the following:

1. Begin to start in the general science department with the faculty of education at Soran University on the 21 of September 2020 until the 27 of September 2020, as this period was devoted to the procedures of equivalence between the students of the two research groups as well as for the pre-application of the scientific thinking test and arranging the study schedule for the researcher with the presidency department.
2. The actual teaching of the two research groups was from Monday 28 September 2020 until Monday 21 December 2020, with a full semester of the academic year (2020-2021) and the application continued for (10) weeks.

3.7 Applying the research tool:

After completing the application of the experiment, the researcher began to apply the research tool to the students of the two groups, and he supervised, with the help of teaching staff from the department, the application process as follows:

Acquiring chemical concepts test:

The researcher applied the test of acquiring chemical concepts to the students of the two groups in one day, on 11 January 2021, and the students were informed of the date of the test before the test day.

3.8 Correcting the research tool:

After completing the application of the research tool, the researcher devoted himself to correcting the answers of the students of the two groups as follows:

Acquiring chemical concepts test:

The researcher corrected the answers of the students of the two groups on the test, by relying on the correction key prepared for this purpose, as he assigned (1) degree to each correct answer and (zero) for each wrong or abandoned answer or those with more than one answer.

4.1 Data analysis

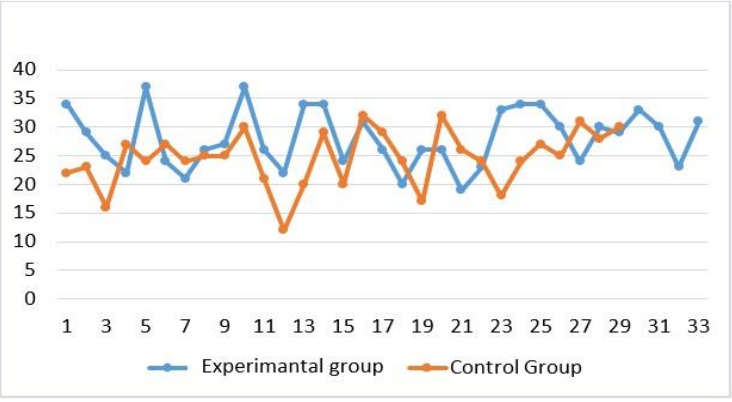
To verify the validity of the hypothesis, the arithmetic mean and standard deviation of the students' degrees of both experimental and control groups were calculated in the remotely applied post-test of the acquiring chemical concepts test, Appendix (10), and by using the t-test for two independent samples, it was found that the calculated T-value amounted to (2.712), which is larger than the schedule T-value of (2.000) at the significant level of (0.05) and the degree of freedom (60). This means that there is a statistically significant difference between the average degrees of the experimental group students and the average degrees of the

control group students, and for the benefit of the experimental group, as a result, this rejects the first null hypothesis and accepts the alternative hypothesis, as shown in Table (4.1).

Table (4.1) shows the arithmetic mean, standard deviation, and the calculated and schedule T-value for the two research groups in the acquiring chemical concepts post-test

Group	Number of students	Arithmetic mean	standard deviation	T value		Significance at level (0.05)
				Calculated	Schedule	
Experimental	33	28	5.05	2.71	2.00	statistically significant
Control	29	24.55	4.925			

This indicates that the experimental group (which was taught according to the TPS strategy) acquired more chemical concepts after the completion of the experiment than the control group (which was taught according to the traditional method), meaning that there is effectiveness in using the TPS strategy as this was evident in the degrees of the two groups' students, as shown below in the line chart (4.1).



Line Chart 4.1 students' degrees of experimental and control groups in the post-test in the acquiring chemical concepts

4.2 Discussion

The researcher attributed the superiority of the students in the experimental group over the control group to the effectiveness of the independent variable represented by the TPS strategy, which helped students acquire chemical concepts. This is because this strategy is characterized by many characteristics that helped students acquire the concepts, including:

1. The effectiveness of the TPS strategy in enhancing the student's active role in learning, building self-knowledge, and motivating students' previous experiences in new educational situations.
2. The nature of presenting the educational content in a sequential and interconnected manner according to the steps of the TPS strategy helps facilitate the process of communication and interaction between the students.
3. Providing students with the opportunity to record the information and concepts that they come up with during the lecture.
4. The researcher believes that the TPS strategy provided the students of the experimental group an opportunity to study chemical concepts according to their academic abilities and levels, and also enabled the researcher-teacher to clarify chemical concepts easily and better.

This result agreed with the results of the following studies: Al Aboos & Zinebat (2016), El Sarayreh (2017), Ali, Ibrahim and Al Atiya (2017). The results of these studies confirmed the mastery of the experimental group over the control group in acquiring chemical concepts, as a result of using different methods and

approaches to teaching to acquire chemical concepts and other variables.

And differ from the results of the Morshedi, Omran, and Mamouri (2018) study, the results of this study showed that there are no statistically significant differences between (experimental and control) in the acquiring chemical concepts.

5. Conclusions, recommendations, and suggestions

5.١ Conclusions:

In light of the results of the study, the researcher reached the following conclusions:

1. The Think-Pair-Share strategy has demonstrated that it has great effectiveness in acquiring chemical concepts of the experimental group students.
2. The students of the experimental group demonstrated their motivation and perseverance in following up the implementation of steps and the procedure of the Think-Pair-Share strategy measures as well as revitalizing the spirit of cooperation and participation among them.
3. Despite the superiority of the strategy of Think-Pair-Share over the traditional method with statistical significance, it is not denied that the traditional method has resulted in acquiring chemical concepts even to a small degree that is not of the same statistical significance.
4. The latest introduction of several chemical concepts during the teaching of the two research groups resulted in a remarkable interest from students regarding the nature of those concepts and their close connection with the content of analytical chemistry.

5. The new educational environment which is created by the Think-Pair-Share Strategy made the chemistry lectures interesting and removed some misconceptions about the chemistry lectures as a difficult and boring subject in comparison to the rest of the subjects.

5.٢ Recommendations:

In light of the results of the study, the researcher recommended the following:

1. Using the Think-Pair-Share strategy in teaching chemistry subjects in the General Science Department of the Faculties of Education and Basic Education in the universities of the Kurdistan Region - Iraq.
2. Inserting the theoretical framework and applied procedures for the Think-Pair-Share strategy in subject vocabularies of methods of teaching science in the Faculties of Education and Basic Education in the universities of the Kurdistan Region - Iraq.
3. The Pedagogical Training Centre in the universities of the Kurdistan Region, and the Institute of Training and Development in the Directorates of Education, held a training workshop for teachers of general science on the mechanism of implementing the Think-Pair-Share strategy in teaching chemistry at the university level.
4. Emphasis on science teachers on the importance of acquiring chemical concepts for students of the General Science Department, as they play an important role in helping students to understand the content of chemistry.
5.

5.٣ Suggestions:

Complementing the current research, the researcher recommends the following future studies:

1. A comparative study between Think-Pair-Share strategy and brainstorming strategy, and their effect on the variables covered by the current research.
2. A study on the impact of a Think-Pair-Share strategy in developing other dependent variables such as critical thinking and metacognitive thinking.
3. Carrying out a similar study at another educational level (stages).

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پوختە

تویژینەوەکە ئامانجی ناساندنی (کاریگەری بەکارهێنانی ستراتیژیەتی بیرکەوە-هاوبەشبە-بەشداربە (TPS) لە بە دەستهێنانی چەمکە کیمیاییەکان). تویژەر پشتی بەستووە بە نەخشەسازیی هاوتایی (یەکسانی) لە نێوان دوو کۆمەڵەدا، کۆمەڵەی ئەزموونی بەپێی ستراتیژیەتی بیرکەوە-هاوبەشبە-بەشداربە (TPS)، وە کۆمەڵەی کۆنترۆلکراویش بەپێی ڕێگای ئاسایی پڕۆسەی فێرکردنیان بۆ ئەنجامدراوە. کۆمەڵەی تویژینەوەکە پێکهاتووە لە قوتابیانی قۆناغی دووەم لە زانکۆی سۆران، بەشی زانستە گشتیەکان بۆ ساڵی خوێندنی (٢٠٢٠-٢٠٢١)، هەروەها نمونەی تویژینەوەکە پێکهاتووە لە ٦٢ قوتابی، کە تویژەر بەشێوەیەکی هەڕەمەکی بەسەر هەردوو کۆمەڵەی ئەزموونی و کۆنترۆلکراو دابەشی کردوون. ژمارەی قوتابیانی کۆمەڵەی ئەزموونی (٣٣) قوتابی کوڕ و کچن و کۆمەڵەی کۆنترۆلکراویش، ژمارەی قوتابیەکان (٢٩) قوتابی کوڕ و کچن. تویژەر هەستاوە بەئامادەکردنی تاقیکرنەوەی پێوانەی بەدەستهێنانی چەمکە کیمیاییەکان کە لە (٤٥) بڕگە لە جۆری هەڵبژاردنی چوار وەڵامی پێکهاتووە. ئەنجامەکان وادەردەخەن کە بەکارهێنانی ستراتیژیەتی بیرکەوە-هاوبەشبە-بەشداربە لە وانەووتنەوەی کیمیادا کاریگەری پۆزەتیڤی هەیە لە بەدەستهێنانی چەمکە کیمیاییەکان. لەژێر سێبەری ئەنجامەکان تویژەر ڕاسپاردەی گرنگی بۆکارهێنانی ستراتیژیەتی بیرکەوە-هاوبەشبە-بەشداربە چونکە ستراتیژیەکی نوێیە. لەگەڵ پێشنیارکردنی ئەنجامدانی چەندین تویژینەوە لە پاشەڕۆژدا.

وشە کلیلەکان: بیرکەوە-هاوبەشبە-بەشداربە، ستراتیژی، چەمکە کیمیاییەکان، وانەوتنەوەی کیمیا.

المستخلص

هدف البحث التعرف الى فاعلية استخدام استراتيجية فكر-زاوج-شارك في اكتساب المفاهيم الكيميائية لدى طلبة جامعة سوران في مادة الكيمياء، اعتمد الباحث تصميم المجموعات المتكافئة، مجموعة تجريبية درست بحسب استراتيجية فكر-زاوج-شارك، واخرى ضابطة درست على وفق الطريقة الاعتيادية المتبعة. وتكون مجتمع البحث من طلبة السنة الثانية في جامعة سوران، قسم العلوم العامة، للعام الدراسي (٢٠٢٠-٢٠٢١)، واشتملت عينة البحث على (٦٢) طالباً تم تقسيهم إلى مجموعتين، وزع الباحث المجموعتين التجريبية والضابطة عليهما عشوائياً، حيث بلغ عدد طلبة المجموعة التجريبية (٣٣) طالباً وطالبة، والمجموعة الضابطة، بلغ عدد طلبتها (٢٩) طالباً وطالبة. اجرى الباحث التكافؤ بين طلاب المجموعتين في عدد من المتغيرات. وأعد الباحث اختبارا لقياس اكتساب المفاهيم الكيميائية حيث اشتمل (٤٥) فقرة من نوع الاختيار من المتعدد. اظهرت النتائج ان استخدام استراتيجية فكر-زاوج-شارك في تدريس مادة الكيمياء له تأثير إيجابي على زيادة اكتساب الطلاب للمفاهيم الكيميائية وفي ضوء نتائج البحث أوصى الباحث بضرورة استخدام استراتيجية فكر-زاوج-شارك بوصفها استراتيجية حديثة، فضلاً عن إجراء المزيد من الدراسات المستقبلية.

الكلمات المفتاحية: فكر- زاوج - شارك ، الاستراتيجية، المفاهيم الكيميائية ، تدريس الكيمياء.