

The Effect Of Productive Thinking Strategy Upon The Student's Achievement For The Subject Of Research Methodology In The College Of Islamic Sciences

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Abstract

The aim of this paper is to find out the effects of the strategy of productive thinking upon the student's achievement for the subject of research methodology in the College of Islamic Sciences. Achieving this objective, the researchers set the null hypotheses: (1) No difference is noticed to be statistically significant at the level of significance (0.05) among the student's mean scores in the experimental group who were taught by the strategy of productive thinking, and the student's mean scores in the control group who studied by the traditional method in the achievement test. (2) At level of sig. (0.05), there is no statistically significant difference in the mean of scores of the pre-tests and post ones in the achievement test of the experimental group students. The 3rd class students in the Dept of Islamic Creed and Thought at the College of Islamic Sciences / University of Baghdad for the academic year (2022-2023) represented the research sample. The pre-test (productive thinking) was applied to all students of the 3rd class in the Dept, who were (150) students. They were distributed into two groups: (70) undergraduates in an experimental group, and (80) undergraduates in a control group. The experimental group were taught by the strategy of productive thinking, whereas the control group who were taught by the traditional method. After the end of the experiment, the t-test was used for two independent and interrelated samples. The results revealed that there was a statistically significant difference among the student's mean scores in the experimental group studying research methods subject by productive thinking, and among the student's

scores in the controlling group who were taught the same subject in the traditional method in the post-test for the experimental group. Moreover, the results also showed that there was a statistically significant difference among the mean scores of the students of the experimental group studying research methods subject according to the productive thinking, and the students' scores in the experimental group in the pre-test and their scores in the post-test. This indicates that the experimental group student's achievement got increased.

Keywords: Thinking, productive, achievement, research methods.

Introduction

The research problem:

Education is one of the crucial facts in all aspects of life, that affects human relations in its entire forms. It is a social and moral requirement with an essential educational dimension, because it is considered as standards and goals that we must find in every well-prepared society, whether it is advanced or not. Education can infuse the souls in the form of trends, motives, and aspirations, as they appear in the apparent conscious and subconscious behavior and in situations that require the interdependence of these individuals. It is acquired through the influence of home, school, mosque, church, friends and peers, and through the community as a whole. (Al-Jamali, 2017: 10-11).

By accumulating information and increasing knowledge and its various fields, there has been an urgent need to find a method, means to facilitate that knowledge. There was an urgent need to find a method or means and facilitate the process of transferring this knowledge and delivering it to the young people's minds. So, they would receive it with a desire and longing to understand it easily in order to be able to enrich and purify it from impurities. (Al-Jamali, 2009: 689).

Thinking is a complex concept involving intertwined dimensions and components that express the complex nature of the human brain, so it was necessary to investigate them, because the activities performed when thinking are invisible and intangible ones. What is seen in reality is represented in the products of the act of thinking and the product of the psychological whole, as it only happens when there is a person who is capable of thinking and can address a problem. (Jarwan, 1999: 33).

The obvious fact states that thinking cannot occur without a living being who can do so in relation to a specific problem or situation. (Al-Jubouri, 1990:970). Thinking is a human skill throughout his life, which varies gradually with the growth of the individual according to the type of learning, so that, behavior reaches its highest level. It is the environment or the world that helps human develop this skill, because the environment is a set of forms that need contents and meaning. The mental process, that explains thinking, is that process that gives the forms their true connotations. (Faiq, 1966:184). Productive thinking skills play an important role in helping learners expand their thinking and view things in a new way (Al-Jamali, 2021: 3)

Thinking includes several possibilities and potentialities, taking into account that teaching supported by encouraging productive thinking improves and develops creative thinking. Productive thinking includes transforming things or ideas, identifying elements, describing strategies, preparing design, presenting topics, locations and resources, identifying jobs and other instances (Al-Surour, 1997: 313). Productive thinking may be practiced better, if taken for granted, but when it is stimulated by determination and feelings, it may be critical and creative. Productive thinking is closely related to creativity and talents, as the goal of productive thinking is to collect information and use it in the best means to make utilitarian benefits in the life of the individual and society. Clarity, accuracy, importance, depth, and precision are among the criteria specific to renewed productive thinking. Teachers can motivate students to apply the previous productive thinking abilities by asking students questions for each of the productive thinking abilities. (Schlichter & Palmer: 1993:120)

Productive thinking skills are taught along with teaching the content of the textbook, where the teacher individually or collaboratively with co-workers integrates thinking teaching activities in the curriculum, within the framework of the classroom environment and for all students in the class. Activities for teaching productive thinking have been developed in a way that takes into consideration the individual differences among students, in terms of mental abilities, inclinations, interests, and level of motivation. (Rashid and Farhan, 2021: 60).

The teaching and learning processes aim at improving and developing all different thinking skills, including productive thinking, so that learners can apply them in various daily lives in a way that differs from the situations in which they were acquired. Productive thinking plays a role in teaching all curricula, where there is a strong relationship

between productive thinking and teaching curricula, as it is important to use productive thinking strategies in learning curricula. To conclude, the problem of this research is addressed by finding an answer for the following question: What are the effects of the strategy of productive thinking upon the student's achievement for the subject of research methodology in the College of Islamic Sciences?

The research importance:

Thinking is a general term that encompasses all types of symbolic activity. It includes inference, imagination, formation of overall meanings, and innovation. It is used as a substitute for real things and realistic situations, that is, it uses symbols that supersede things and circumstances. A symbol is a thing such as an idea, sense, or an image, that replaces something else, where we respond to it in the way we respond to the thing itself. It appears that we have two levels of activity sequence, from alert to response (Al-Meligy, 2000: 221).

Thinking represents what a person would like to reach in his future, which whereby he tries to reach something that is out of reach at present or past. The mental processes work complementary to each other, which whereby a person obtains the information he needs to control his environment. The ability to perceive properly, remember accurately, think productively, and to act appropriately are the simulations that can be used to judge the extent of an individual's success in interacting with his environment (Abdul-Ghaffar, 1971: 235).

Thinking is one of the most important and complex human behaviors. It is a feature by which Allah distinguished man from the rest of other creatures. Islam urged thinking and the use of reason in all matters, as it is the most important means for the individual to obtain a solution to his problems and answer his many questions. Thinking is necessary to keep pace with the developments of the times and its continuous developments, where the individual will not be able to face the various modern challenges, without exploiting thinking skills. Accordingly, educational institutions must be keen to develop thinking of all kinds among learners, and try to provide them with thinking skills to build a generation of thinkers that will benefit their country and help in its renaissance. Productive thinking is the scientific methodological tool that combines creative thinking skills, business critical thinking, and high quality problem solving. The power of productive thinking is that it combines creative thinking with critical thinking and employs them to achieve practical results (Harson, 2008: 45).

Proceeding from the fact that developing and teaching thinking in general, and productive thinking consisting of creative thinking and critical thinking in particular, are one of the high-level educational goals that educational institutions work with all their potentialities to achieve. The university stage is the fertile stage for teaching productive thinking and discovering talents. Accordingly, developing the productive thinking skills among learners has taken most of the attention of researchers interested in this field. It gives the learner an opportunity to innovate in various social and economic fields through the skills it possesses and to learn about new ways of doing business, facing problems and solving them in unfamiliar creative and innovative ways (Al-Waadi and Al-Ajami, 2022: 39).

Productive thinking is one of the vital developments of the types of thinking. It is an applied process that is easy to learn and can be repeated, and helps people understand more clearly and plan more effectively and innovatively. This process depends on both critical and innovative thinking strategies (Tim, 2007:45). Frihtemer (1945) shows that productive thinking starts from a deep understanding of the problem, which will help suggest basic characteristics for its solution, a real and appropriate solution to the core needs of the problem (Erika, 2015: 8). Productive thinking is commensurate with the situation in which it is applied, as it involves moving from a state of bewilderment or confusion in some vague issues of basic features and characteristics to a different state where everything is a clear, logical and appropriate issue. The essence of the process is a kind of reorganization or restructuring, i.e. moving from meaningless vocabulary to understandable vocabulary with clear meanings and connotations (Wertheimer.1996:4-5)

Modern educational trends emphasize the importance of productive thinking and its positive contribution to the educational process. Therefore, it has become indispensable for those who are responsible for the educational process to activate it and pay attention to, as its advantages lie in the fact that it combines critical thinking and creative thinking. Thinking takes its strength and effectiveness from the total power of the mind and the brainstorming that it does, as it constitutes a summary of many types of effective thinking practiced by the learner to achieve his desired goals (Furtak & Primo, 2015:67)

Reasoning aims to reach a meaningful conclusion regarding the issue or task in question. It is possible to refer here to the role of the individual's cognitive structure and the skills he possesses in achieving that result. In the sense that the goal of thinking is subject to the existing

interactions among the assets of the individual's cognitive structure and ability to employ current thinking skills, or to acquire new skills that help him in achieving the desired goal. Education and training are cumulative and aim at building new competencies and refining existing competencies. Competencies play a role in disturbing the balance and then restoring balance to the knowledge structure to achieve the purposes of education and training (Netta & Yamin, 2000:8).

The productive processes of thinking do not bear the characteristic of assembling, but rather the characteristic of gradual construction, as they are purely coincidental. It is whereby the state of associations and aggregation occurs, as it is not random in nature. Despite the hardships, disparities, and dynamic developments, productive thought processes continue to show progress. In the midst of development, these processes often lead to tangible expectations, assumptions, and conclusions called straight thinking (Razouki et al., 2018: 18).

It can be concluded that productive thinking is a dynamic cumulative process that takes place inside the brain through the interaction of the individual's cognitive structure, but it is a process with a goal and should end with the production of new ideas and the analysis and evaluation of these ideas. This indicates that it is a complex process that is not limited to one type of thinking, but rather is the outcome of the interaction of more than one type of thinking (Razouki et al., 2018:18).

Educators confirm that there is a problem that concerns everyone involved in education, represented in the low level of undergraduate's achievement in education in general, due to the use of old traditional teaching methods, which are based on the use of deductive thinking in facing life and academic situations. In the development of the thinking process, the educational institution has benefited from the results produced by the psychology of thinking, as the recent eras have witnessed an increasing interest in what is called the processes and strategies of thinking. Thinking occupied a central place in the efforts of psychologists to define its components, particularly in linking the elements of thinking with learning, especially aspects of school and university learning. University represents one of the important educational establishments that a society living in an era of vast scientific progress and advanced technology cannot do without. For the success of its role in enhancing thinking among students and providing them with good thinking habits, the factors that limit this had to be addressed. They

are represented by the level of the student himself, the level of the circumstances that surround him, including what is related to the admission of students and their distribution in the academic specializations, the extent of their desire for the type of specialization they are accepted in, and their future outlook for this specialization. This leads to a weak motivation in academic achievement, and then to a weak use of their mental abilities, including the capacity to reason and address problems, as it is a mental skill that the university seeks through its programs and curricula to develop. Motivation is considered a pattern of thinking and a basis for cognitive development, and it is vital in acquiring knowledge, solving problems, and making decisions (Al-Douri, 2004: 5).

University education is the top of the educational pyramid in all countries of the world. The importance of this type of education lies in the fact that it plays an important role in providing society with all its sectors with qualified personnel who are able to manage these sectors adequately, keeping pace with the progress and development, and achieving security, stability and well-being through its intellectual and scientific influence on work and production directions. Undoubtedly, the success of university education in performing its tasks to the utmost extent depends to a large extent on creating the appropriate conditions for the university and surrounding it with all kinds of care and attention. According to this logic, the importance of studying the issues encountering postgraduates of the Arabic language departments becomes clear, as it has attracted the attention of many researchers and specialists in education. It comes within the priorities of plans and programs to improve, develop and raise the adequacy of this type of education, as the problems facing postgraduate students may have a significant impact on limiting their continuation of study, excellence and brilliance. This is the matter whose negative impact does not impose on postgraduate students only, but also on society in general, due to the waste that may result in the material and human energies and resources of society (Al-Jamali, 2-3: 2020).

Moreover, the significance of this research can be shown by the following:

The era lived in at present is an era of information and knowledge, which has led to an increase in the learner's responsibility and the improvement of his abilities to interact with new materials and experiences.

1. The strategy of productive thinking may support the idea of continuous learning and assist students in improving the efficiency of

information processing in the constantly increasing realm of knowledge.

2. The significance of studying productive thinking and searching for the best and most effective ways to use its strategies among students because of its role in developing the educational process in general and achievement in particular.

The Research objectives and hypotheses:

This objective of the research is to detect the effect of the strategy of productive thinking on the achievement of research methodology for students of the College of Islamic Sciences). In order to realize this objective, the researchers set the following null hypotheses:

1. No difference is noticed to be statistically significant at the level of significance (0.05) among the students mean scores in the experimental group who were taught by the strategy of productive thinking, and among the student's mean scores in the control group who were taught by the traditional method in the achievement test.
2. No difference is noticed to be statistically significant at the level of significance (0.05) in the mean of the differences among the scores of the pre and posttests in the achievement test of the students of the experimental group.

The research limits:

This research is limited to studying the subject of research methods among the students of the 3rd class in the College of Islamic Sciences / Department of Islamic Creed and Thought at Baghdad University for the academic year 2022-2023.

Defining the terms:

First: (Linguistically): "Alathar "trace, remnant, after, past, effect" according to Ibn Manzur is the rest of the thing. The plural of "alathar" "trace, after, past, effect" is athaar" "remnants, effects" and athur "trace, after, past, effect" . "kherjt fi 'iithrih" I went out after him", i.e. "fi 'iithrih" means 'after him'. "Alathar" by attaching Kasra diacritics upon mean "remnant, trace" what remains of a thing, the trace of a thing. "Ta'atheer" Influence" refers to the trace of a thing, or leave a mark on it. (Ibn Manzoor, Index of Al-Athar, 2005: 25)

Second: Idiomatically: Ibrahim (2009) defined it as "the ability of the subject matter of the research to reach a positive result, however, if it is

not realized, then the factor might a main reason behind the occurrence of dire consequences.” (Ibrahim, 2009: 30)

Issa (2012) defined it as “a product of knowledge or a motor soul that is generated by human action, which is represented by the research subject and is intentionally affected by.” (Isa, 2012: 31)

The procedural definition of ‘effect’: It is the amount of change caused by the strategy of productive thinking in the research sample, both groups, as a result of their exposure to the independent variable. It is known by the degree that the undergrdautes get in the achievement test.

Second: The strategy:

- 1- Muhammad and Majeed (1991) defined it as “a regular and sequential sequence of the teacher’s teaching steps.” (Muhammad and Majeed, 1991: 48)
- 2- Al-Khawaldeh, et al, (1995) defined it as “a set of moves and activities that the teacher uses when teaching.” (Al-Khawaldeh, 1995: 180)

As for the procedural definition, it is the procedures for teaching the subject of research methods according to the steps specified in the strategies of productive thinking and the preparation of educational activities in order to raise the level of academic achievement in the research methods book.

Third: Productive Thinking:

Sternberg (1992) defines it as “a mental process that results in loads or ideas that depart from the cognitive frame of the thinking individual, or it is the environment in which one lives in, where a new result arises from the interaction that occurs between the individual in his own unique way of dealing with what is in his environment and confronts him.” (Razouqi et al. 2018:12)

Harrison (2008) defines it as “a type of thinking that combines the skills of creative thinking and critical thinking and employs them to produce new ideas” (Hurson, 2008:45).

Fourth: The Strategy of Productive Thinking:

The researchers define it as: "a group of mental processes that integrate critical thinking and creative thinking skills with the aim of developing academic achievement in the research methodology subject, solving

problems related to the research methodology modules, and reaching new out-of-the-ordinary outcomes."

Theoretical framework and previous studies

A brief introduction into productive thinking

Productive thinking is a term employed by Pomiszowski, (1981), and Bloom referred to it as analysis and synthesis assessment, and various combinations of other operations. These processes, on the other hand, lead to a deeper understanding, defensible judgment, and value production. Planning your actions and words, visualizing scenarios, using logic, taking into account other people's viewpoints, coming up with conclusions, and forming new perspectives may all be necessary. The words convey a message. This kind of thinking is not just concerned with evaluating already made arguments; it is also concerned with coming up with new ideas and has implications for action. (Jaber: 2008: 139).

The importance of productive thinking lies in these points:

1. Productive thinking helps learners find various sources that help diversify their interests and increase their knowledge in each subject.
2. The use of productive thinking in education and caring for it causes a deeper comprehension. It conveys the process of acquiring knowledge from a passive mental process to an active mental process, and aids better absorb the content and link its components with each other, and come up with novel, more precise results and ideas.
3. The significance of productive thinking in the learner's life is evident through its capacity to address many problems, and to prevent hazards due to the conclusions and analysis it draws.
4. Productive thinking allows the learner to practice setting ideas and addressing problems encountering the person and expanding his horizons.
5. Productive thinking stimulates learners to dialectical thinking, without which the learner would not be complete mentally and emotionally. Dialectical thinking makes the learner independent in his thinking, liberates him from dependency, and moves him away from a narrow self-centeredness. (Razouki et al., 2018:67)

The strategies of productive thinking

The creative solution to problems is a framework of processes that acts as a system that includes strategies for productive thinking, which can be

used to understand problems, generate a variety of unconventional ideas, evaluate and develop ideas, and strategies for productive thinking (Al-Asar, 2000: 30).

1. Defining the problem accurately helps in removing the barriers that arise from preconceived ideas that impede this type of thinking.
2. Defining the problem in terms of the contradictions in it, whether material or non-material, in order to formulate it in a way that results in improving some of its characteristics.
3. Searching for previously solved problems, and the standard indicators, that result in contradiction, must be guided.
4. Searching for known solutions by which the problem under study can be measured. (Rashid and Farhan, 2021, 60)

Theories explaining productive thinking

Tyler's Theory:

This theory showed that productive thinking went deeper into creativity and creative thinking and helped the student to sense the problem, find a solution to it and helped in adapting to the world around. Thinking and generating ideas are the main goal of the process of productive thinking. Palmer & Schlichter (1993) recommend that direct education be followed by divergent thinking, which is represented by productive thinking that leads to success in carrying out various assignments and tasks. Students should learn that they have to do four things: think of several ideas, different ideas, unusual ideas, and add ideas to make them better. Teachers can motivate students to apply thinking skills and each of the previous productive thinking skills by asking students questions for each of the productive thinking skills. McKinnon believes that creative production, whether scientific or literary, can be judged in terms of its fulfillment of three basic requirements: novelty, relevance, and potential for development. One of the components is the disclosure of the important bases which whereby the creative product can be accepted or rejected, as many researchers in this field have identified specifications for evaluating creative works in terms of their originality and suitability for the creative product.

Theory of Insight:

The proponents of this theory believe that thinking starts from a problem, and that solving any problem requires prior thinking, and that the whole must be taken into account. As for the parts, they must be checked within the framework of the whole. Vertimer believes that thinking consists of

perception, perceptual structural features, and structural requirements. By matching and defining these requirements, the attitude towards structural developments will require a change of view and dealing constructively with the gaps, disturbances and surface conditions. It also requires examining the appropriate and inappropriate internal structural relationships that exist between the disorders and the situation as a whole. In addition to its multiple parts, assembly processes, structural fragmentation, and dealing with it within its structural form, role, dynamic meaning, and changes in it. In addition, it includes the constructive and structural transport process, especially the special case of assembly. It also requires the search for constructive truth rather than the fragmentary one.

Leiven's theory:

According to this theory, the individual lives in a behavioral field, which is that space that goes deep into the self and the issues around it, in which it raises a kind of motivation that results in continuous tensions until it ends with the fulfillment and satisfaction of the individual's needs. Productive thinking stems from the response to the forces that make up the field, and depends on a group of factors, some of which are internal to the person himself and others are external (Mohsen and Khalil, 2022: 4334)

Previous studies:

Suleiman's Study (2021):

The study assesses the efficacy of a few cognitive load theory-based interventions for fostering analytical proficiency and self-control in pre-science learners. The teacher's guide, a test of productive thinking in skills (fluency, flexibility, prediction of assumptions, elicitation, interpretation, and evaluation of discussions), and a measure of self-regulation skills in science and its dimensions (self-monitoring, organizing and transferring information, managing time, self-reward, learning resource management, and environment) were prepared to reach the objectives. The sample of the study, which included (70) middle school students, was randomly chosen, and were distributed into two groups: an experimental one that studied the selected unit with strategies centered on cognitive load, and the other was a control group that were taught in the traditional method with (35) persons in each group. After the experimental treatment and testing the validity of the hypotheses, the findings of the study came up to conclusion that:

- (1) The experimental group were superior over the controlling group in testing productive thinking as a whole and in its sub-dimensions.
- (2) The experimental group outperformed the controlling group in the measure of self-regulation skills as a whole, and in its sub-dimensions.
- (3) There is a positive correlation among the scores of the experimental group students in productive thinking and their scores in the self-regulation scale. (Suleiman, 2021: 333-278).

Abdel-Fattah's Study (2021):

The key aim of the study is to evaluate how well middle schoolboys' creative thinking and love of mathematics can be fostered by combining the methods of scientific stations and concept gardens. The research used the experimental method, where the main research sample included a sample of (76) pupils from the first preparatory grade, fell into: an experimental group (n = 39), and a control group (n = 37). To achieve the objectives of the research, the research materials and tools were prepared: the teacher's guide, the student's worksheets, the test of productive thinking in mathematics, and the love of mathematics scale. The pre and post research tools were applied to both groups. After the experimental treatment and testing the validity of the hypotheses, the findings revealed that the students of the experimental group were superior over those of the control group in the test of productive thinking in mathematics as a whole (and for each dimension of the test separately). Furthermore, the students of the experimental group were superior over those of the control group for the love of mathematics scale as a whole (and for each dimension of the scale separately); (Abdel-Fattah, 2021: 225-286).

Al- Mashaqabeh's Study (2021):

The study identified the skills of productive thinking mentioned in the science book for the 4th class in Jordan, and identifying the degree to which science teachers of the 4th grade in Jordan practice productive thinking skills, based on the variables of gender, years of experience, and the interaction among them. To achieve the objectives of the research, a content analysis card was made, and a questionnaire was employed to gather data from the study sample. The study community consisted of 4th grade science teachers in Jordan. The researcher chose the study community and sample included (60) science teachers for the 4th grade in the northwestern rural region. The researcher analyzed the science book for the 4th class (part one), where she prepared this tool to monitor

the skills of productive thinking and to find out the extent to which the content of the developed science book (Collins) for the 4th class included them. The results of the study showed that the productive thinking skills mentioned in the science textbook for the basic stage in Jordan were at a high level of appreciation, and that the degree of practicing them by science teachers for the 4th grade was also high. According to the results, the researcher recommended encouraging the teachers of science subject for the 4th grade, the basic stage, to use all information and communication technology data available in their schools, and to employ them in teaching science content (Al-Mashaqabeh, 2021, 1).

Al-Elayyan's Study (2022):

The study intended at revealing the impact of a developed study unit centered on the strategies of brain-based learning on enhancing productive thinking in math among 2nd class intermediate schoolboys. The study adopted the quasi-experimental approach, where the researcher used the productive thinking test in math in the unit (relative numbers). The study sample included (37) students from the 2nd intermediate grade at Dar Al Bara'a Intermediate Private School, randomly distributed into (2) classes. One of the classes represented the experimental group of (19) students, and the other was represented by the control group of (18) students. The results revealed that there were statistically significant differences at the level ($\alpha \geq 0.05$) among the student's mean scores in the experimental and control groups in the post application of the test of productive thinking skills in mathematics for the experimental group (Al-Elayyan, 2022: (284-321).

The methodology and procedures of research

This section describes the methodology and procedures of the research, including how to choose the best experimental design, identify the research variables, describe the research community and its sample, select it, decide how to conduct the pre- and post-tests, choose the tool, and carry out the application procedures. This section also defines the statistical approach that was taken to accomplish the research's goals and test its hypotheses. The researchers used an experimental strategy that allowed them to accomplish their goals by doing the following:

First: The research design:

The researchers adopted the design, which is centered on the pre and post test for both groups, as illustrated in Table (1).

Table (1) The experimental design of the research and a pre and post test for both equal groups.

Group	Independent variable	Test	Dependent variable	Test
Experimental	The strategy of productive thinking	Pre	Achievement test	Post
Control	The traditional method	Post	Achievement test	Post

Second: The research community:

The undergraduate participants of the College of Islamic Sciences at the University of Baghdad for (2022-2023), who were (4587) participants distributed among the scientific depts in the faculty, represents the research community.

Third: The research sample:

The sample was selected from the Dept of Islamic Creed and Thought (the 3rd class). The pre-test (the achievement test in the subject of research methods) was conducted to all the (150) undergraduates of the 3rd class in the Dept of Islamic Creed and Thought. They were fallen into two groups: the first one was experimental, including (70) students of both genders, and the second one was a control group, including (80) students of both genders.

The equivalence of research groups:

Before starting the experiment, the researchers compared the taxonomic factors that associated with the traits and features of the experiment participants between the groups. These factors were selected according to the findings of initial research, specifically:

1: The student’s chronological age calculated in months:

After performing the t-test for the chronological age calculated in months among the experimental and control groups, the results of the test were as illustrated in Table (2).

Table 2: The T-test results for the average chronological age between the experimental and control groups.

Test	No.	Arithmetic mean	Standard deviation	T- Value		Level of sig.
				Calculated	Tabular	
Experimental	70	252.4000	1.02717	1,499	1,976	No differences
Controlling	80	252,1875	0.69526			

It is noticed through Table (2) that the calculated T-value (1,499) is less than its tabular value (1.976), showing that the differences are insignificant in the average chronological age between both groups.

2- The scores of previous achievement in the subject of research methods

This was confirmed by conducting the T-test for the mean scores of the achievement test in the subject of research methods.

Table (3): The results of T-test for the mean scores of the achievement test in the subject of research methods in the pre-test among both groups.

Test	No.	Arithmetic mean	Standard deviation	T- Value		Level of sig.
				Calculated	Tabular	
Experimental	70	12.9714	0.88418	0.201	1.976	No differences
Controlling	80	13.0000	0.85684			

It is noticed through Table (3) that the calculated t-value (0.201) is less than the tabular value (1.976). Thus, no differences that were statistically significant were noticed in the achievement test scores in the topic research methods between the two groups. Thus, equivalence was achieved between them in the achievement test scores in the subject of research methods.

3- IQ test

The researchers adopted (Raven IQ test) for intelligence, as it is one of the tests that were standardized on the Iraqi environment to detect the equality of both research groups. The test included 60 questions distributed between both groups, and were corrected (1) mark for each question, as illustrated in Table (4).

Table (4): The results of T-test for the mean scores of the intelligence test in the pre-test between the experimental and control groups

Test	No. of sample	Arithmetic mean	Standard deviation	T- Value		Level of sig.
				Calculated	Tabular	
Experimental	70	29,4143	0.49615	0.806	1.976	No differences
Controlling	80	29.3500	0.46998			

Internal and external safety:

There are extraneous variables, which contain elements that could have an influence on the experiment's findings in addition to comparing the two groups' categorization variables. It requires identifying and limiting the effects of these elements and controlling them. Below are the work procedures to decrease the effect of these factors, including:

1. Duration testing: The experiment was set on Sunday, corresponding to 5/3/2023, and the experiment ended for the controlling and experimental groups on Thursday 20th of April 2023.
2. Absence during the experiment: There was no case of sacking off for students in both groups.
3. The subject: Both groups were taught the same scientific subject prescribed within the course of the subject of research methods for the academic year 2022-2023.
4. Subject teacher: The researchers taught the experimental and control groups during the experiment so as not to affect the teacher's personal characteristics and the differences in teaching methods.
5. The place where the experiment was conducted.

The experiment was applied to the experimental and controlling groups in the College of Islamic Sciences / Department of Islamic Creed and Thought.

According to the aforementioned, the interior safety of the research experimentation and the exterior safety were made through the sample representation of the community of study.

Fourth: Determining the subject:

The topic to be presented to the research group students during the experiment was chosen by the researchers based on the requirements of the established curriculum.

Fifth: Formulating behavioral goals:

According to the broad objectives and content of the material to be researched in the experimentation, the researchers created 20 behavioral goals that were dispersed throughout the year levels of Bloom's taxonomy (knowledge, comprehension, application, analysis, synthesis, and evaluation). It was given to a panel of experts and research techniques specialists for validation of its validity and compliance with the study material. After analyzing the expert's responses, some of the objectives were modified relying on the rate of agreement held by the researchers, which was (80%) of the agreement of the experts. Thus, the total of behavioral goals in their final form were (20) behavioral goals.

Sixth: Building an achievement test in the subject of research methods:

Owing to the fact that the current study necessitates the development of a test to gauge student performance in the experimental and controlling groups (the research sample) research techniques classes. The researchers created a test counting on the pedagogical content of the study and the (3) levels of ideas (definition, discrimination, and generalization) that are characterized by validity, stability, and objectivity because there was no ready-made and suitable exam for this research.

Drafting the test items:

The researchers used the objective paragraphs for creating the test paragraphs because of their objectivity in the correction. These paragraphs could not be impacted by the corrector's self-qualities, and they are characterized by validity, stability and comprehensiveness, as they were built on scientific foundations. It covers the parts of the study material and its objectives. The multiple choice format was selected by the researchers because it is more widely used, more popular, and has a lower guessing percentage. The researchers also made a test for measuring the 3 levels of acquiring the notion, where the test items became (20) items.

Response instructions:

The guidelines for responding the questions must be as precise and brief as feasible. It should also make clear to the students what is expected of

them, how the responses are to be recorded, and how much time is allocated for each response. The test's instructions on how to complete it have been developed, and a general sense of the amount of questions and allotted time for answering them has been provided. The exam items were answered in (40min) total.

Test Correction Instructions:

A typical answer was set for the test items, where (1) point was assigned to the item indicating the true answer, and (0) for the false one. Paragraphs left out, and those that carry more than the choice of treating the incorrect paragraph, were treated. The maximum score attained was (20).

Analyzing the test items

The statistical analysis of items:

Through the identification and reformulation of weak paragraphs and the exclusion of incorrect ones, paragraph analysis seeks to raise the standard of the test: 1. The complexity of the paragraph, and 2. The discrimination of the paragraph.

For achieving this task, the procedures below were followed:

- Correcting undergraduates ' answers.
- Arranging the marks from the highest to the lowest as a descending order.
- • Making use of two different marks. The students' marks in the first section include those who got the highest marks, while those in the second section include those who got the lowest marks. Since it gives both groups the optimum size and difference feasible, it is recommended that the rate of marks in the higher and lower categories be 27% of the overall score.

The goal of determining the paragraph difficulty coefficient is to remove the extreme (very easy, very difficult) paragraphs and choose paragraphs of the proper complexity. The difficulty coefficient was determined to range between (0.40-0.80) for each paragraph, as indicated in Table (5):

Table (5) Difficulty coefficient for the achievement test items in the subject of research methods

No	Coefficient of Difficulty	No	Coefficient of Difficulty	No	Coefficient of Difficulty	No	Coefficient of Difficulty
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1	0.50	6	0.44	11	0.59	16	0.66
2	0.51	7	0.55	12	0.57	17	0.50
3	0.49	8	0.48	13	0.49	18	0.52
4	0.55	9	0.66	14	0.62	19	0.61
5	0.61	10	0.61	15	0.50	20	0.47

Bloom indicated that the test was considered better if the difficulty of its items had been (0.20-0.80) (66 Bloom: 1971). After using the determination coefficient equation, the entire values were higher than (0.40) as shown in Table(6):

Table (6) Determination coefficient for the achievement test items in the subject of research methods.

No	Coefficient of Determination	No	Coefficient of Determination	No	Coefficient of Determination	No	Coefficient of Determination
1	0.46	6	0.48	11	0.56	16	0.56
2	0.49	7	0.50	12	0.46	17	0.48
3	0.39	8	0.40	13	0.39	18	0.47
4	0.40	9	0.52	14	0.43	19	0.47
5	0.44	10	0.55	15	0.57	20	0.54

From presenting the results in Table (6), it is obvious that all of them are greater than (0.30). This is consistent with the criterion set by Ebil, as it indicates that the paragraph is well-distinguished if its distinguishing power is (0.30) or more.

Test Validity:

One of the mandatory procedures to extract the coefficient of test validity is to obtain face validity. Undoubtedly, the optimum method to extract face validity is to express the scale items to some competent specialists in tests and measurements and adopt their viewpoints about the extent to which the scale items implement the qualities to be measured. In this research, the test items were shown to experts and specialists (Appendix 2) for identifying their opinions about the validity of the items. The test, with all its items, was agreed upon by the experts, with percentages ranging from 80-100% for the items.

Scale Stability:

Re-test method:

The researchers applied the test to (40) undergraduates from the third class in the College of Islamic Sciences. The time period between the first and second applications was (15) days, as the span between both tests should not be long, so that the learner can learn or forget new things learnt. Moreover, It shouldn't be very short so that he retains the results of the first scale, thus the time frame should be between (10 and 20 days). This depends on the undergraduates's age, and the total of questions. The stability coefficient of the test was discovered utilizing the Pearson correlation coefficient and was determined to be high (0.86)..

Practice

In applying the experiment, the researchers followed the following:

The experiment was firstly applied to the members of both research groups on Sunday, corresponding to 3/5/2023, by teaching 2 hrs. per week for each group, and teaching continued until Thursday, corresponding to 4/20/2023.

- The two research groups were studied, as the researchers adopted productive thinking strategies to instruct the undergraduates in the experimental group, and the undergraduates in the controlling group using the traditional (standard) technique.
- The achievement test was performed to the participants of both groups simultaneously.

The statistical means

- "Pearson's Correlation Coefficient": This was employed to detect the stability of the test employing the test-retest method
- Item Difficulty Coefficient: It was employed to investigate the difficulty coefficients of the test items.
- Determination Coefficient of Paragraph: To detect the discriminatory power coefficients for the test items.
- T-test for both independent and interrelated samples: to detect the similarity among the research groups in the variables, and to test the hypotheses.

Results presentation and discussion

First: Results presentation:

The 1st hypothesis: No difference that is statistically significant at (0.05) of significance level is noticed among the student's mean scores in the experimental group who were taught by the productive thinking strategy

and the student's mean scores in the control group who was taught in the traditional method in the achievement test by comparing the post-test of the two groups. It was figured out that the average score of the experimental group students was (18.1857) with a standard deviation of (0.72817), while the average score of the control group was (13.4500) with a standard deviation of (0.74460). By employing the T-test for both independent samples to find out the significance of the differences between averages, it was discovered that there were statistically significant variations between both groups., as shown in Table (7):

Table (7) The results of T-test for two independent samples in the post achievement test.

Test	No. of sample	Arithmetic mean	Standard deviation	Degree of freedom	T- Value		Level of sig.
					Calculated	Tabular	
Experimental	70	18.1857	0.72817	148	39.262	1.976	0.05
Controlling	80	13.4500	0.74460				

Table (7) illustrates that the calculated T-value (39.262) is higher than the tabular T-value (1.976) with freedom (148) at a significance level (0.05). This shows that there is a statistically significant difference the students' average scores in both of the research groups for the experimental group. Thus, the null hypothesis is refuted, whereas the alternative one, which states that there is a statistically significant difference among the mean scores of the experimental group students who studied on productive thinking strategies, and the mean scores of the control group students who studied the same subject in the traditional method in the post-test, is accepted.

The 2nd hypothesis: The average differences among the pre- and post-test scores on the achievement test for the participants in the experimental group are not statistically different at the significance (0.05).

To attest this hypothesis, the T-test was employed for both samples to check where there was a kind of acquiring the syntactic models of the learners of the experimental group who were taught by productive thinking strategies. The mean of the differences among the students' scores in the post achievement test was (18.1857), with a standard deviation of (0.72817). The average differences among the scores of a group of undergraduates in the pre-achievement test was (12.9714), with a standard deviation of (0.88418), as shown in Table (8):

Table (8) The T-test results for both related samples of the pre and post use in the achievement test of the experimental group

Test	No. of sample	Arithmetic mean	Standard deviation	Degree of freedom	T- Value		Level of sig.
					Calculated	Tabular	
Post	70	18.1857	0.72817	138	38.087	1.976	0.05
Pre	70	12.9714	0.88418				

Table (8) illustrates that the calculated t-value (38.087) is higher than the tabular t-value (1.976) with freedom (138) at a significance level of (0.05). That is, the result is statistically significant for the post-test. Therefore, the null hypothesis was rejected, whereas the alternative hypothesis which states that there is a statistically significant variation among the mean scores of the experimental group students in the pre-test of the concept acquisition test, and their mean scores in the post test, was accepted. This indicates that the strategies of productive thinking have an effect on achievement in the subject of research methods for the participants of experimental group.

Conclusions

According to the research results, the researchers have come up with the following:

- 1- The strategies of productive thinking have an impact on achievement in the subject of research methodology for the students of the experimental group.
- 2- The use of productive thinking strategies in teaching and caring for it pave the road to a profound comprehension of the subject content.
- 3- The use of productive thinking strategies in teaching leads to address the issues that undergraduates face in academic subjects, and because productive thinking consists of critical thinking and creative thinking that allows students to break free from the traditional method used in teaching.

Recommendations

According to the research results, the researchers recommend:

1. Using productive thinking strategies on larger samples and different age and academic stages, initiating from the primary period to the university.

2. Including college curricula with topics related to the improvement of thinking, programs and strategies for thinking in general, and productive thinking in particular, so that training is done on them to benefit from them.
3. Moving away from explaining school subjects in a way that leads to low achievement among students, and then the lowest percentage of achievement, and to benefit from various thinking strategies, including productive thinking strategies in teaching.

Suggestions

Based upon the research results, the researchers suggest the following:

- Making related studies to the current one on school subjects and other classes and on both genders.
- Conducting other research to figure out the effect of employing productive thinking strategies on acquiring linguistic concepts.
- Conducting a study aiming at identifying the obstacles to productive thinking among students.
- Conducting a study on the relationship of productive thinking with other variables such as personality styles

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