

The effect of the PECS strategy on the achievement of students of the College of Basic Education in the subject of practical parasites and their analytical thinking

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ABSTRACT

The research aims to identify the effect of the PECS strategy (p.e.c.s) on the achievement of students of the College of Basic Education in the subject of practical parasites and their analytical thinking, and in light of the aim of the research, the researcher derived the following two zero hypotheses:

- 1- There is no statistically significant difference at the level of significance (0.05) between the average scores of the experimental group students who studied the practical parasites according to the PECS strategy and the average scores of the control group students who studied the same material in the usual way in the achievement test prepared for the purposes of this search.
- 2- There is no statistically significant difference at the level of significance (0.05) between the average scores of the experimental group students who studied the practical parasites according to the PECS strategy and the average scores of the control group students who studied the same material in the usual way in the analytical thinking test. Intended for the purposes of this research.

The researcher adopted the partial-controlled experimental design of the experimental and control groups with the post-test of academic achievement and the analytical thinking of the two research groups (experimental and control), and the research community represents students of the third stage of the Science Department / Life Sciences Branch in the College of Basic Education / Al-Mustansiriya University, Wasit University and Diyala University for the year Academic (2020-2021), The number of its members reached (281) male and female students, and a representative sample of the research was chosen from the community of students of the third stage / Department of Science / Branch of Life Sciences / College of Basic Education / Al-Mustansiriya University of (83) students and distributed in three classrooms (A, B, C And by random assignment, the two halls (A and B) were chosen as the two main research groups, as division (A) was randomly selected to be the experimental group and (B) a control group, where the number of sample members reached (60) male and female students, and the parity process was conducted between members of the two groups in variables (Chronological age, Parents' academic achievement, previous microbiology test, microbiology scores for the second semester of the previous year, Raven's intelligence test), and the researcher prepared two research tools, as the first consisted of an achievement test in the practical parasites subject of the multiple choice type consisting of (40) a paragraph, As for the second tool, it was represented by the analytical thinking test, and it may consist of (30) items, and the results showed a statistically significant difference at the level of significance (0.05) for the two research groups (experimental and control) in favor of the experimental group that was studied according to the PECS strategy in the test post achievement and analytical thinking test.

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First chapter /

First - the research problem

The use of practical application in biology and its activation by the teacher and the learner alike is one of the advantages of teaching biology as it helps to simplify and

clarify scientific concepts and acquire the skills necessary for laboratory work and their mastery, It may contribute to raising the level of educational attainment of the learners and developing their thinking, as well as enhancing cooperative work among the learners and providing them with the skill to solve problems in a scientific way and the researcher realized, through her

experience in teaching the practical side of biology subjects, that there are many obstacles, including the poor level of student achievement and the failure to use new methods and strategies to help them develop their different thinking, enhance collective action between them, and exchange opinions and ideas among them. It is imperative to use methods and strategies that help to simplify scientific concepts in the practical side and link them to the theoretical side. This in turn leads to the learners' positivity in educational situations and their acquisition of skills and experiences that encourage them to think analytically to reach solving the problems they face, and among these strategies is the PECS strategy, which is considered One of the active learning strategies, where the teacher raises a specific topic or issue, and students deal with this topic from its four aspects, which are the problem, the causes resulting from the problem, the effects resulting from it, and the proposed solutions to it, which leads to stimulating students' motivation to learn and urge them to think, hence the problem of searching by answering the question raised:

(What is the effect of the PECS strategy on the achievement of students of the College of Basic Education in the subject of practical parasites and their analytical thinking?).

Second - The importance of research: The theoretical importance of research can be determined by the following

1- The first research (according to the researcher's knowledge) at the local and Arab level, which dealt with the PECS strategy in the practical teaching of the subject (parasites) for students of the College of Basic Education and their analytical thinking.

2- Analytical thinking is one of the types of thinking that educational goals emphasize at all school levels.

3- The importance of the university stage as the stage in which students can learn and consider it an important stage for the learner's growth, physically and mentally.

As for the applied importance of the research, it is determined as follows:

1- The importance of experimenting with modern strategies, including the PECS strategy in achievement and analytical thinking.

2- The researcher's choice of the PECS strategy as it is suitable for the Iraqi educational environment, and it is not financially expensive, and its steps are limited and suitable for class time now, it only needs to organize student groups with papers to make an outline of the steps to implement the strategy.

Third - The objective of the research: The research aims to identify: the effect of the PECS strategy on the students of the College of Basic Education in the subject of practical parasites **and their analytical thinking.**

Fourth - Research limits:

1- The human limit: a sample of students of the College of Basic Education / Department of Science / Branch of Life Sciences.

2- Spatial boundary: College of Basic Education / Al-Mustansiriyah University / University of Wasit / Diyala University.

3- Time limit: the first semester of the 2020-2021 academic year.

3- Knowledge limit: the practical part of the parasites course to be taught to students of the Department of Life Sciences / Third Stage.

Fifth - Defining terminology

PECS Strategy, defined by:

- It is an instructional strategy of active learning strategies followed by the teacher (researcher) with the student, as the researcher poses the topic of the lesson in the form of a problem, and the student identifies the problem and the effects resulting from the problem, the causes leading to it, and the proposed solutions to solve it through stimulating motivation and group discussion in a specific subject (Radhy, 2017) : 22).

3-Achievement: It is the proof of the student's ability to accomplish what he acquired from the educational experience that was set for him (Alderman, 2007: 101).

As for the procedural definition of achievement, it is: the total score obtained by the respondent or the respondent in the achievement test that was built in this research.

4- Analytical Thinking:

- It is the ability to confront problems by carefully dismantling their parts in a systematic manner, attention to detail and planning carefully before making a decision as well as gathering as much information as possible and the ability to contribute to clarifying things to reach rational conclusions through facts (Gregory, 1988: 151).

As for the procedural definition of analytical thinking, it is: the total score obtained by the respondent or respondent in the analytical thinking test used for the purposes of this research.

Second Chapter /

3- PECS strategy

It is considered one of the constructive strategies based on active learning, as it helps to achieve the goals of stimulating motivation among the learners, also this strategy (p.e.c.s) includes short words, where the teacher presents an issue or a specific topic and the learners address it in order from four sides "(Muhammad, 2020: 243)

Therefore, the researcher chose the PECS strategy, which is one of the active learning strategies, as it is suitable for middle school and undergraduate students, at this stage, they have reached a mental and age-appropriate level to accept the steps of this strategy and interact with it positively, as well as suitable for the nature of the subject (Al-Ramli, 2020: 25), and that the letters (p.e.c.s) represent an abbreviation of the word as:

| | |
|----------|------------------|
| P | Problems |
| E | Effects |
| C | Causes |
| S | Solutions |

Chart (1) Clarifying the meanings of the letters of the strategy (Ambu Saidi and Suleiman, 2016: 144).

The goal of the strategy: To achieve the goal of active learning represented in stimulating motivation among the learners and their motivation for teamwork in order to reach the desired goals chosen by the researcher for the variables of his research.

Steps to implement the strategy

1- The teacher explains the lesson to students in a concise and comprehensive format.

2- Distributing students in groups, each group comprising (5-6) students, and then distributing the strategy outline to them in the form of papers to be implemented collectively in order to achieve active learning.

3- Students conduct brainstorming and group discussion in order to address the issue from its four aspects represented by:

- The problem or problems in the community
- The effects resulting from the problem
- The causes leading to the problem
- Suggested solutions to the problem

4- The teacher discusses with the students what they have reached (each group leader begins by explaining what his

group has come up with, and stating the opinion of all groups (Embu Saidi and Suleiman, 2016: 143).

Time to implement the strategy: It can be used after completing a specific goal or as an activity given to learners during the lesson

Third axis

Clifford showed that the analysis is a process that includes searching in the details of things and deriving new solutions from the cognitive stock of the learner to meet the requirements of the situation in question based on the succession of cognitive processes and their synchronization, starting with attention and ending with the evaluation through knowledge, memory and thinking in its two types as convergent and divergent (Al-Zayat, 1995: 496), Analytical thinking needs to be contemplated in dealing with solutions, when comparing analytical conclusions with others, the most responses were those of those who contemplate the proposed solutions compared to those who respond quickly to the first solution that occurs to their minds (Hamzah, 2019: 29).

(Jakus & Zubcic (2014) defined analytical thinking as the ability to visualize and articulate expression, analyze components of problems and issues, develop solutions to simple and complex problems, make decisions, and identify causes in light of available information and knowledge (Jakus & Zubcic, 2014: 5).

Steps of analytical thinking:

1- The existence of a problem facing the individual and pushing him to carry out the activities necessary for the solution.

2- Observation in order to collect the necessary information about the problem in order to understand and analyze it.

3- Formulating assumptions after collecting the information and investigating and analyzing the problem.

4- Realizing hypotheses, proving them, them with other information and with what the individual has from previous experiences

5- Reaching definitive conclusions, laws and general rules (Razuki and Nabil, 2018: 210).

Obstacles to analytical thinking

The first obstacle: When we stop analyzing, theoretically anything can be analyzed to infinity, and if we do not link our analysis of the situation to a specific goal, then the analysis will become a hindrance to thinking rather than a facilitator for it.

The second obstacle: that analysis often does not lead to the production of something new because it breaks down the basic components of it into subcomponents. Researchers have devised several methods or tactics to overcome these two handicaps, as methods were designed with the aim of training individuals on how to effectively analyze problems, allowing the process of analysis to be directed and organized, as against other methods designed with the aim of using analysis as a gateway to generate ideas (Kadhim, 2015: 322).

Theories that dealt with analytical thinking

First: The theory of self-control and the theory of thinking styles by Sternberg and Gregory

And it is one of the most common theories to explain the nature of thinking styles, and the main idea in this theory is that people need to adapt themselves mentally, and ways of thinking are their ways to achieve this, Sternberg referred to Gregory's participation in classifying his theory and laying down rules and methods of thinking about it, including the analytical thinking style, Individuals prefer to use a certain style of thinking over another, and that depends on the suitability of that style to their abilities and mental potential, he also believes that from an analysis of what he says and what people do, it is possible to determine the thinking style and learning style of people, and Gerigore in his scale showed the characteristic of an individual who thinks analytically, including (he analyzes situations, focuses on data and checks numbers, He is logical, uses his mind to perceive situations, is contemplative and realistic, is good at solving problems and is firm in his decisions, as they are about vision, insight and contemplation, and easily distinguishes between people and perceives their character, and loves to collect facts and analyze issues, and provides evidence that arouses the attention of others and needs evidence and proofs when presenting his ideas (Hamza, 2019: 43).

Second - Harrison and Bramson's theory (Harrison & Bramson 1982):

This theory reveals the thinking styles preferred by the individual, the nature of the connections between them and his actual behavior, as well as whether these methods are fixed or subject to change, and also explains how the differences between individuals grow in terms of the predominance of certain thinking styles they have and these styles as defined by Harrison and Bramson, the synthetic thinking style and the style Ideal thinking, practical thinking style, analytical thinking style, and realistic thinking style, and since these methods do not work separately, but are subject to double or triple fusion, According to this theory, both hemispheres of the brain perform general functions, as the right hemisphere

controls motor functions and other mental functions such as intuition, anthropomorphic perception, non-verbal performance, manual actions, and abstract artistic production, while the left hemisphere controls logical and mathematical mental functions as well as Analytical and functional functions and constructive notes (Harrison & Bramson, 1982: 2).

Third Chapter/ Research Procedures

First - Research methodology and experimental design

The researcher adopted the experimental method in her research because it is appropriate to the nature of the research and its goal, so the researcher chose the experimental design with a post-test to measure the achievement and analytical thinking of the experimental and control groups, which partially control one another.

Second - The research community and its sample

The current research community consists of students of the third stage / science department / life sciences branch of the Faculties of Basic Education at Al-Mustansiriya University, Diyala University and Wasit University for the academic year (2020-2021) and their number (281) students * and distributors as follows:

1- Al-Mustansiriya University / College of Basic Education / Department of Science / Life Sciences Branch (83) male and female students

2- Wasit University / College of Basic Education / Department of Science / Branch of Life Sciences (48) male and female students.

Diyala University / College of Basic Education / Department of Science / Branch of Life Sciences (150) male and female students

The researcher selected a representative sample of the research from the community of third-stage students / Department of Science / Life Sciences Branch / College of Basic Education / Al-Mustansiriya University of (83) male and female students as an intentional sample.

Third - Equivalence of the two research groups: parity between the two research groups was made according to the variables (the chronological age of students calculated in months, the academic achievement of the parents, the academic achievement of the mothers, the previous achievement, i.e. the general average scores for the microbiology of the students of the two research groups, the test of previous information, the test of analytical thinking and intelligence.

Fourth - Control of extraneous variables (internal safety)

Fifth - Research requirements

A- Determining the scientific subject: Before starting the experiment, the researcher determined the content of the scientific material that would be studied for the two research groups during the first semester, according to the vocabulary of the practical parasitology subject to be taught to the third phase students of the academic year (2020-2021).

B- Formulating behavioral objectives: The researcher formulated behavioral objectives depending on the content of the scientific material. The number has reached (227) behavioral objectives according to the (Bloom) classification in the cognitive field with its six levels (knowledge, understanding, application, analysis, structure, evaluation), because it is considered One of the most common, used and detailed classifications (Bloom, 1983: 107).

C- Preparation of teaching plans: The researcher prepared two types of teaching plans for the two research groups in Appendix (9), where one represents teaching plans for the experimental group according to the PEX strategy (p.e.c.s), while the other represents teaching plans for the control group according to the method.

Sixth: Preparing the Two Search Tools

A- Preparation of the achievement test: The researcher prepared the achievement test in the practical parasites subject for the third stage, the life sciences branch, according to the content of the educational material and the purposes that were identified in the knowledge field for levels (knowledge, understanding, application, analysis, synthesis, evaluation), and the researcher adopted the following steps To prepare for this test

B- Determining the purpose of the test: The aim of the test is to measure the achievement of the third stage students in the subject of practical parasites in primary animal subjects (Protozoa), Class sarcodina, Flagellata Class, Class Sporozoa, Carriers Division Phylum Ciliophora and Phylum Platyhelminthes.

Determining the scientific subject: The scientific subject is determined according to the vocabulary of the practical parasites subject to be taught to students of the third stage of the life sciences branch for the academic year (2020-2021)

3- Determining the test items: The achievement test items of (40) items have been prepared, and each paragraph consists of four alternatives, one correct and three false, and it is comprehensive for the content of the course material and for behavioral purposes.

4- Preparing the test map: The researcher prepared a table of specifications for the achievement test according to the following steps:

next:-

A- The weight of each semester of the subject was calculated based on the number of hours for each semester

B- The relative weight of the behavioral objectives was determined for the six levels of (Bloom) for the cognitive domain

5- Formulation of the achievement test paragraphs: The test consisted of (40) test items distributed on Bloom's cognitive levels (knowledge - understanding - application - analysis - synthesis - evaluation) and on topics for the five chapters of the subject

6- The validity of the test: The researcher relied on the types of truthfulness, which are apparent validity, content validity, and construct validity.

- The first exploratory application of the achievement test: For the purpose of ascertaining the time that students need to answer the test and also ensuring the clarity of the test paragraphs and instructions, the test was applied to an exploratory sample consisting of (20) students from the third stage of the College of Basic Education affiliated to the Presidency of the University Wasit / district After completing the application, the researcher found that all the items of the achievement test are clear and understood by the sample, and it was found that the average response time for the achievement test is (24) minutes.

8- The second exploratory application of the achievement test: The researcher applied the achievement test on a second exploratory sample consisting of (100) students from the third stage of the College of Basic Education of the University of Diyala, and after the researcher arranged the grades in descending order from the highest grade to the lowest, she took the highest (27%) of the students 'higher scores represent the upper group and the lower (27%) of the students' grades to represent the lower group, after that, the scores of both the upper and lower groups are statistically analyzed for the purpose of extracting the psychometric characteristics of the test as follows:

- Difficulty coefficient for the items: The researcher calculated the difficulty factor for the objective items and found that it ranged between (0,35-0,51), so the test items are considered good and acceptable, and their difficulty factor is appropriate.

2- Paragraph Discrimination Coefficient: The strength of discrimination for paragraphs was calculated and found to

range between (0.48-0.70), which has a good indicator of acceptance of paragraphs in terms of their discriminatory ability.

Achievement test in its final form: The achievement test in its final form was applied to the students of the two research groups (experimental and control).

B - Analytical thinking test: The test was adopted for its ease of application and correction, clarity of its paragraphs, and its suitability for the target age group in the current research. , The coordination component and the affective component)

Psychometric properties of the analytical reasoning test:

A- Content validity: This type of honesty is achieved through rational analysis of the test content based on the opinions of experts in the field.

B - Virtual honesty: by presenting test positions to a group of experts to judge their validity in measuring the characteristic to be measured.

Fourth Chapter/ Presentation of the results and their interpretation

A- Presenting the results related to achievement and related to the first null hypothesis: The researcher calculated the average scores of the experimental and control group students in the achievement test as well as the variance between the two means, and by applying the T-test for two independent and equal samples, the following results were obtained:

Table (1) T-test results for two independent samples for the experimental and control groups in the post-test for parasites

| the group | Number of the student | Average arithmetic | Contrast | Degree of freedom | T-Value | | Statistical indication at (0.05) level |
|--------------|-----------------------|--------------------|----------|-------------------|------------|--------|--|
| | | | | | Calculated | Tabula | |
| Experimental | 30 | 33,76 | 50,55 | 58 | 16,75 | 2,000 | Statistically significant in favor of the experimental group |
| Control | 30 | 20,26 | 18,06 | | | | |

1- Presenting the result of scientific significance: to know the size of the relationship between the research variable, whether that relationship is due to the chance factor or to

the independent variable. Strategy (p.e.c.s) the researcher has created the scientific significance of the effect of the independent variable by using the effect size equation

Table (2) * The size of the effect of the PEX strategy (p.e.c.s) on the cognitive achievement test for the practical parasites

| The effect of PECS strategy on achievement test | The computed T-value | The square of the T-value | Impact size (value U ²) | The level of impact size |
|---|----------------------|---------------------------|-------------------------------------|--------------------------|
| | 16,75 | 280,56 | 0,82 | very good |

* Note that the minimum acceptance for the level of impact size is (0.60)

1- Presentation of the results related to the analytical thinking of the second null hypothesis:

The researcher calculated the average scores of the two groups' students in the analytical thinking test as well as

the discrepancy between the two means, and by applying the T-test for two independent and equal samples, the

following results were obtained, as in the table:

Table (3) the results of the T-test for two independent samples for the experimental and control groups in the dimensional thinking test.

| the group | Number of the student | Average arithmetic | Contrast | Degree of freedom | Calculated | | Tabula Calculated |
|--------------|-----------------------|--------------------|----------|-------------------|------------|--------|--|
| | | | | | Calculated | Tabula | |
| Experimental | 30 | 24,23 | 4,08 | 58 | 12,37 | 2,000 | Statistically significant in favor of the experimental group |
| Control | 30 | 14,23 | 17,22 | | | | |

- Presenting the result of scientific significance: To find out the size of the relationship between the research variable, whether that relationship is due to the chance factor or to the independent variable PECS's strategy, the

researcher has found the scientific significance of the effect of the independent variable by using the effect size equation

Table (4) the size of the effect of PECS's strategy in the Test of Analytical Thinking

| The effect of PECS strategy on the Analytical Reasoning Test | The computed T-value | The square of the T-value | Impact size value u^2 | The level of impact size |
|--|----------------------|---------------------------|-------------------------|--------------------------|
| | 12,37 | 153,01 | 0,72 | good |

Second: Interpretation of results

Interpretation of the results related to the first hypothesis: The researcher attributes the interpretation of this result to the following reasons:

1- Learning in small groups gives students self-confidence and cooperation with each other in order to discover the correct answer and exchange information, which raises the level of their academic achievement.

2- The steps of the PECS strategy created an atmosphere of harmony between the students and the teacher through the obvious excitement shown by the students in the classroom, which increases their motivation to learn experiences and concepts in an accessible and consistent way with the nature of the scientific material, and this raises the impact of this strategy in increasing Their cognitive achievement.

3- The low level of achievement among students of the control group compared to the experimental group until the control group was not studied according to the PECS

strategy, as the interest in preservation, rote memorization and reliance was on explaining the scientific material from the researcher and presenting it to students in the usual way only.

Interpretation of the results related to the second hypothesis: The researcher attributes the interpretation of this result to the following reasons:

1- The PECS strategy has proven its effectiveness in developing analytical thinking among third stage students / Department of Science / Branch of Life Sciences.

2- The use of the PECS strategy allows the teacher to take into account individual differences among students, which leads to the development of analytical thinking.

3- The sample members have a relatively high level of analytical thinking, by virtue of their age stage as well as the nature of their studies.

Third: Conclusions:

1- The use of the PECS strategy in the practical teaching of parasites for students of the science department / life sciences branch works to improve their level of achievement in this subject.

2- The use of the PECS strategy in the practical teaching of parasites for students of the science department / life sciences branch leads to raising the level of students' analytical thinking.

3- The adoption of the PECS strategy enabled students to be able to link their previous information with the new information they obtained and thus increase their activity and knowledge ideas.

Fourth: Recommendations

1- Moving away as much as possible from the usual methods in line with the tremendous development in the field of knowledge

2- Encouraging students to work together in classrooms or laboratories to develop their various skills

3- Emphasis on the PECS strategy in the vocabulary of the teaching method courses in the Faculties of Education and the Faculties of Basic Education.

Fifth: - Suggestions

1- Conducting a similar study for the objectives of the research using the PECS strategy in other variables such as: (creative thinking, critical thinking, scientific tendencies, curiosity... etc.).

2- Conducting a study to evaluate the level of students' practice of analytical thinking in the various educational stages.

3- Conducting a study to compare the effect of the PECS strategy with other active learning strategies.

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