

# The Effect of Teaching According to the TASC Model on Chemistry Achievement and Systems Thinking of Students in the Second Intermediate Grade

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**Abstract:** The research aims to identify the impact of the TASC, as the research population consists of (2415) female students distributed in (15) middle and high schools for girls. Al-Basma School was selected as a sample for the research, and it includes (4) classes for the second intermediate grade. Two classes were randomly selected, (C) experimental and (B) control, with (35) students per class. The equivalence of the two groups was checked with the following variables: (age, prior knowledge test, intelligence, organizational thinking). The researcher adopted two tools: Chemistry Achievement Test and Organizational Thinking Scale, and their psychometric properties were checked. The researcher reached the results that there is a difference between experimental group students who studied on the TASC model and control group students who studied in a non-modern way in chemistry achievement in favor.

## Chapter One:

### 1.1 Introduction and the importance of the research:

Those concerned with the educational process agree on the necessity of teaching thinking and developing its skills for all learners, in all stages of study, with the aim of building a thinking generation that possesses mental skills that help it build its society and face contemporary challenges, so teaching thinking is one of the main objectives of education in general, and chemistry education in particular.

There are many educational models that arose from the constructivist theory and proved to be effective in teaching, and one of the most important of these models is the Thinking Activity in a Social Context (TASC) model, which allows learners to acquire new knowledge and link it to previous information with logical links, which has a positive role through gathering information, organizing it, identifying the issue, generating ideas, choosing the best ones, and making decisions with peers (Bell and Wallace, 2004: 69).

The importance of this model is due to its applicability to all age levels, as well as the fact that it is the starting point for leading learners to identify and formulate issues related to them, helping them to learn basic skills in a collaborative context, which is consistent with the principles of constructivist theory that emphasizes the process of cognitive reconstruction of the learner through collaboration, as the information of the group is greater than the information of each learner alone (Jabbar 2023b).

The importance of the TASC model is that it contributes to enriching the linguistic and scientific knowledge of students, as each student presents his ideas to his colleagues, and explores the reasons for supporting or opposing the ideas presented, with the aim of convincing them, and then reaching a solution to the issues (Bell and Wallace, 2004: 70).

Among the studies that used the TASC model to improve science achievement and cognitive skills, Al-Baz's study (Al-Baz, 2023) found that there is an effectiveness of teaching with the TASC model in raising the level of achievement in science and developing cognitive skills (Al-Baz, 2023: 274).

The study (Septiyana & et al, 2019) aimed to improve the self-efficacy of a sample of (30) students in a preparatory school in Indonesia, and the result of the study was that the level of students of the experimental group taught with the TASC model was better than the students of the control group taught in the usual way.

The study (Johnstone, 2008) indicated that the Active Thinking in a Social Context model is a framework for problem solving, an approach to teaching, curriculum expansion and integration, and provides a framework to support students in collaborating during study, encouraging creativity, and developing problem-solving skills.

Achievement is of interest to the family, the learner and the teacher, and is a guide to success in the academic stages, and measures the learner's ability to match his creative abilities with his school performance (Jabbar 2023b).

According to (Reber and Reber, 2008), achievement motivation means completing, achieving and reaching the goal, which is a personal and self-motivation as a manifestation of diligence for success and striving for good performance (Reber and Reber, 2008: 6), and it can be said that achievement is a set of information and skills that learners acquire as a result of their exposure to a specific unit of study (Nasser, 2011: 13) (Nasser, 2011).

Systems thinking aims to enable learners to focus on specific models, classify, organise ideas, analyse them into their constituent parts, make inferences, build the structure of available models, and reach the required results (Al-Feel, 2015: 25).

According to Raved & Yarden, 2014, systems thinking is the ability to: Identify the components of a system, identify simple relationships, dynamic relationships, and organise the components into a framework of interactions.

There are many studies that addressed the interest in systemic thinking skills and their development such as (Raved & Yarden, 2014), (Salibi 2018), (Dawood 2020), (Mohammed 2022) These studies indicated that learners' systemic thinking skills are weak, as well as their ability to: Processing, organizing and linking information, and this requires the development of systems thinking skills with models and strategies that encourage them to think systematically.

The intermediate stage is one of the critical stages because it is the cornerstone of the subsequent educational levels, and this reflects the increasing importance of adopting modern trends in science teaching methods in general, with modern educational models, to improve the reality of teaching in schools, and then raise the level of achievement (Jabbar, 2019: 3).

## **1.2 Research Problem:**

Most educators concerned with teaching agree that there is an imbalance in educational institutions represented in the weak ,the poor investment of mental abilities represented by thinking abilities in general, and systematic thinking in particular, and this view is supported by the results of previous studies that found that The low level of academic achievement in chemistry, such as the study of Al-Masoudi 2022, Abdullah 2022, and Jabbar 2023a, as well as the weak interest in the mental abilities represented by systematic thinking, as a result of not using modern teaching methods, and here the need appears for modern teaching models commensurate with modern trends in the field of teaching, and one of these models is the TASC model, as it is concerned with teaching higher levels of thinking, as learning occurs in small interactive groups, and learners are required to provide inferences when reaching solutions, in addition to that they discover information while searching for solutions (Meeker and Schaefer, 2011): 381).

Based on the above, organizational thinking skills among second grade female students, due to the use of traditional models and strategies by female teachers, which necessitates the use of teaching models that help improve achievement and develop organizational thinking, and the two researchers

are trying to address this issue by using the TASC model in teaching and its application, so the current research problem is summarized in trying to answer the following question: What is the impact of teaching according to the TASC model on chemistry achievement and organizational thinking of second grade female students?

### 1.3 Research Objective:

1. To identify the impact of teaching according to the TASC model on the achievement of chemistry and systems thinking among female students in the second intermediate grade .

### 1.4 Research hypothesis:

1. There is no statistically significant difference at the level of (0.05) between the average scores of the experimental group of students who are taught according to the TASC model and the average scores of the control group of students who are taught the standard method in chemistry achievement

### 1.5 Fields of research:

**1.5.1 Human Subjects:** Students of the second intermediate grade for girls at Al-Basma Intermediate School for Girls, belonging to the Baghdad Education Directorate, Rusafa I.

**1.5.2 Temporal field:** For the period from (22/11/2023 to 41/1/4202).

**1.5.3 Spatial area:** Al-Basma Middle School for Girls belonging to the Baghdad Education Directorate in Rusafa first.

## Chapter Two:

### 2. Research methodology and fieldwork:

**2.1 Research Methodology:** The researcher used the TASC model to investigate the impact of the TASC model on chemistry achievement and organizational thinking as it is the appropriate method to verify the two research hypotheses.

### 2.2 Research population and sample:

The research population consists of (2282) female students in (15) middle schools for girls in the General Directorate of Education of Baghdad Rusafa first Governorate.

### 2.3 Research sample:

Al-Basma Middle School for Girls was deliberately chosen to be the research sample (64 female students) The school includes (4) second intermediate grades, as the two divisions (B and C) were randomly selected and their number (64) students (32) students in each division, where division (B) control and (C) experimental as in table (1).

**Table (1) Research sample**

After exclusion	Exclusions	Before Exclusion	Division	group	t
32	8	40	(c)	Experimental	1
32	5	38	(d)	Adjuster	2
64	13	78	Total		

### 2.4 Research Procedures:

**2.4.1 Experimental Design:** A two-group equivalent experimental and control design with post-testing was adopted, which is a partial control design, Table (2).

**Table (2) Experimental design of the research sample**

Tools	Minions	Independent	Parity	Group
Achievement Test Organizational Thinking Scale	Collecting Organization al Thinking	Tusk Model	1.Chronological age in months 2. Intelligence	d
		A regular method		c

			3.previous information	
			4. Systems thinking	

#### 2.4.2 Equivalence procedure: The equivalence of the following variables was checked:

**1.Age:** : The information was obtained from the students' civil status identities deviation between the students of the two groups (experimental and control), the t-test was used for two independent samples and the calculated t-value was found to be lower than the tabulated t-value (2), which indicates that there is no difference in chronological age between the two groups, Table (3).

**Table (3). T-value Age variable**

Significance Statistical	Level Significance	Degree Freedom	T-value		Deviation Standard deviation	Average Arithmetic	The sample	Group
			Tabular	Calculated				
Non-functional	0.05	62	2.00	0.220	4.150	168.2	32	Experimental
					5.215	169.8	32	Adjuster

**2.2 Intelligence test:** Intelligence: Raven's intelligence test was used, it was found that there was no statistically significant difference between the students of the two groups in the intelligence variable, Table (4).

**Table (4) .T-value for the intelligence variable**

Significance Statistical	Level Significance	Degree Freedom	T-value		Deviation Standard deviation	Average Arithmetic	The sample	Group
			Tabular	Calculated				
Non-functional	0.05	62	2	0.660	7.321	42.540	32	Experimental
					6.898	41.371	32	Adjuster

**2.Test of prior knowledge:** It consists of (20) paragraphs for multiple choice (four alternatives), two arbitrators, table (5).

**Table (5) T-value in the previous information variable**

Significance Statistical	Level Significance	Degree Freedom	T-value		Deviation Standard deviation	Average Arithmetic	The sample	Group
			Tabular	Calculated				
Non-functional	0.05	62	2	0.950	2.384	13.071	32	Experimental
					1.980	12.551	32	Adjuster

**2.Systems thinking:** The scale was applied to the experimental and control groups, it was found that there were no differences between the two groups in the organizational thinking variable, Table (6)

**Table (6) T-value in the organizational thinking variable**

Significance Statistical	Level Significance	Degree Freedom	T-value		Deviation Standard deviation	Average Arithmetic	The sample	Group
			Tabular	Calculated				
Non-functional	0.05	62	2.00	0.059	5.041	66.382	32	Experimental
					3.997	65.882	32	Adjuster

#### 5- Control of extraneous variables:

The course material: The two groups (experimental and control) were taught the same material from the chemistry textbook for the second intermediate grade, fifth edition, 2023.

Class distribution: (two lessons per week) for each group (experimental and control).

**2-6 Research Tools:****1- Determining the scientific material: Adoption of the approved chemistry textbook for the academic year 2023:**

the first three chapters of the book.

**2- Formulating behavioral objectives:** (140) objectives were formulated according to Bloom's taxonomy in the cognitive domain and were presented to a group of professors. The level of agreement between the opinions reached (90%), according to Cooper's agreement. Table (7) .

**Table (7) Behavioral purposes**

Cognitive domain					Levels Content	Chapters	Units
Total	Analysis	App	Understanding	Remember			
37	2	6	23	6	Elements and chemical bonds	The first	The first
49	6	22	7	14	Chemical compounds	The second	
54	3	20	21	10	Formulae and chemical reactions	The Third	The second
140	11	48	51	30	Total		

Plans: (40) daily teaching plans were prepared, (20) plans for each group.

**2-7 Tests used in the research:****2.7.1 Achievement test: The test was built according to the following steps:**

1. Determine the objective of the test: Measuring the achievement of female students in the content of the chemistry textbook.

2. The scientific material: It was mentioned in the research requirements (identifying the scientific material).

3. The test map: Table (8).

**Table (8) Distribution of achievement test items between classrooms and levels of the cognitive domain**

Total	Analysis	App	Assimilate	Remember	Bloom levels		Sequence	
140	11	48	51	30	Course content		Chapter	
100%	8%	34%	36%	22%	Relative weight	Number of servings	Chapter	
Number of paragraphs							Chapter	
8	0	3	3	2	40 %	8	Elements and chemical bonding	The first
6	1	2	2	1	30 %	6	Chemical compounds	The second
6	1	2	2	1	30 %	6	Formulae and chemical reactions	The Third
20		2	7	7	4	100%	20	Total

**1- Constructing the paragraphs of the achievement test:** (20) objective paragraphs were formulated.

Validity of the test: (Apparent validity): It was presented to a number of arbitrators, and the agreement rate was 96% according to Cooper's agreement formula.

Construct validity: This type of validity is achieved by distinguishing the difficulty factor of the passage as follows.

**Exploratory application of the achievement test:**

**The initial exploratory sample:** (Ghamdan Middle School for Daughters) returning to Rusafa first (40) female students, and it was found that the test paragraphs were clear and understandable, and the time taken to answer (32) minutes.

**Second exploratory sample:** The test was applied to a sample of (120) female students from Al-Ashraq Intermediate School, and then determined the proportion of (27%) for the upper group, (27%) for the lower group, and (27%) for the upper group.

The difficulty of the paragraphs: The paragraph difficulty formula was applied, and the coefficient of difficulty of the paragraphs was between (0.43-0.74), so the test paragraphs are considered acceptable, as scientists indicated that the range of acceptable coefficient is (0.20-0.80) (Al-Yaqoubi 2013:120).

B. Paragraph discrimination coefficient: The paragraph discrimination formula was applied and it was found that the discrimination coefficient of paragraphs ranges from (0.28 - 0.70), as (Majeed et al., 2012) emphasizes that a paragraph is considered good if its discrimination coefficient is from (0.20) and above (Majeed et al., 2012:33).

C. Effectiveness of False Alternatives: False alternatives to the test were found to be attractive.

Stability (Cronbach's alpha<sub>20</sub>): Stability was verified by this method by taking (90) forms from the statistical analysis sample, and the correlation reached (0.86), which is acceptable as the test is stable if the correlation coefficient is between (0.70 - 0.90) (Abu Libdeh, 2008:223).

**2-8 Organizational Thinking Scale:** A measure of systems thinking was adopted (Dolansky & Moore, 2013). The scale consists of (30) items of self-report type, and the scale has (3) alternatives (always, sometimes, rarely) with weights (3, 2, 1) respectively, and the scale was translated from English to Arabic, and the validity of the translation was verified by the translation and back-translation method.

Apparent validity of the scale: The researcher presented the scale to specialized experts and the agreement rate was 95%.

**Clarity of paragraphs and time taken to answer:** The scale was applied to a sample of (30) female students at (Al-Ashraq Middle School for Girls) **Statistical analysis of the scale items:**

**A. Two-group ANOVA:** To calculate the discriminate power, the Organizational Thinking Scale after correcting the answers and identifying (27%) of the upper group and (27%) of the lower group, that all values are greater than Table (2) at significance level (0.05) and degree of freedom (62), which indicates that all paragraphs are discriminate.

Pearson correlation coefficient: When Pearson correlation coefficient was applied, the correlation coefficients were found to be significant, as they were higher than the tabular value (0.124) and the degree of freedom (118).

**Stability: Internal consistency (Alpha Cronbach's alpha):** a random sample of 70 questionnaires for statistical analysis, and the correlation coefficient was (0.88), which is an acceptable value in the general scale of the significance of correlation coefficients (Odeh and Al-Khalili, 1988:146).

The final version of the Organizational Thinking Scale: The scale consists of (30) items, so the maximum score of the scale is (90) with a hypothesized mean of (60) and the minimum score is (30) Appendix (2).

Procedures for applying the experiment: Teaching started on 22/11/2023 until 14/1/2024.

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### Chapter Three:

### 3 - Presentation and discussion of the results:

#### 3-1 Presenting and discussing the results of chemistry achievement for the control and experimental groups:

The first hypothesis: The t-test was used for the two independent (5.129) is larger than the tabular t-value (2.00) with a degree of freedom (62) at a significance level of (0.5). This indicates that there is a difference in chemistry achievement in favor of the experimental group, Table (9).

**Table (9) Calculated and tabulated t-values for the students of the two research groups in the achievement test**

Significance Statistical	Level Significance	Degree Freedom	T-value		Deviation Standard deviation	Average Arithmetic	The sample	Group
			Tabular	Calculated				
functional	0.05	62	2	5.129	2,315	16,894	32	Experimental
					1,642	14,326	32	Adjuster

Thus, the null hypothesis is rejected and replaced by the alternative hypothesis which states that there is a statistically significant difference

Improving the level of chemistry achievement and acquiring other new knowledge and basic thinking skills, in an atmosphere of cooperation among them (Wallace & Adams, 1999: 123).

This result also agrees with the results of Al-Baz, 2023, Mahmoud, 2017, and Johnstone, 2008, which indicated that teaching according to the TASC model leads confirms the researchers' theoretical findings that there is a causal linear correlation between the TASC model (independent variable) and academic achievement in chemistry (dependent variable).

Effect size: ( $\eta^2$ ) was calculated and found that the effect size is significant, as (Nassar, 2006) indicates that the effect size is significant if it is (0.14) or more (Nassar, 2006:54), Table (10).

**Table (10) The t-value ( $\eta^2$ ) and effect size ( $\eta^2$ ) in chemistry achievement**

The size of the effect	Impact Size Value	Calculated T-value	Tabular t-value
Big	0.297	3.961	2

#### 3.2 Presenting and discussing the results of organizational thinking for the experimental and control groups:

Hypothesis 2: When a t-test was used for the two independent samples of knowledge to test the significance of the difference between the mean scores of the experimental and control groups, the calculated p-value (06. 771) was found to be greater than the tabulated p-value (2.00) with a degree

of freedom (62). (771), which is greater than the tabular t-value (2.00) with a degree of freedom (62) at a significance level (0.5), which indicates that there is a difference between the experimental group and the control group students in the degree of organizational thinking and in favor of the experimental group, Table (11).

**Table (11) Calculated and tabulated t-test for the students of the two research groups in organizational thinking**

Significance Statistical	Level Significance	Degree Freedom	T-value		Deviation Standard deviation	Average Arithmetic	The sample	Group
			Tabular	Calculated				
functional	0.05	62	2	6.771	4.094	73.814	32	Experimental
					3.792	67.137	32	Adjuster

Thus, the null hypothesis is rejected, and the alternative hypothesis is replaced by the alternative hypothesis that the post-test in organizational thinking, 9, is valid for the experimental group.

These results are consistent with the development of basic thinking skills (Wallace & Adams, 1999: 123). This result is consistent with the findings of (Raved & Yarden, 2014), (Salibi, 2018), (Dawood, 2020), (Mohammed, 2022), which indicated the possibility of developing students' organizational thinking skills through modern teaching strategies and models, including the TASC model.

The size of the effect: When applying the formula of Eta square to know the effect size, it was found that the value of Eta square is equal to (0.425), which is a large effect size in organizational thinking, Table (12)

**Table (12) The value of (t) and ( $\eta^2$ ) and the effect size on organizational thinking.**

The size of the effect	Impact Size Value	Calculated T-value	Tabular t-value
Bigger	0.425	6.771	2

## Chapter Four:

### 4- Conclusions and Recommendations:

**4-1 Conclusions: In light of the results of the research, the following conclusions can be drawn:**

1. There is an impact of teaching according to the TASC model in improving the chemistry achievement of second intermediate female students.
2. There is an impact of the TASC model on organizational thinking.
3. The magnitude of the effect of teaching according to the TASC model on academic achievement and organizational thinking is significant.

### 4-2 Recommendations:

- 1) Organizing developmental courses on active learning in general and the TASC model in particular for female and male chemistry teachers.  
and chemistry teachers.
- 2) Encourage teachers to use modern teaching strategies to raise the level of achievement of their students of their students.
- 3) The impact of teaching with Posner's model on science achievement and constructivist thinking among second grade female students.
- 4) Organizational thinking skills and their relationship with chemistry achievement among fifth grade female students.

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