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Using jigsaw strategy in teaching chemistry on developing critical thinking and motivation

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Abstract

This research aimed to identify the effect of using Jigsaw strategy in teaching chemistry on developing critical thinking and motivation for 10th grade female students in Al-Zarqa'a Governorate. The study applied two tools, critical thinking test and motivation scale. The results showed that there were statistically significant differences between the mean performance of the two groups on the critical thinking test and the motivation scale, in favor of the experimental study group, which was studied the chemistry course by using the Jigsaw strategy. In conclusion, the Jigsaw strategy had a positive role in developing the corporation and love.

Keywords: Jigsaw strategy, Critical thinking, Motivation.

Usar la estrategia de rompecabezas en la enseñanza de la química para desarrollar el pensamiento crítico y la motivación

Resumen

Esta investigación tuvo como objetivo identificar el efecto del uso de la estrategia Jigsaw en la enseñanza de la química en el

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desarrollo del pensamiento crítico y la motivación para las estudiantes de décimo grado en la gobernación de Al-Zarqa'a. El estudio aplicó dos herramientas, prueba de pensamiento crítico y escala de motivación. Los resultados mostraron que hubo diferencias estadísticamente significativas entre el rendimiento medio de los dos grupos en la prueba de pensamiento crítico y la escala de motivación, a favor del grupo de estudio experimental, que estudió el curso de química utilizando la estrategia Jigsaw. En conclusión, la estrategia Jigsaw tuvo un papel positivo en el desarrollo de la corporación y el amor.

Palabras clave: Estrategia de rompecabezas, Pensamiento crítico, Motivación.

1. INTRODUCTION

The current era is the era of rapid jumps affecting in the methods and ways of dealing with life, and with the appropriate responses that we interact with the facts of reality in a timely manner. Therefore, the society seeks to keep pace with this age, and prepare its children to be able to cope with this era with all its different changes and developments and to prepare them to face different life situations. This requires attention to the development of thinking processes and different skills, and to include it as a basic goal and a major output of educational systems and focus on it at all levels of study.

The importance of thinking comes from the fact that it is a fundamental necessity that educators focus on in the process of learning and teaching so that the students can interpret and understand practical phenomena and global laws in the service of their community. Critical thinking and its development are one of the

slogans adopted by national, regional and international conferences (AL-HAMOURY, & ALWAHR, 1998). The studiers believe that the development of critical thinking skills lies in the use of modern teaching strategies that emphasize the role of students in the educational learning process. These strategies include active learning, which represents one of the latest trends in teaching which is connecting the learning with the working and the positive participation by students with their colleagues and making them the center of the educational process so that they can keep up with the current era with all its changes and developments.

Collaborative learning is one of the most active learning strategies in the learning process. It promotes positive self-esteem among all participants in the process of learning and teaching. It increases students' self-esteem, develops positive attitudes towards themselves and generalized material, also increases creativity and participation among students and reduces the stress (COOPER, 1999; MILLER, 2003).

Among the strategies based on collaborative learning, the studiers selected the Jigsaw strategy, whose idea is to help students to accomplish a topic or a task. The Students are divided in a heterogeneous group of 5-6 individuals, where a student is taken a task not given to any other member of the group, making each student an expert in his own part of the educational material. After the distribution of educational material to members of the same group, students reorganize themselves in groups of experts in order to interact

and benefit from each other to help each other learn the subject, then return to their original groups and teach other people what they have learned. After the original group meetings and discussions, let them answer short tests each individually on the material they have learned. Students can also be assessed in groups, whether the expert groups or the original group, through an assessment scale or a write-off (AL-QALQILI, 2004; SAADA, 2003).

Many educators point out that the effect of collaborative learning on the Jigsaw strategy goes beyond increasing achievement and the ability to think critically, and to develop positive attitudes towards learning subjects, in spite of their importance and value, because knowledge and skills are useless if the learner cannot apply them in collaborative interaction with others in different locations and situations (ZITOUN, 1999). The students who are cooperative learners are best able to acquire this strategy and to transfer its impact and application in their scientific and practical lives, so they'll become a model for their students who will teach them in the future (GHAITH, 2003).

The purpose of using the Jigsaw strategy is intended to instill enthusiasm and cooperation among students while working as a team. The application of this experience to a large number of students will require a lot of energy and effort so that the experiment will go in the right way. In addition, each student will feel responsible and competitive so that he will find the best solution to reach his friends' understanding of the topic, which will make him responsible for

finding solutions and ideas for them. So they can understand the sub-particles are not well understood before (DOKPESI, 2015).

2. METHODOLOGY

The study adopted a semi-experimental method in order to achieve with the study aim. The study community is made up of all the 10th-grade female students at Awjan school in Alzarqa/Jordan; they were randomly distributed into two categories: experimental included 23 female students who were taught by using Jigsaw strategy and controlled included 23 female students were taught by using normal methods.

To answer the study two questions, the researcher used:

1: Critical thinking Test was identifying.

The study used 20 items critical thinking tests that achieve with the subjects and the specific aged phase.

Some arbitrators were provided by the 20 items critical thinking test to confirm its credibility, the arbitrators (university professors specialized of curriculum and teaching methods. Some of the chemistry's supervisors and teachers give their views about how correct the items test is (belonging all items, linguistic and scientific

editing, availability of alternatives with its suitability and any other suggestions to amendment).

The test was applied on a group which includes (20) students to be confirmed of its stability, the test stability is calculated by using Kuder- Richardson20 (KR20) its rate (0.77), also it is4 confirmed of its stability by using the Repetition stability method, The test was applied and re-applied within two weeks, person's coefficient was calculated between the two applications which resulted in a rate (0.85), preference and difficulty coefficients were calculated for each item of the critical thinking skills test, then that gave us difficulty coefficients rated between (0.38-0.66) and preference coefficients rated between (0.35- 0.65), These values are acceptable.

2: Motivation scale

A scale of motivation was used; it is consisted of 20-items according to the fivefold Likert scale which agrees with the specific aged phase.

Some arbitrators were provided by the scale of motivation to confirm its credibility in order to give their opinion about how correct the items test is. Their linguistic suitability and any other suggestions to amendment, coefficients of correlation were calculated between the items performance and the total performance which gives a value (0.51- 0.91); it indicates that coefficients of correlation were high and

statistically significant (α = 0.05), this enhances the structure credibility of the study tool.

Firstly, the scale was applied on a reconnaissance sample that consisted of (20) female students. The stability of the scale motivation was calculated by using the Cronbach's Alfa method to calculate the internal consistency for scale's items and it was reached (0.75). It was confirmed of the scale's stability by using the repeated stability, reapplied the scale on the same reconnaissance sample was done during 2 weeks, the coefficient of stability was calculated between the two applications and it was reached (0.79), which indicates the scale validity to use and apply.

3. DATA ANALYSIS

Descriptive statistical analysis was used, Means, Standard deviations and (t) test were used on two independent samples, analysis of covariance was used too because it achieves the competence between the two groups (experimental and controlled).

4. FINDINGS AND DISCUSSING

Results related to 1st question which states: Is there a difference of statistical significance at the level (a = 0.05) in developing the critical thinking skills for the chemistry 10th grade students, has

Jigsaw strategy affected between the two groups (experimental and controlled).

Mean, standard deviations for the post and re-application tests were calculated to test critical thinking skills on the chemistry subject.

Table 1. Mean and standard deviations of pre-test and post-test, for the two groups of study to test critical thinking in chemistry

group	No	pre-test		post-test		standard error
		Mean	Standard Deviation	Mean	Standard Deviation	
Experimental	23	12.01	4.15	17.22	4.22	0.54
Control	23	11.82	3.53	14.01	3.41	0.52

As presented in the above (Table 1), the Mean for the experimental group was the highest and it was reached (17.22) because it was taught by using Jigsaw method for the post-test, while the Mean was reached (14.01) for the controlled group because it was taught by using the usual method, to determine the difference between the two groups up to the Mean for statistical significance at the level (α = 0.05), the analysis of covariance was obtained.

Table 2: The results of the accompanying variance (ANCOVA) for the differences between the Mean achievements of the two groups on the test of critical thinking skills in chemistry

Source of Contrast	Total squares	Freedom Score	Mean squares	The value (f) calculated	Significance Value	Eta Square
pre-test	42.44	1	42.44	---	---	---
Teaching strategy	258.12	1	258.12	14.11	0. 00**	0. 23
error	813.13	43	14.59	---	---	---
Total Squares Source	1109.37	45	---	---	---	---

** means statistical significance at (0.05 = α)

As presented in the above (Table 2), that there is a difference of the critical thinking post-test performance for the experimental group, the (f) calculated value was reached (14.11) at the level of significance (0.00)which is less than (α = 0.05). This indicates that there is a difference in favor the experimental group; this result refuses the 1st zero hypothesis which states there is no difference of the statistical significance at the level (α = 0.05) in critical thinking skills test, due the Jigsaw strategy compared to the usual method, this means that the difference of the 10th-grade students post-performance on the critical thinking skills test, due the differences, teaching strategies and that was in favor the experimental group, the impact value reached (0.23) based on Eta square, this means that the Jigsaw strategy has affected 23% on their rates of the critical thinking test.

Jigsaw strategy focused on the students and made them as pillars of the learning – educational process, and giving them the opportunity to practice the thinking, students who were taught by using Jigsaw strategy. They have got the ability to affront the new situations and overcoming them, resolving their problems and making their own decisions, the Jigsaw strategy needs to use mental process and thinking skills, that reflects positively on the students' critical thinking, this question result agrees with almanac's study (2013).

Jigsaw strategy made the students work together which had an impact to increase the focus and attention and reduce of their distract, they all think and follow to achieve the tasks, this strategy helps the students to understand and ask questions for saving the information, exchanging the experiences too.

The 2nd question results, the question states

> Is there a difference of a statistical significance at the level ($\alpha = 0.05$) to motivate the 10th grade students toward the chemistry subject by using Jigsaw strategy between the two groups (experimental and controlled)?

To answer the question above, and test the hypothesis related to it, Mean, standard deviations and the standard fault for the post and re-application were calculated to perform the two study groups on the items of motivation scale.

Table 3: Arithmetical Mean, standard deviations and standard error of the tribal and remote scales, for the performance of my group Study on the parameters of the driving scale

group	No	pre-test		post-test		standard error
		Mean	Standard Deviation	Mean	Standard Deviation	
Experimental	23	52.34	6.81	80.28	3.99	0.75
Control	23	53.01	7.70	67.10	3.52	0.77

As presented in the above (Table 3), the Mean for the experimental group was the highest and it was reached (80.28) because it was taught by using Jigsaw strategy, while the Mean was reached (67.10) for the controlled group because it was taught by using the usual method, to determine the difference between the two groups up to the Mean for statistical significance at the level ($\alpha = 0.05$), the analysis of covariance was obtained.

Table 4: The results of the associated variance (ANCOVA) for the differences between the Two motivation groups of the study on the motivation scale towards chemistry

Source of Contrast	Total squares	Freedom Score	Mean squares	The value (f) calculated	Significance Value	Eta Square
pre-test	0. 38	1	0. 38		---	---
Teaching strategy	8555.82	1	8555.82	415.21	0. 00**	0. 44
error	1107.88	43	19.52	---	---	---
Total Squares Source	10320.348	45	---	---	---	---

** means statistical significance at ($0.05 = \alpha$)

As presented in the above (Table 4), that there is a difference on the post-performance for the motivation scale, due to the experimental group, the (f) calculated value was reached (415.21) at the level of significance (0.00), which is less than ($\alpha = 0.05$), this indicates that there is a difference in favor the experimental group, this is higher than the controlled group performance because its Mean is (67.10), this result refuses the 2nd zero hypothesis which states there is no difference of the statistical significance at the level ($\alpha = 0.05$) to motivate the 10th-grade students toward the chemistry subject, due to use Jigsaw strategy compared to the usual method.

The difference of the 10th-grade students post-performance on the scale of motivation toward the chemistry subject is differentiated by the difference of the teaching strategy, which was in favor to the experimental group which was taught by using Jigsaw strategy in comparison with the controlled group which was taught by using the usual method. This difference indicates the impact of using the Jigsaw strategy to motivate the 10th-grade students toward the chemistry subject, the impact was reached as ITA value (0.44), this means that Jigsaw strategy has affected 44% on the 10th-grade students motivation toward the chemistry.

5. CONCLUSIONS

Jigsaw strategy might increase the students' confidence themselves while they were studying the module according to some

organized steps which include clear instructions and convinced logical sequence. It reflects positively the increasing of the students' activity and interaction during the chemistry classes, that had a positive impact to motivate the students toward the chemistry subject and feel interested to study and follow it up.

In fact, these results could be explained that the Jigsaw strategy had a positive role in developing the corporation and love because it has provided them with an interactive environment that made the scientific subject an exciting subject and that helped them to motivate toward learning and acquisition.

In addition, the learning environment which prevailed during the implementation of the Jigsaw strategy might have a positive impact of increasing the students motivation. The interaction is increased between the students themselves and a dynamic participation between the students and the teacher, thus an exchanging of the experiences and discussing the results that they have got, then all obstacles are going to be removed between the students themselves and between the students and the teacher, this result could be referred to the user first preparatory step that has provided a motive and exciting environment which is convenient with the interesting chemistry subjects, discovered the students' abilities, adapted their scientific direction and met their needs, thus developed the students attention and evoked their motivation toward the chemistry subject.

Finally, the researcher recommends to train the chemistry teachers how to use the Jigsaw strategy which is considered one of the modern strategies that based on the learner, and the necessity of encouraging the chemistry teachers to use Jigsaw strategy through teaching the chemistry, and taking in consideration the curriculum outline for Jigsaw strategy while designing the curriculum and providing the teacher guide by strategies for teaching Jigsaw strategy, and Chemistry books should have critical thinking activities, and conducting more studies that use the critical thinking and motivation on other subjects.

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