Strategic Impact (D.C.A.A.T.A) In Mental Alertness Among Fourth Year Middle School Students In Chemistry

Ahmed Hanawi Hassan[1], Dr. Wafa Abd Al- Razzaq Abbas Al-Anabi[4]

[1]*Department of General Sciences - College of Basic Education - University of Babylon*

KEYWORDS

{strategy (D.C.A.A.T.A)}, Mental Alertness Scale, Chemistry.

ABSTRACT

The eresearch aim.s too iidentify the impact of the strategyy [(D.C.A.A.T.A) in mental alertness among fourth-year middle school students in chemistry].The quasi-experimentall design wass adopted for thee experimentall and controll groupss withi the posttest, where the sample size was (73) students, distributed among (36) forr thee experimentall groupp andd (37) forr thee controll groupp, and too achieve Objective of the research: The researchers built a measure of mental alertness consisting of (28) items according to Langer's four dimensions. After applying the measure too thee twoo researchh groupp, the researchers analyzed thee results. It became clear thatt thee studentss of thee experimentall groupp were superiorr too thee studentse thee controll groupp according to thee (D.C.A.A.T.A) strategy in the measure of mental alertness, and that The size of the effect of the (D.C.A.A.T.A) strategy was very large on the mental alertness scale, and in light of this, the following conclusion was reached that teaching according to the (D.C.A.A.T.A) strategy contributed to improving thee levell off mental alertness off fourthh-yearr middlee schooll studentss inn chemistry.

1. Introduction

First: thee research problem: Problem off the Research

Chemistry iss onee off thee important sciences that alll countries of the world seek to pay attention to, because of the factors in it for success and continuous progress for those countries and their knowledge that whoever excels in this science will be able to lead the world and control its capabilities and wealth, as it is a science that contains the secrets of energy and knowledge of its sources. The atom, its compositions and atomic structure, radiations and their importance, etc., which makes it a standard for possessing the tools of progress and industrial renaissance and a future outlook with multiple dimensions for the progress or backwardness of these countries. (Badawi,2019: 2). Traditional methods of teaching are no longer appropriate for contemporary life, and therefore many educational theories have emerged that help in acquiring various mental, social, and motor skills. The task of the modern teacher, according to current methods, is to provide opportunities for learners to acquire knowledge on their own and participate in all educational activities. As a result, modern teaching methods have evolved in line with the changing perspectives on the educational process. Where teaching methods once focused on memorization and recitation, they have expanded to include perceptual and cognitive levels, which require learners to take an active role in education, with the aim of revealing and developing their latent abilities. (Zayer et al., 2014: 34-35)

Most chemistry teachers, both male and female, observed a decline in the mental alertness of fourth-year middle school students. To address this issue, the researcher selected the (D.C.A.A.T.A) strategy and focused on mental alertness. Its application to a sample of fourth-grade middle school students may help address some aspects of the problem. The research problem can be framed by answering the following question:

- **Whatt is the impact off strategy? (D.C.A.A.T.A) in mental alertness among fourth year middle school students in chemistry?**

Second: The importance of research: Importance of the Research

Today, the world is witnessing an information and technological revolution that has included all aspects of human life This revolution posed a challenge to the educational system, as it imposed a

huge amount of knowledge on the preparation of scientific and educational cadres that take their effective role in development in all its dimensions, and confront the challenges facing it. (Al-Kubaisi,2007: 5) .

Therefore, education is considered a process of education and at the same time learning, and because of cultural development in the world, every person must learn every day, so education has become necessary for the individual. (Zayer and Iman,2011: 16).

The researcher believes that the methods used in teaching science in general, and teaching chemistry in particular, must be compatible with modern teaching approaches that focus on the student and make them the focal point of the educational process. Among these modern teaching strategies are active learning strategies, which are rooted in constructivist theory.

One such modern teaching strategy is D.C.A.A.T.A, which depends on the cognitive organization of content. This strategy helps students organize complex scientific information around scientific phenomena during their investigation of a topic from six aspects: Description (D), Comparison (C), Link (A), Analysis (A), Translation or Application (T), and Proof (A). In this approach, the teacher outlines each stage and places the students' thoughts under each of the six stages (Julih, 1999: 28).

The science of chemistry contributes to developing the student's personality and developing his mental and cognitive abilities to face daily problems and highlight the theoretical and applied aspects. This is supported by building the curriculum, which requires providing the student with scientific knowledge and providing him with desirable behavior patterns. Chemistry is one of the important elements in our contemporary life, as it is included in all fields and activities. There is no single branch related to chemistry and its applications, which made its importance a clear feature of the progress and prosperity of nations. (Al-Khatib and Mustafa,2011: 15).

The theoretical literary heritage has proven through many studies and literature that mindfulness greatly affects learning through full awareness of the educational process, awareness of the individual's internal and external experiences within the performance of educational tasks and thinking, as mindfulness has high correlations with the variables of learning efficiency, self-esteem, psychological stability, and reducing Stress, planning, readiness, motivation to learn, and many other traits and skills directly related to the various educational processes, meaning that individuals who enjoy mental alertness have high abilities to pay attention, a high willingness to learn, and have the ability to accomplish tasks. (Bernay, 2014: 22).

Third: Research objectives:Objectiv off thee Researchh

Thee researchh aimss too identifyytheeeffect off using astrategyy (D.C.A.A.T.A) for fourth year Mental Alertness

Fourth: Research Hypotheses

To achieve the two objectives of the research, the researcher developed two hypotheses:

Null Hypothesis: There is no statistically significant difference (at the significance level of 0.050) between the average scores of the experimental group of students who will study chemistry according to the D.C.A.A.T.A strategy and the average scores of the control group of students who will study the same subject according to the usual method on the mental alertness scale.

Fifth: Research Limitations

The research is limited to the following aspects:

1. **Human Limit**: Middle school students (fourth year of middle school).
2. **Temporal Limit**: The first semester of the academic year 2023-2024 AD.
3. **Spatial Limit**: Governmental preparatory and secondary schools for boys affiliated with the General Directorate of Education in Babil Governorate - Hilla Center.

4. **Cognitive Limit**: Chapters (first and second) of chemistry for the fourth year of preparatory school, first edition of 2021 AD.

Defining Terms: Define search terms.

1. **Impact**: According to Arafa (Al-Saadoun, 2012), "The amount of intended change that occurs in the dependent variable due to the influence of the independent variable on it" (Al-Saadoun, 2012: 220). The researcher defines it procedurally as the size of the change intended to be brought about by the influence of the independent variable (strategy) DCAATA on the two dependent variables: achievement and the level of mental alertness of the experimental group students in chemistry for the fourth year of middle school, measured by the achievement test and the mental alertness scale prepared for the purposes of the current research.

2- DCAATA Strategy: Define it (Ghayyad and Ahmed, 2018)"This strategy is considered one of the educational learning strategies, and it is derived from the six stages that it goes through, and to apply it, the learners must be encouraged to think and follow its steps.".(Ghayyad and Ahmed,2018:26).

The researcher defines it operationally as:that itA set of six sequential teaching steps, ranging from simple to more complex in dealing with educational topics to achieve the research goal, which is (descriptionD, Comparison C, Correlation A, Analysis A, Translation T, Evidence A) which the researcher adopted in teaching chemistry topics to the experimental group of fourth grade middle school students..

3- Mental alertness: Mindfulness

2000), (Langer as : "It is a flexible state of mind and openness to new things, and it is an effective process for inventing new things." ((Langer, 2000:40).

The researcher defines it operationally as: A flexible state of mind, represented by openness to new experiences. It is a process of distinctive activity aimed at inventing new concepts, measured by the score that students obtain on the mental alertness scale, which consists of 28 items. A paragraph outlining its four dimensions was prepared by the researcher for this purpose.

Chemistry: According to the Ministry of Education (2005), "Chemistry is the science that studies chemical elements and chemical substances (their composition, properties, and structure), the mutual transformations between them, and chemical reactions" (Ministry of Education, 2005: 31).

Chapter Two: Theoretical Background and Previous Studies

The First Axis: Theoretical Background

1-1. Definition of Constructivist Theory:The term "constructivism" is derived from "construction" or "structure," which has its Latin origins and refers to the way in which a building is erected. Constructivism is a learning theory, rather than a teaching or directing method.

Teachers can teach in ways known as "constructivism" when they are aware of it and teach in a way It is compatible with how students learn, and constructivist theory is concerned with the internal cognitive processes of the learner, that is, what happens inside the learner's mind when he is exposed to educational situations, such as his previous knowledge, the extent of his acceptance of learning, his motivation, and his ability to process information. Therefore, the teacher's role is to create the learning environment to make the learner build his knowledge on his own. (Al-Adwan, Ahmed ,2016:33).

Joseph Novak referred to constructivism as the idea that people adopt, or it is the process of constructing meaning within their thoughts as a result of an effort to understand and extract meaning from them (Al-Huwaidi,2004: 300).

As for Zaytoun, he pointed out that the constructivist theory is described as a spider's web that spreads in various directions and fields in contemporary education, and it serves as a road map that shows the features, ideas, and standards for effective constructivist learning and teaching. (Zaytoun,2007: 72)

2-1- Sources of constructivistt theoryy:

Constructivism was initially based on four theories:

1. Piaget's theory of cognitive learning and cognitive development.
2. Cognitive theory in the student's (learner's) processing of knowledge and its focus on the internal factors affecting education.
3. Social theory of social interaction in the classroom, laboratory, or field.
4. The humanistic theory highlights the importance of the learner and their active role in discovering and building knowledge.

(Al-Adwan, Ahmed,2016: 39)

Second: Active learning: Active Learning:

1-2- The concept of active learning:

that Concepts that Submit it Researchers To learn Active multiple, Lost Understands from him meaning road to learn And education in that One so Involved Female students in all activities, And exercises, And projects Effectively big from road environment Educational Rich miscellaneous Allow their By listening The positive And dialogue Building, And discussion Wealthy, And thinking Conscious, And analysis proper, And meditation the deep, for every what is reading, Or write, or poses from material study, matters, issues, or opinions, among each other, with a teacher who encourages them to take responsibility for their own education with his close supervision (Saadah et al.,2006: 33).

Likewise, it is learning that guarantees the learner active participation in the educational situation through the research and decisions he undertakes, and writing reports on topics under thee supervision and guidance off thee teacher .(Abdullah,(2007: 66)

2-2-Active learning strategies are based on constructivist thought:

1. strategy (D.C.A.A.T.A).
2. Deniz's strategy DS).
3. pentagram strategy PG).
4. Scientific stations strategy.
5. Learner-centered environment strategy.
6. Cognitive acceleration strategy (Addy and Shayer model).
7. Realistic teaching strategy. (Ghayyad, Ahmad,2018: 23, 47, 65)

Third: Strategy (D.C.A.A.T.A**):**

1-3- The origin of the (D.C.A.A.T.A) strategy:

Attributed to theorist Spencer Kagan "(Spencer Kagen, a teacher inn thee United States of America, is one off the teaching strategies based on organizing knowledge, meaning that the student builds knowledge independently, relying on himself. This strategy can be used in learning, as it increases the students' readiness and abilities to think and benefit from previous existing experiences. In their cognitive structure, where students are encouraged to think flexibly when reading any topic or concept by looking at it from its aspects represented by building or forming the aspects of the strategy, which are description, comparison, correlation, analysis, translation, proof, as the use of the (DCATAA) strategy allows for taking into account the concept. Looking at it in depth and analyzing

all its aspects and branches in detail. (Richard & Ann, 2010:126)

2-3- Strategic steps (D.C.A.A.T.A):

1- Describing: (D) He studies the characteristics of the subject or phenomenon, its definition, and the characteristics that characterize it, so that he can answer the question specific to this subject using one of his five senses (sight, hearing, smell, touch, and taste).

2- Comparison: (Comparing) (C) The student searches between the characteristics of the current topic studied and another phenomenon similar to the one studied, and students must know the similarities and differences between them.

3- Associyzing (A) searches for things that are related to the topic when the teacher asks a question that is related to the current topic. (Jazlin & Sharon, 1999:175)

4- Analyzing: (A) Analyzing the components of the concept.

5- Translation (T): (Translating) applying information to other applications.

6- Evidence (A): (Arguing) supporting the information by repeating it with new examples.

(Ghayyad and Ahmed,2018: 2240)

Thee secondd axiss: previouss studiess:

- **Previous studiess dealtt withh thee strategy (D.C.A.A.T.A, Table No. (1).**

Name of Researcher, Country, and Year	Aim of the Study	Independent Variable	Dependent Variable	Sample Size and Academic Stage	Method Used	Study Tools	Statistical Methods	Most Important Results of the Study
Al-Amari, Iraq (2023)	The study aimed to investigate the strategic impact of the DCATAA method on understanding grammatical terms and their application among a sample of fifth-grade science students.	DCATAA strategy	Grammatical terms	71 fifth-grade science students	Experimental method	Test for understanding and application of grammatical terms	t-test for two independent samples, chi-square (χ^2), Pearson correlation coefficient, difficulty and discrimination coefficient equation, effectiveness of false alternatives equation	The results of the research showed that the students in the experimental group, who were taught using the DCATAA strategy, outperformed the control group, who were taught using the usual method, in understanding and applying grammatical terms.

Chapter Three: Research methodology and procedures

First: Experimentall designn:-

Experimental Design

Experimental design is defined as a work program through which the procedures for implementing the experiment are carried out. The conditions and factors surrounding the experiment are planned so that the researcher can observe them and test the differences to reach accurate results about the relationship between the independent variable and the dependent variables (Hamza et al., 2015, p. 63). Figure No.

(10) illustrates this.

Group	**Parity**	**Independent Variable**	**Dependent Variable**	**Posttest**
Experimental	Chronological age (in months)	Achievement in Chemistry for the Third Intermediate Grade	Otis Intelligence Test - Lennon	Mental Alertness Scale
Female Officer	The Usual Method		Mental Alertness Scale	

Number format (1) explains the experimental design of the research.

Second: The Research Community and Its Sample

After identifying the names of the middle and secondary day schools (government) affiliated with the General Directorate of Education in Babylon Governorate, Hilla Center, Al-Thawra Preparatory School for Boys was chosen "by simple random assignment method" to represent the research sample. The number of students is 228, distributed among six divisions, each consisting of 38 students in the fourth year of middle school for the academic year (2023-2024 AD). By random drawing, Section B was chosen to represent the experimental group, whose students will study chemistry according to the strategy (D.C.A.A.T.A), totaling 38 students. Section F represents the control group, whose students will study chemistry according to the usual method, also totaling 38 students. Three students were excluded statistically because they failed the fourth year of middle school. The reason for their exclusion is that they possess information about the subjects that will be taught during the experiment, which could affect the results. However, they were allowed to remain in their classrooms to preserve the school system, as shown in Table No. (2).

Table No. (2) Distribution of students into the two research groups beforee andd after exclusion

Table of Student Exclusion

Group	**Number of Students Before Exclusion**	**Number of Excluded Students**	**Number of Students After Exclusion**
1. Experimental	38	2	36
2. Female Officer	38	1	37
Total	**76**	**3**	**73**

Equivalence of the Two Research Groups:

The researcher was keen to achieve parity between the two research groups in some variables that they believed might affect the results of the experiment. The process of establishing parity was carried out between the students based on the following variables: chronological age in months, chemistry grades for the third intermediate year, and the intelligence test (Otis-Lennon). Through statistical procedures, the researcher concluded that the two research groups are equivalent in all variables, as shown in Table No. (3).

Table (3): Equality of the Two Research Groups
(Chronological Age in Months, Chemistry Grades for the Third Intermediate Year, Intelligence Test (Otis-Lennon))

Variable	**The Group**	**Number of Students**	**SMA**	**Standard Deviation**	**Variance**	**Degree of Freedom**	**T Value**	**Statistical Significance at Level 0.05**

Chronological Age (calculated in months)	Experimental	36	167.78	14.20	201.66	71	0.661	2
Female Officer	37	165.73	12.23	149.59				
Chemistry Grades (previous year)	Experimental	36	68.22	13.56	183.89	71	0.313	2
Female Officer	37	69.27	14.95	223.54				
Otis Intelligence Test - Lennon	Experimental	36	25.36	6.48	41.95	71	0.707	2
Female Officer	37	24.43	4.61	21.25				

Fourth: Controlling Extraneous Variables The researcher made every effort to control non-experimental variables believed to affect the safety of the experiment. Below are the most important extraneous variables that may affect the experiment: selection of research sample, experimental extinction, maturation-related processes, confidentiality of the experiment, study material, duration of the experiment, subject teacher, physical conditions, distribution of classes, and measurement tools.

Fifth: Preparing the Research Requirements

• **Preparing the Study Plan:** The researcher developed a study plan for teaching chemistry to fourth-year middle school students in light of the curriculum content and behavioral objectives. Two models of teaching plans were presented: the first model using the D.C.A.A.T.A strategy and the second using the traditional method in teaching chemistry. Both plans were reviewed by a group of experts to gather their opinions and suggestions. **Sixth: Research Tool**
To achieve the research goals, a tool was prepared to measure the dependent research variable, which is mental alertness.

1-6:Building a mental alertness scale:

The researcher built a measure of mental alertness for fourth-year middle school students, due to the lack of a ready-made, agreed-upon measure of mental alertness, and the reason for the difference is the dimensions and areas of mental alertness. Therefore, the researcher built a measure of mental alertness that is characterized by validity and stability, and the measure was built.

2-6: Determine thee goal off thee measure: -

The scaleeaimsstoomeasuree thee leveloof mental alertness among thee studentssof the research sample, who are (students in the fourth year of middle school).

3-6: Defining the dimensions of mental alertness: -

After reviewing a group of literature and previous studies that included a mental alertness scale, and consulting the supervisor, it was agreed upon on Langer's classification (43:2000, Langer) It includes four dimensions of mental alertness, which are (vigilant discrimination, openness to new things, orientation toward the present, and awareness of different points of view), as explained in the second chapter, which measures thee level off mental alert ness samong fourth-year middle school students.

44-6: Formulating the Scale Items: A scale was prepared according to Anger's four dimensions of mental alertness. It was formulated with 7 items for each dimension, so the mental alertness scale consists of 28 items and was structured in the form of behavioral attitudes. Students answer it with options that represent the degree of applicability to them, which includes four alternatives: "It applies to me a lot," "It applies to me to a moderate degree," "It applies to me to a small degree," and "It does not apply to me."

5-6: Identifying Alternatives to the Scale: The researcher established a criterion for correcting the mental alertness scale. The answer to each item was based on four alternatives according to the four-point Likert scale: "applies to me a lot," "applies to me to a moderate degree," "applies to me to a small

degree," and "does not apply to me." Weights were given to convert these alternatives into A quantitative number for the purpose of conducting statistical operations, and these weights are (1,2,3,4) respectively for the positive items of the scale, and vice versa for the negative items, meaning their weights are (4,3,2,1), meaning the first alternative is given the lowest score and the fourth alternative is given the highest score, and thus the total score of the scale in its final form is limited to (28–112) degrees**.**

6-6: The apparent validity of the scale:-

For the purpose of verifying the apparent validity of the researcher, the scale was presented in its initial form to a group of experts and specialists in the field of education, methods of teaching science, and measurement. The chemistry supervisors and teachers (9) were asked to express their opinions about the paragraphs of the scale and the extent to which they achieve the required purpose. Some paragraphs were amended, and the wording of others was reconsidered in light of their opinions and observations. After analyzing the arbitrators' responses, the percentage was calculated, ranging between 87% and 100%. The calculated Chi-Square (X^2) values ranged from 8.07 to 15, which is higher than the table value of 30.84, with a degree of freedom of 10 at the significance level of 0.050. The results showed the validity of all items on the scale according to the opinions of experts and specialists, and thus all items (28) were retained. Table 40 shows this.

Table 40 *The statistical significance of the face validity of the mental alertness scale*

Scale Paragraph Number	Number of Arbitrators	Agree	Disagree	Percentage	Chi-Square Value	Average Significance Level (0.05)
1 (1-3-4-5-7-8-9-10-11-12-13-14-15-16-17-22-26-27-28)	15	15	0	100%	15	Statistically significant
2 (18-19-20-21-23-24-25)	15	14	1	93%	11.27	Statistically significant
3 (2-6)	15	13	2	87%	8.07	Statistically significant

Psychometric Properties:

Discriminating Power of Paragraphs: After arranging the students' answers in descending order and choosing a percentage (27%) for both the high and low groups, the discriminating power of the items on the mental alertness scale was then calculated. Using the t-test for two independent samples, the significance of the differences between the average scores of the students from the two groups (high and low) was confirmed for each item. It was found that the items of the scale had discriminatory power values ranging between 2.322 and 5.988 (see Appendix 21). It became clear that all the calculated t-values were higher than the tabulated t-value, which is equal to 2.00 at a significance level of 0.05 and a degree of freedom of 52. Thus, all items of the scale are statistically significant.

Construct Validity (Internal Consistency) of the Scale:

The researcher used the scores from the survey sample in the statistical analysis of the scale to determine the following:

1. **The Relationship of Item Scores to the Total Score of the Scale:** To assess the extent to which the score of each item correlates with the total score of the scale, the researcher subjected the scores of 100 students from the second survey sample to item analysis. This sample was also used to calculate the discriminatory power of the scale items. The Pearson correlation coefficient was calculated for each item's score with the total score of the scale. The correlation coefficients ranged between 0.267 and 0.595, and all items were statistically significant when

compared to the critical value of 0.198. Thus, all items of the scale, which consisted of 28 paragraphs, were included. Table 5 explains this.

Table 5: Correlation Coefficients Between Item Scores and Total Score of the Mental Alertness Scale

Paragraph	Correlation Coefficient	Indication
1	0.472	Function
2	0.487	Function
3	0.388	Function
4	0.478	Function
5	0.506	Function
6	0.358	Function
7	0.578	Function
8	0.534	Function
9	0.595	Function
10	0.524	Function
11	0.437	Function
12	0.533	Function
13	0.407	Function
14	0.302	Function
15	0.471	Function
16	0.404	Function
17	0.531	Function
18	0.384	Function
19	0.458	Function
20	0.483	Function
21	0.541	Function
22	0.439	Function
23	0.450	Function
24	0.470	Function
25	0.429	Function
26	0.267	Function
27	0.465	Function
28	0.337	Function

2. **The Relationship of Item Scores to the Overall Field Score:** To find the validity of the internal consistency of the scale statistically, the Pearson correlation coefficient and the level of statistical significance were calculated between the score of each item and the score of each domain. The correlation coefficients for the scale were as follows:
    - First domain: 0.489 - 0.612
    - Second domain: 0.341 - 0.680
    - Third domain: 0.497 - 0.714
    - Fourth domain: 0.510 - 0.721

These values indicate good correlation coefficients, and all correlation coefficients between the item and domain scores were statistically significant. Thus, the measure of mental alertness is characterized by construct validity. Table 6 explains this.

Table 6: Correlation Coefficients Between Item Scores and Total Score for Each Field of the Mental Alertness Scale

Domain	Correlation Coefficient	Indication
First Field	0.539	Function
Second Field	0.632	Function
Third Field	0.650	Function
Fourth Field	0.533	Function

3. **The Relationship of the Domain Score to the Total Score of the Scale:** The score of each domain must correlate with the total score of the scale. The correlation coefficients between the score of each domain and the total score of the scale were calculated using the Pearson correlation coefficient. The correlation coefficients ranged between 0.661 and 0.842, which are good and statistically significant correlations, as shown in Table 7.

   Table 7: Correlation Coefficients Between Domain Scores and Total Score of the Mental Alertness Scale

Domain	Correlation Coefficient	Indication
First Domain	0.831	Function
Second Domain	0.842	Function
Third Domain	0.772	Function
Fourth Domain	0.661	Function

4. **Scale Stability and Reliability:** Several methods exist for calculating the reliability of the scale. The researcher used the Cronbach's alpha method to calculate the reliability coefficient. The reliability coefficient was found to be 0.85, indicating good stability, as a coefficient of 0.70 or higher is a good indicator of reliability. According to Abu Al-Diyar (2012: 35), a scale with a high reliability coefficient is a good and accurate measure.
5. **The Final Version of the Scale:** After extracting the psychometric characteristics, the scale was finalized with 28 paragraphs after modifications by experts. Thus, the total score of the scale ranges between 28 and 112 degrees.
6. **Procedures for Implementing the Experiment:** After preparing the research tool (mental alertness scale), the researcher began the implementation procedures as follows:
   - The mental alertness scale was administered on Thursday, December 28, 2023, at noon, after informing the students of its date a week prior to the application. The chemistry teacher assisted the researcher in the application.

Eighth: Statistical methods:

Use the finder program (Microsoft Excel – 2010) and the Statistical Portfolio for the Human Sciences (SPSS)**In his research procedures and data analysis.**

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