

# The Effectiveness of the Information Gap Strategy in the Skills of Writing Chemical Equations and Decision-Making among First Grade Students

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This research aims to find effectiveness of the information gap strategy on the skills of writing chemical equations and decision-making and among the first grade students. The sample of the study consisted of (56) students distributed in two groups experimental and control. Attest has been prepared the skills of writing chemical equations of the type of multi - test and decision making. A multi-test was prepared from the skills of writing chemical equations of the type of multi –test and decision making scale and verified the validity of the two tools. The results showed that there are statistically significant differences at the level ( $\alpha=0.05$ ) between the experimental group and the control group in the testing skills of writing chemical equations and decision making scale for the benefit of the experimental group. In light of the result, the researcher recommended the need to use the information gap as an effective active learning strategies to acquire the skills of writing Chemical equations and decision-making among students.

**Key words:** *Information gap strategy, chemical equations, decision-making.*

## Introduction

The world is witnessing remarkable technological development and progress in various fields of life, including education, where there is a continuous change and modernisation in this area, whether in the modern teaching aids used in teaching or in modern strategies and teaching methods or change in the curriculum itself where the curricula are constantly changing from year to year. On this basis we must pay attention to modern teaching strategies, which are based on the development of thinking skills of students, and since the intermediate stage is a link between the primary and preparatory stage is an important stage it can perform types of skills and intellectual and mental abilities that are taught through several

subjects, including chemistry that helps the learner to think, not how to memorise and remember the subjects without assimilating them and helping them to use information in working life and absorb learning skills (Fakhro, 2001).

Good learning is one that contains the learner and gives him opportunities to interact with his teacher and peers inside the classroom and allows him a relaxed and familiar atmosphere to help him express himself in a free way directly, and then achieve the results of learning in a real effective manner, and meaningful interaction with the learning environment is necessary to achieving active learning, the learner may actively interact in the learning situation, as far as learning outcomes are effective and effective.

The challenge here is how to help learners to shift from silence in front of the teacher to an active situation that requires movement, speaking, reading and writing, and supplementing papers. Working by conducting activities, asking questions, summarising information, organising and acquiring scientific material effectively (Sharon & Martha, 2001) are thus actively involved in the educational situation and learning better than if they were just recipients of information from the teacher. Chemistry plays a key role in the development of research skills and mental abilities of students, where mental skills include students' knowledge of all elements related to the scientific phenomenon, and know the changes that occur in this phenomenon and identify the elements that cause these changes, which occur in this phenomenon and identify the elements that cause. These changes occur, and the relationship between them, and science subjects in general and chemistry in particular, a different material in its teaching from other subjects, as it requires the involvement of students in scientific activities and laboratory experiments (Ambo Saidi and Baloch, 2009) and this is provided by active learning, which appeared as in the last decade of the twentieth century and increased interest by educators with the beginning of the twenty-first century as one of the contemporary educational and psychological trends in teaching, active learning is one of the contemporary educational and psychological trends in teaching, and active learning is one of the modern trends that advocate the positive role of the learner in the educational position and considered as the focus of the educational process (Abu, 2008).

The importance of active learning in the development of positive attitudes towards the teaching material and increase interaction within the classroom between the teacher and students on the one hand and the students themselves on the other, and the acquisition of skills in addition to increasing the interest of students and arouse their attention for a longer time because of their preoccupation with and interaction with activities (Sherbini and Effat, 2011). Active learning is characterised by a number of advantages, including giving the learner the ability to analyse situations and solve problems that face him. It also increases the process of retaining and transmitting new information and their ability to learn without assistance, and enhance their self-confidence and self-reliance. This is because active

learning is what requires learners to use higher thinking tasks (Haidar, 2000). Many studies and research have confirmed interest in learning. Active and strategies as a study Aloul (2012), studying al-Zaidi (2010), study blond (2017) which demonstrated the effectiveness of active learning in increasing academic achievement and the development of various skills in many subjects, including science.

Active learning has different strategies, including the information gap strategy, the idea of which is based on the principle of integration among learners. Students are divided into groups, either bilaterally or quadruple, collaborating with each other and completing the information. This is based on hiding part of the information in a group of students and showing it to the students, in order to solve the entire activity (Jones, 1995). Another set of strategies is effective and useful, providing a space for positive communication between students to get the missing information, and gives the class an atmosphere of enthusiasm, fun and motivation to learn as well as the development of multiple skills such as dialogue, asking questions and linking information. Thinking, guessing, and making sure information increases the motivation for learning, and these strategies follow the following steps:

- The teacher divides the students into two groups (two students) or quadrants (consisting of four students for each group).
- The teacher provides an activity carried out two steps complementary to each other to achieve the goal of learning, a prerequisite in the steps.
- Each student deals with his own activity and works to achieve it.
- After completing the activity, the group members participate in the discussion about the results so that each student will train his colleague.

Results are presented orally or in writing to students (Al-Shammari, 2011).

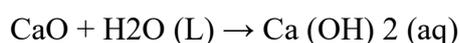
The researcher noted that chemistry is not studied at this stage in the form of complete and independent courses, but is taught in the form of chapters included in the courses of science, which includes in addition to chemistry classes in physics and biology, and these beginnings in the middle stage mainly should pay attention in order to effectively pave the way for students to study more deeply in the later stages of education. There is a lack of clarification of the foundations to be taken into account when writing the chemical equation, which may affect the interest of both chemistry teachers and students of the chemical equation and how to write. In chemistry, this reaction is expressed in an equation in which the reactions are written verbally or symbolically from the left side while the it comes verbally or symbolically from the right end, separated by an equal sign (=), a right arrow in non-reflective reactions

( $\rightarrow$ ), or two opposite arrows in reflex reactions. Chemical equation, which describes the reaction with the symbols and chemical formulas of the compounds, describes the conditions under which the reaction takes place and describes the physical state of the reactants and products (Sultan, 2003), where chemical equations are the language of chemistry that is related to expressions of chemistry such as symbols and Chinese. Therefore, chemical equations achieve two objectives: first, to provide the student with one of the important bases that contribute to the study of chemistry and express it properly, and second, to develop the student's ability to continue reading and studying in this science (Islah, 2016).

The chemical equation is defined as a good abbreviated method for expressing a particular reaction or the sum of secondary reactions (Juma and Murad, 2006). It is also defined as a brief expression describing the chemical reaction in terms of the symbols and chemical formulas of the reactants and the resulting substances (Muhammad et al., 2017). This requires knowledge of the reactants and the resulting substances, the correct symbols of the elements and chemical formulas of the compounds, and the identification of the physical state symbols such as the physical state of gas (g), liquid (L), steel (S) and aqueous solution (aq), taking into account the law of conservation of matter when balancing the equation (Khalil, 2005). ). The researcher has adopted several steps to teach students how to write the chemical equation and is suitable with beginners in the study of the basics of chemistry, namely:

1. Write the chemical symbol of the element or chemical formula of the compounds in the reactor side (where the oxidative number of each element or atomic group is established to write the correct chemical formulas)
2. Writing the outputs based on the classification of chemical reactions into four types with giving some simple rules with each type:

A-reaction of the union: It consists of the union of two or more substances (element or compound) to form a new compound such as the reaction of two free elements produces one new compound such as  $A + B \rightarrow AB$ , but if the reaction involves the union of two components, one simple molecule such as  $H_2O$  or  $CO_2$ , the result is the formation one new compound:



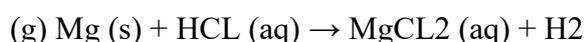
B-decomposition reactions (decomposition), which is the opposite of the interactions of the Union in which the compounds of two components to disintegrate into the primary elements (can be maintained roots without disintegration in the interactions of the type of replacement and write each in the side of the outputs and each is fixed on the oxidative number of its own)  
 $2AgCl \rightarrow 2Ag + Cl_2$



If the disintegrated compound contains more than two elements, it disintegrates to give a number of simple compounds or an element with the compound and the elements that can exist freely. Stable compounds are the expected products of this disintegration (including noble elements H<sub>2</sub>O, CO<sub>2</sub>).

### C - Replacement Reactions

- Single substitution: in which an element replaces the place of another element in a compound and the result is a new compound. If the element is a metal or H, it displaces the element with a positive oxidative number from the compound, such as:

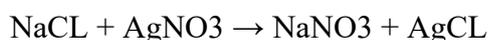


If the element is halogen (I, Br, F, Cl) it displaces the element with negative oxidation number from the compound such as

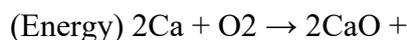


The elements (H<sub>2</sub>, O<sub>2</sub>, N<sub>2</sub>, Br<sub>2</sub>, I<sub>2</sub>, CL<sub>2</sub>, F<sub>2</sub>) are always diatomic

Bilateral substitution: exchange of sites between positive and negative ions occurs in two compounds during the reaction



D - combustion reactions: The interaction of a substance with oxygen, forming oxides of the elements of the molecule of the substance involved in the reaction and the release of energy.



The combustion products of hydrocarbons are water (H<sub>2</sub>O) and carbon dioxide (CO<sub>2</sub>).

3 - Balancing the chemical equation so that the number of atoms of each element in the reactors and products is equaled by multiplying it by the number in front of the formula, which:

- If the outer shell of the atom contains the number of electrons less than half of the state of saturation of the casing, the atom tends to lose these electrons and the formation of a positive ion.

- In the case that it contains more than half saturated corn tends to acquire to complete the state of eight

Any required to write the correct chemical equations several skills, including learning the symbols of elements and oxidative numbers of atoms or roots and how to write chemical formulas correct manner 'Despite the importance of equations chemistry, but middle school students face many difficulties in understanding and writing because it requires these students to acquire several skills. This is what several studies, including Hamdan study (2012) and reform study (2016) considers and through the researcher access to educational literature and consult a number of teachers and supervisors of chemistry have reached six basic skills to write chemical equations commensurate with the level of students in this stage is to:

- Identify the symbols of the elements and their names and the preparation of oxidation.
- Identify the symbols of the atomic groups and their names and the preparation of oxidation.
- Write the chemical formulas of compounds correctly.
- Expressing the chemical equation and verbally and symbolically correct.
- Predict the products of the chemical equation by identifying the type of chemical reaction.
- Balancing the chemical equation (law of conservation of substance).

Decision-making is an important and complex process in the lives of individuals. Not all decisions are easy and clear, but a skill that requires a lot of training, ability, knowledge and experience, and the researchers point out that despite the decision. However, attitudes, values system, and emotional state, in addition to the social factors surrounding the individual, affect the decision-making process directly or indirectly (Katami, 2010). If the decision-making process is so important in life organisations, its importance is deepening and expanding in educational institutions. Which represents the intermediate stage base, has expanded its concept to include all aspects of life because the individual goes through in his daily situations that require taking one or more decisions and addressed, and these decisions we live in every moment of our lives is an important process at home, school and work, and here many people are having difficulties and need help making their decisions, some of them lacking the information they need, some of them have information but are unable to use the information they get, and some of them are hesitant when choosing between multiple possibilities (Zahran, 1998).

Richard defines decision-making as "a process of identifying problems and finding solutions to them" (Richard, 2001) and is defined as a "course of action chosen by the decision-maker to deal with the problem" (John, et.al. 2000). This means that making the right decision helps to reach the right solution and not making mistakes (Hakim, 2008), and scientists have agreed that the decision-making process includes several basic elements, namely the existence of a situation or problem calls for decision, and alternatives and choose one of the preferred

alternatives. Then the decision is implemented (Radwan, 2012) and the decision-making process is done in several sequential and integrated steps and can not take the decision without going through these steps must first identify the problem and understand and then collect enough information about it, and then identify all the alternatives that could be a solution, then evaluate the alternatives to choose the best alternative. Finally, making the right decision and implementing it to reach the desired goal (Said, 2015).

The decision-making process is influenced by a range of factors such as trends, tendencies, values and beliefs, in addition to psychological factors and personal influences that the decision does not come spontaneously or random, but there are several factors affect it so we find the decision different from one person to another according to the trends and tendencies of the person and according to psychological factors and personal orientations (Cateet, 2011). Given the importance of decision-making in the life of the individual and its impact on the reality of his existence in many ways has been the decision-making process has received attention and this is confirmed by many studies such as Abu Khater study (2014) and said (2015) study, which showed the possibility of providing individuals with decision-making skills using a modern learning strategy that focuses on the active role of the learner and work in small groups, which allows the student to participate and thus affect decision-making as well as provide an atmosphere of acquaintance and understanding. It also contributes to learning patience and develop the art of listening and communication skills between students (Faraj, 2007).

In the light of the above, the researcher believes that the decision-making process is important and not easy, it requires an organised intellectual effort and sufficient information to help the individual to choose the appropriate alternative that is consistent with what the decision-maker holds. Trends and goals, because it plays a large role in the lives of individuals in general and the lives of students in particular, they enhance their self-confidence and their ability to make decisions, they are the basis of future leaders, and this is what the current study seeks to achieve through the use of the information gap strategy and know how effective in gaining writing skills chemical equations and decision-making among the first graders of the medium because they emphasize the provision of an active learning environment and the positive role of the learner.

### **The Study Problem**

The problem of the current study is the importance of developing students' skills in understanding chemical reactions and expressing them with chemical equations in a sound scientific way, which is one of the most important objectives of teaching chemistry in the intermediate stage. It is not easy to learn in light of the teaching reality in our schools far from achieving it. Ineffective strategies by teachers based on the automatic memorisation of

symbols and writing chemical equations without understanding them, and through the work of the researcher as a teacher in middle schools I felt a clear shortage of students in writing chemical equations, especially among students in the first grade because they are beginners in the study of this item where they face many difficulties in understanding or writing because it requires students to acquire several skills necessary to write and budget. This is due to many reasons, including the textbook and its presentation of the scientific material, which is accustomed to the learner to memorise and do not develop scientific thinking. Numerous studies such as Juma and Murad (2006) and Islah (2016) have shown that students are weak in writing chemical equations, and that students' acquisition of writing skills is not achieved through methods that lack the practice and development of mental processes, but through the use of strategies. The researcher noted the inability of students to make the right decisions, where we face in life many challenges and situations require decisions to be made, and some students do not use their mental processes accurately and effectively when faced with these situations because they lose the ability to collect and analyze information, as well as their mistakes and haste in the selection of alternatives and the difficulty of finding appropriate strategies for decision-making and to reach the right solution to the problem. Many studies were conducted, such as Barhoum (2013) and Radwan (2012), which indicated that developing students' decision-making skills requires an active learning environment in which the interaction between learners is employed. Through cooperative learning groups, this researcher seeks to address them by studying the information gap strategy, which may help improve students' decision-making ability, so the problem of the current study can be identified to the lack of skills in writing chemical equations and decision-making among first graders. For the average, the study problem can be addressed by answering the following questions:

- 1 - What is the effectiveness of the information gap strategy in the skills of writing chemical equations for first grade students?
- 2-What is the effectiveness of the information gap strategy in the decision-making process for first grade students?

### **The Importance of Studying**

It is expected that the present study will contribute to provide a model of how to teach according to the information gap strategy, which can be useful in providing students with the skills of writing chemical equations, which students are exposed to for the first time in their study of chemistry, as evidenced by the importance of this study in addressing the intermediate stage, which is the upper basic stage, especially the first intermediate grade, which is the starting point towards the abstract processes, which prepares the student for the preparatory stage and provides him with many basics for understanding and learning chemistry. It also educates students about the impact of making the wrong decisions and successful in their lives and the impact of it is considered the first study at the local and

international level that dealt with the effectiveness of the information gap strategy. To acquire the skills of writing chemical equations (to the knowledge of the researcher), the results of which may contribute to the provision of recommendations and proposals for those in charge of the educational process and decision makers in the preparation of seminars and training courses for teachers of science and chemistry in Murr Medium of how to use this strategy and included in the curriculum of chemistry to him, so the researcher assumed that this strategy may contribute to the acquisition of writing chemical equations and decision-making skills in the first grade average students in chemistry.

Objectives of the study: The current study seeks to achieve the following objectives:

- Identify the effectiveness of the information gap strategy in the skills of writing chemical equations among first grade students
- Identify the effectiveness of the information gap strategy in the decision-making process for first grade students.

### **Study Hypotheses**

- 1 - There is no statistically significant difference at the level of significance ( $= 0.05\alpha$ ) between the average scores of students studying the information gap strategy and the average scores of students studying in the usual way to test the skills of writing chemical equations.
- 2 - There is no statistically significant difference at the level of significance ( $= 0.05\alpha$ ) between the average scores of students studying the information gap strategy and the average scores of students studying in the normal way in the post-test of the decision-making scale.

### **Limitations of the study**

#### ***The study was limited to***

- Middle school students in middle schools in Baquba.
- First semester of the academic year (2017, 2018)
- Chapter IV (chemical reactions and expressed by chemical equations) of the chapters of chemistry in the book of science, part I of the first grade average, Ministry of Education, Republic of Iraq, 2017.

### **Study Terms and Definitions**

#### ***Effectiveness has been Defined by***

- (Zaytoun, 2001): "The extent to which the output of the system corresponds to its objectives" (Zaytoun, 2001).



- (Abdel Karim, 2009): The ability to do something or make a change. (Abdel Karim, 2009)  
Procedurally: The ability of the information gap strategy to influence and reach its goals in acquiring the skills of writing chemical equations and decision making among the first grade students.

### ***The Information Gap Strategy was Defined by***

- (Harmer, 2007): It is an active learning strategies in which each student works with each other and have somewhat different information they can give a full picture by sharing this information with each other.

- Chemical equation writing skills known to both.

(Aslah, 2016): A set of skills needed to formulate a symbolic chemical equation that expresses the chemical reactions that the student acquires in order to develop their ability to formulate and construct them properly. Energy and the skill to distinguish between ways that reflect the change in enthalpy (Aslah, 2016)

Procedurally: A series of skills that the student learns and increases his ability to write the chemical equation sequentially and efficiently and with the least possible time. Chemical equilibrium skills are measured by the degree to which the student gets the test prepared by the researcher for this purpose.

### **Decision-Making and Defined by**

- (Clemen, 1999): Special behavior interrupts and stops the thinking process and ends with the choice of alternatives available to achieve a particular goal. (Clemen, 1999)

- (strohs, 2002): the process of solving the problems and attitudes facing the individual and characterised by complexity, dynamism, multi-purpose, ambiguity or ambiguity. (strohs, 2002)

### ***Previous Studies***

After reviewing the previous studies, which dealt with the variables of the study shows the scarcity of studies that dealt with the information gap strategy at the local and international level.

### ***Studies on the Information Gap Strategy***

Al-Quraishi and Al-Safi (2016) study conducted in Iraq aimed at identifying the impact of the information gap strategy on fifth grade primary school students' motivation towards science. The research sample consisted of 51 students distributed in two experimental and control groups. (26) Paragraph, after statistical processing of data, the results showed that there are statistically significant differences in favor of the experimental group, which studied the strategy of information gap.

### ***Studies on the Skills of Writing Chemical Equations***

The study (2012) Sangar, Naah aimed to identify the difficulties of misconceptions facing students in writing chemical equations, weighted ionic compounds, and the researcher used the descriptive method, the sample of the study consisted of 105 students from universities, the study tool was in the work semi-regular interviews to explore the thinking processes at the particle level associated with writing these equations. The results of the study showed that there are many misconceptions represented by the number of moles and the number of atoms of the compounds involved in the equation.

Hamdan study (2012) aimed to investigate the effectiveness of a computerised program to develop the skills of writing chemical equations and their computational applications among the students of the eleventh grade in Gaza and their attitudes towards chemistry. The sample of the study consisted of 76 students from the eleventh grade at Al Rayes Secondary School, where the researcher used the semi-experimental method has been prepared two tools for the first study is to test the skills of writing chemical equations and the second measure of the trend towards chemistry, and after statistical treatment showed the existence of statistically significant differences for the benefit of the experimental group in both the post-test skills towards.

Zu'bi study (2017) was conducted in Jordan and aimed to identify the impact of teaching chemistry using a strategy (think, write, pair, participated) in improving the understanding of the tenth grade students of the chemical equations and develop their motivation to accomplish classroom duties, the sample of the study consisted of 70 students from the tenth grade in the school of martyr. Firas Ajlouni were randomly distributed to two experimental and control groups, and the researcher used the semi-experimental method, the researcher has prepared a test consisting of 20 paragraphs to measure the understanding of equations in the unit of chemical calculations, and prepared a questionnaire consisting of 20 items to measure and understand the equations in the unit of calculations Emiaiah, achievement motivation. The study found the presence of the impact of the strategy to improve as a promising questionnaire consisting of (20) paragraph to measure achievement motivation, and the study



found the presence of the impact of the strategy to improve students' understanding of the tenth grade basic equations of chemical and the development of motivation to complete homework classroom.

### ***Studies on the Decision-Making Process***

Sadiq study (2008) aimed to identify the impact of interaction between thinking maps and mental development on the achievement of science and innovative thinking and decision-making third grade preparatory students and the researcher used descriptive analytical and experimental method, the researcher has prepared three tools for the study are (test achievement and ability to make decision And testing Piaget stages of mental development). After processing the results statistically indicated the existence of statistically significant differences for the benefit of the experimental group.

Through a review of previous studies related to the variables of the current study, the researcher found only one study, Al-Quraishi and Al-Safi (2016), which dealt with the effect of the information gap strategy in the motivation of fifth grade students in science, as Sangar, Naah (2012) identified. Hamdan (2012) prepared a computerised program to develop the skills of writing chemical equations, and the tendency towards chemistry for the students of the eleventh grade. Zou'bi (2017) used a strategy (Think, Write, Pair, Participate) to improve the understanding of chemical equations and motivation of achievement for Grade 10, as well as Sadeq (2008) and Cutierez (2015). In the light of the above, the present study differs from the previous studies in dealing with the effectiveness of the information gap strategy in writing chemical equations and decision making skills among middle school students, especially the first grade. This is what the current study tried to address, has been benefiting from the previous studies in the test methodology of study and statistical methods as well as the preparation of study tools, namely the test of writing skills of chemical equations and decision-making scale.

### **Method and procedures**

Methodology: The researcher followed the experimental design of partial control with post-test for its suitability for the current study as shown in the chart below

**Chart 1:** Study design scheme

Dependent variable	Independent variable	Equivalence	The number	Group
skills of writing - chemical equations	: Information gap strategy	Prior achievement in science	<b>28</b>	Experimental
decision-making -	Ordinary method	Time age month	<b>28</b>	Control

The study community and its sample: The current study community is represented by the first grade average students in the middle schools of the Directorate General of Education Diyala / Baquba for the academic year (2017 - 2018), the researcher chose the medium Ibn al-Nadim boys intentionally to apply the study experience for the interest shown by the school administration with the researcher in providing all the possibilities as well as the cooperation of the School of Chemistry, which showed its willingness to cooperate in the implementation of the experiment. The researcher has chosen in a random manner simple two divisions out of (4) people from the first grade of the average to represent the sample of the study, which reached the number after the exclusion of failing students (28) in each division, the two groups were randomly selected to represent the experimental group and the control group.

- Equivalence of the two groups: The two groups were rewarded in some variables that they believe to have an impact on the results of the study, namely (chronological age in months, previous academic achievement in science, as shown in Table 1).

**Table 1:** Represents the equivalence of the two study groups in the previous achievement and chronological age

Statistical significance	t-calculated	T-tabular	Standard deviation	Average account	The number	Group	Variables
Is statistically significant	0.96	2	11.6	189.4	28	experimental	Time age month
		2	11.4	186.4	28	Control	
	0.24	2	10.8	67.6	28	experimental	Prior achievement
		2	10.7	66.9	28	Control	

### Study Procedures

**Determination of scientific material:** The scientific article is specified in the fourth chapter (chemical reactions and expressed in chemical equations) of the chemistry chapters in the book of science, the first part scheduled for the academic year (2017-2018), and the teaching of this chapter takes three weeks by (2) lessons per week.

**Formulation of behavioral objectives:** A number of behavioral objectives were formulated distributed at the three lower levels of Bloom's classification of cognitive domain (remember, absorb, apply) In the light of the views of a group of experts Appendix (1) has been added and modified some of them and thus became the number of adopted goals is 42.

**Preparation of teaching plans:** In the light of the content of the fourth chapter and the behavioral goals that have been formulated, the researcher prepared 6daily teaching plans for each of the two study groups Annex (2).

**Tools of the study:** The researcher used in this study two tools are test the skills of writing chemical equations, decision-making scale.

Based on the list of skills of writing chemical equations that have been prepared, the researcher has written the test clauses in its preliminary form and to confirm the validity of the test clauses was presented to a group of arbitrators and experts Appendix (1). After taking

their observations and suggestions, the final test settled on (20) clauses of the type of test. The appendix (3) is distributed over the six skills according to the relative importance of each skill so that one score for each test paragraph was monitored.

- To confirm the stability of the test, the researcher used the method of re-testing on an exploratory sample consisting of 40 students from the average (friends) of boys other than the study sample. The test was re-applied to the sample itself. The correlation coefficient between the two applications was calculated. It is a good stability coefficient.
- Decision-making scale

After reviewing the previous studies and taking advantage of the decision-making measures as in the study of Subh (2015) and the study of Sadiq (2008), the researcher formulated paragraphs of the scale taking into account that the paragraphs are short and clear and bear one idea and the content of the representative of the situations of daily life and suitable for the study sample. Accordingly, 26 paragraphs were drafted and (3) alternatives were chosen for each paragraph. These alternatives have weights ranging from (3-2-1) and they strongly agree and get (3), agree get (2), disagree and get (1)

-To ensure the validity of the scale, the scale was presented in its preliminary form (26) paragraph to a group of arbitrators from the competent to express their views and observations on the validity of the paragraphs of the scale, the researcher used the percentage to identify the extent of the arbitrators to keep the paragraphs that measure the decision-making process for students. The first grade average, the agreement rate (0.80) and above is valid for the arbitrators agreement on the scale clause and exclude paragraphs that did not get the required agreement percentage, with some amendments in the wording of paragraphs except paragraphs (12.7), which were deleted from the scale and thus achieved honesty of the scale.

- The researcher also used the method of Cronbach to calculate the stability of the scale, where he obtained a coefficient of stability (0.88) This indicates that he has a high degree of stability, and thus the researcher was satisfied with the validity and stability of the decision-making scale and the scale in its final form consists of 24 paragraphs Appendix 4 is ready for application to the study sample.

- The research groups started teaching by the School of Chemistry after clarifying the steps of the information gap strategy and the teaching plans of (6) classes at a rate of (2) lessons per week and follow-up continuously on (3/12/2017) and ended on (24/12/2017). One day later, the test of writing chemical equations and decision-making skills was applied to the study sample.



### ***Statistical Means***

The researcher used the statistical bag (Spss) and the following tools (t-test) for two independent samples, Pearson correlation coefficient.

### **Study Results and Discussion**

After the application of the study tools will be presented the results reached and discussed by answering the questions of the study and verify the hypotheses as follows:

First, the results related to the first question: What is the effectiveness of the information gap strategy in the skills of writing chemical equations among the first grade students?

To answer this question, the researcher examined the following null hypothesis: (There is no statistically significant difference at the level of significance ( $= 0.05\alpha$ ) between the average scores of students studying the information gap strategy and the average scores of students who study in the usual way to test the skills of writing chemical equations). The arithmetic mean, standard deviation and the value of two independent samples were calculated as in Table (2).

**Table 2:** Arithmetic mean, standard deviation, T and calculated and tabulated value of the post test scores for the skills of writing chemical equations for the experimental and control groups.

Statistical significance	t-tabular	t-calculated	Standard deviation	average account	The groups	The skills
Statistically function	2	3	0.84	1.8	Experimental 28	Identify object symbols names, and equivalents
			0.44	1.3	Control 28	
Statistically function	2	3.5	0.41	1.8	experimental 28	Identify the symbols names, and equivalents of atomic groups
			0.45	1.4	Control 28=ن	
Statistically function		3.75	0.96	2.7	experimental 28	Write the chemical formulas of compounds correctly
			0.8	1.8	Control 28	
Statistically function		6.4	0.84	3	experimental 28	Express the chemical equation verbally and symbolically correctly
			0.9	1.6	Control 28	
Statistically function		5.14	1,16	3.3	experimental 28	Predicat the products of the chemical equation by identifying the type of chemical reaction
			1.02	1.8	Control 28	
Statistically function	2	3.93	0.79	2.8	experimental 28	Chemical equation (balancing law)
			1.35	1.7	Control 28	

The above results show that the calculated T value is greater than the tabular value in all skills at the significance level ( $= 0.05\alpha$ ). This indicates that there are statistically significant differences between the mean of the experimental group and the average of the control group in the test of writing the chemical equations and for the benefit of the experimental group, thus rejecting the null hypothesis and accepting the alternative hypothesis. The experimental group attributes this to several reasons, including that the information gap strategy has been able to develop the mental abilities of students by providing an active learning environment active full of enthusiasm and fun and also encouraged cooperation and love of participation, which was born. In addition, the steps of the strategy helped increase the interaction and communication between the members of the same group and with the other groups to reach the correct answer and complete the missing information. Despite this strategy, the students need a great effort to be the focus. The educational process, but it helped to retain information for a longer time, because of the discovery of the student information himself. The active role of the students as well as the opportunity to ask their ideas and questions without fear or shame and respect for the views of their colleagues as well to link the information led to increase their self-confidence, which increased in giving them skills and thus increase their achievement in chemistry in general.

Second: Results related to the second question: What is the effectiveness of the information gap strategy in the decision-making process for the first graders? To answer the question, the researcher examined the following zero hypothesis: (There is no statistically significant difference at the level of significance ( $= 0.05\alpha$ ) between the average grades of students studying the information gap strategy and the average grades of students who study in the usual way on the decision-making scale). Standard deviation and the value of two independent samples as shown in Table (3).

**Table 3:** Arithmetic mean, standard deviation, T and calculated and tabulated values of the decision scale of the experimental and control groups

Statistical significance	t- tabular	t- Calculated	Standard deviation	average account	The number	The groups
Statistically function	2	6.3	3.58	49	28	Experimental
			4.11	42.5	28	Control

It is clear from the results presented above that the calculated value of T (6.3) is greater than the value of T (2) in the decision-making scale at the level of significance ( $= 0.05\alpha$ ). This indicates that there are statistically significant differences between the mean of the experimental group and the average of the group. We reject the null hypothesis and accept the

alternative hypothesis. There are statistically significant differences on the mean scores of the two groups and for the experimental group because the information gap strategy is one of the effective strategies that helped students acquire communication skills and positive communication for the test. The information lost within the scope of one group and with the rest of the groups and try to take decisions appropriately and give as many explanations as possible about the problem and thus to find the optimal and appropriate solution to solve, which earns the skills necessary to continue his daily life, as it gave students the opportunity to collective participation and discover knowledge and interpretation and conclusion to generate as much ideas as possible about the problem in a free atmosphere. This raises the motivation of the students to exert more effort and awareness of the problems at hand. This is consistent with the study of Taie (2012) and the study of Maliki (2013), where the results of the study showed a positive impact of some modern strategies in the ability to make decision. Recommendations: In the light of the results of the study, the researcher recommends the following:

- 1 - Emphasis on the use of the information gap strategy because of its positive results in acquiring the skills of writing chemical equations and decision-making.
- 2-Attention to the development of skills of writing chemical equations for students in the intermediate stage as it is an important basis for understanding the chemistry in this stage and subsequent academic stages, as well as to emphasize the decision-making process because it is an important process in the lives of students and must be taken care of and developed from the early stages to form a character and determine his future life.
- 3 - Holding training seminars for teachers in active learning strategies, including the information gap strategy.
- 4 - Preparation (teacher guide) includes how to apply active learning strategies in teaching chemistry with models of study plans to develop teacher efficiency
- 5 - Attention to teaching methods that rely on the active participation of the learner and away from traditional methods where the learner is not the focus of the educational process.
5. Proposals: The researcher proposes the following:
  1. Conducting a similar study to know the effectiveness of the information gap strategy in other variables (such as trends, development of types of thinking, and tendencies).
  2. Conduct a similar study on other educational stages (junior high, university), and other subjects
  - 3 - Design programs based on active learning strategies, including information gap strategies to train teachers
  4. Conduct a comparative study between the information gap strategy and other active learning strategies in teaching chemistry in the development of chemical equation writing skills.



## REFERENCES

- Abdulkarim, M. M. (2009). The effectiveness of brainstorming in the development of creative thinking among fifth grade students in chemistry. *Al-Fath Journal*, 3(43): 214.
- Abu Khater, D. (2014). The effectiveness of a blog that employs Jigsaw in the development of computer concepts and decision-making skills of the 11th grade students in Gaza (unpublished master thesis), Islamic University, Gaza, 5(27): 242 – 257.
- Abu Scorer, S. (2008). The effect of active learning method on fourth grade students' achievement of some scientific concepts in science and their attitudes towards science in gaza governorate (Unpublished Master Thesis), Al-Azhar University, Gaza, 8(37): 152 – 174.
- Baccouche, M., Bebesu, N., Yasser, H. & Karoush, N. S. (2003). Principles of general chemistry, 2nd Floor, Tripoli: GA Company for Scientific Publishing, 7(33): 96 – 103.
- Barhoum, K. J. (2013). The effect of using six thinking hats strategies in developing creative thinking and technology decision making skills for tenth grade students, Unpublished Master Thesis, Faculty of Education, Islamic University, Gaza, 6(24): 184 – 186.
- Blond, F. A. (2017). The impact of the use of two strategies for active learning in the development of life skills in science among students of the sixth grade in Gaza, an unpublished master thesis, Islamic University, Gaza, 6(24): 126- 136.
- Faraj, A. H. (2007). Teaching methods in higher education. Amman, Jordan: Dar Al-Hamed for Publishing and Distribution, 1(83): 124 – 135.
- Gutierrez, S. (2015). Integrating socio – scientific issues To Enhance The Bioethical Decision – Making Skills of High School Students , Canadian centre of Science and Education International Education Studies, 8(1): 142-151.
- Hakim, A. H. (2008). The effect of the interaction of the study program with the study environment on the decision making skills of teachers college students, Umm Al-Qura University, Educational Studies, Umm Al-Qura University, 1(14): 136 – 147.
- Hamdan, G. M. (2012). The effectiveness of a computerized program for the development of chemical equation writing skills and its computational applications among eleventh grade students in Gaza, and their Attitudes Towards Chemistry, Unpublished Master Thesis, Al-Azhar University, Gaza, 6(28): 163 – 173.
- Harmer, J. (2007). How to teach English, England: Pearson Education Limited, Longman. 6(51): 152 – 164.



- Juma, A. A. R. & Murad, A. S. A. (2006). A comparative study between two models for teaching chemical equations in the achievement of the second intermediate students. *Al-Fath Journal*, 3(26): 225 – 236.
- Khalil, H. (2005). *Comprehensive chemistry encyclopedia, Part II*, Amman, Jordan: Dar Osama for Publishing and Distribution, 5(83): 117 – 124.
- Mambo Saidi, A. B. K. and Al-Hosani, H. B. A. (2016). Active learning strategies 180 strategies with examples. Amman, Jordan: Al-Masirah Publishing House, 2(71): 182 – 199.
- Mohammed, Q. A. & Suhail, A. H. & others. (2017). Science book for the first grade medium, i 2, Iraq, The Iraqi Ministry of Education, 1(23): 124 -131.
- Mussawi, M. (2013). Administrative decision making quantitative entrance. 1st Floor, Amman: Zahran Publishing House, 1(63): 87 p 82.
- Pride, A. A. (2001). Factors affecting the development of secondary education, college of education, Qatar University, *Journal of Education*, 3(127): 147 – 152.
- Qandeel, M. R. (2000). The effect of interaction between a proposed structural strategy and the level of visual spatial visualization on geometric thinking and engineering achievement among first grade preparatory students. *Journal of Mathematics Education*, July. 4(62): 236 – 247.
- Qatit, G.Y. (2011). Creative problem solving. Amman: Dar Al Thaqafa for Publishing & Distribution, 4(27): 162 – 179.
- Quraishi, M. A. & Safi, N. B. (2016). The impact of the information gap strategy on motivation of fifth grade students towards science. *Lark Journal of Philosophy, Linguistics and Social Sciences*, 4(230): 245 – 261.
- Richard, L.(2001). *Daft organization theory and decision*, 7th ed , South Western , College Publishing Vander biLt University , U.S.A 6(23): 135 – 142.
- Rizwan, S. (2012). The effect of thinking hats strategy in developing scientific concepts and decision-making skills for Eighth grade students in Gaza. Unpublished Master Thesis, Islamic University, Gaza, Palestine, 8(13): 125 – 135.
- Saadah, J.A.F., Zamil, M., Shateh, J. & Abu Arqoub, H. (2006). Active learning between theory and practice, 1st Floor, Amman: Al-Shorouk Publishing House, 1(27): 128 – 136.



- Sadeq, M. (2008). Interaction between thinking maps and mental growth in science achievement, innovative thinking and decision making for third grade preparatory students. *Journal of Scientific Education*, 11(2): 69-140.
- Sangar, M.J. and Naah, B.M. (2012). Tudentmis conceptions in writing BaLan Ced equations DissoLving ionic Compoundn in Water chemistry education research and practice, 13(3): 186-194.
- Shammari, M. B. M. (2011). 101 strategy in active learning. 1st Floor, Saudi Arabia: Ministry of Education Press, Saudi Arabia, 1(32): 162 – 176.
- Sharon, D. & Marth, A.L.(2001). Learning and development. New York: MC Graw HiLLBook Co. 2(85): 162 – 186.
- Sultan, S. M. (2003). General chemistry, Saudi Arabia, Riyadh: Obeikan Library, 1(31): 126 - 147.
- The Dependencies, R. (2012). The effect of using some active learning strategies in developing mathematical problem solving skills for fourth grade students in Gaza Governorate, Unpublished Master Thesis, Al-Azhar University, Palestine, 5(25): 134 – 147.
- Zaidi, F. (2010). The effect of active learning on the development of innovative thinking and academic achievement in science for third grade students in Makkah Government Schools, Unpublished Master Thesis, Umm Al-Qura University, Saudi Arabia, 1(45): 245 – 248.
- Zu'bi, A. S. (2017). The effect of teaching chemistry using a strategy (Think, Write, Pair, Participate) to Improve Understanding of Tenth Grade Students of Chemical Equations and Develop Their Motivation for Classroom Duties, 6(36): 214 – 225.