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Dr. Mohib Aldeen Mahmoud
Ahmed

Univ. of Mosul
College of Education

* Corresponding author: E-mail :
Moheb_1965@yahoo.com

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E-mail
journal.of.tikrit.university.of.humanities@tu.edu.iq
E-mail : adxxxx@tu.edu.iq

The Effect of Training Methods on Vertical Thinking for Students of The Department of Physics Through an Independent Curriculum or Activities Integrated with The Courses

A B S T R A C T

The research aims at using different methods (styles) to measure the level of vertical thinking for the students of the department of Physics in two colleges (Education for Pure Sciences and Science). The current research community was determined by the students of the third stage for (two departments of physics) in college of education for pure sciences and college of science, for the academic year (2018-2019) and they were (185) students, and they adopted (48)% to represent the research sample randomly and thus the research sample consisted of two experimental groups: first , the students of the College of Education for Pure Sciences and they are (41) students and the second they are (33) students of the College of Science. The researcher also prepared (35) paragraph in the form of event or question requires a solution, and the researcher was keen to formulate events in an easy language appropriate to their age, and presented the test paragraphs to a group of experts specializing in psychology and methods of teaching science, and obtained the approval of experts by (80%) , and thus achieved the external validity of the test and the researcher achieved logical validity .After verifying the hypothesis of the research procedurally, the results showed that the students of the physics department of the college of science exceeded on the physics department of the college of education for pure science. The study also recommended the establishment of training courses for teachers of physics on the development of thinking skills and looking to modern methods of teaching and suggested titles for future researches.

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أثر طرائق التدريب على التفكير العمودي لطلبة قسم الفيزياء من خلال منهج مستقل أو أنشطة

متكاملة مع المقررات

د. مهيب الدين محمود احمد/ جامعة الموصل – كلية التربية

الخلاصة:

يهدف البحث استخدام اساليب لقياس مستوى التفكير العمودي لدى طلبة قسم الفيزياء في كليتي (العلوم و التربية للعلوم الصرفة).

وتحدد مجتمع البحث بطلبة المرحلة الثالثة لـ(قسمي الفيزياء) في كليتي العلوم و التربية للعلوم الصرفة ، للعام الدراسي (٢٠١٨ - ٢٠١٩) والبالغ عددهم (١٨٥) طالبا وطالبة واعتمد نسبة (٤٥)% لتمثل عينة البحث عشوائيا وبذلك تكونت عينة البحث من مجموعتين تجريبيتين الاولى من طلبة كلية التربية للعلوم الصرفة وعددهم (٤١) طالبا ، والثانية من طلبة كلية العلوم وعددهم (٣٣) طالبا، كما واعد الباحث (٣٥) فقرة على شكل مواقف(الغاز) أو سؤال يتطلب الحل، وتم صياغة المواقف بلغة سهلة متناسبة مع أعمارهم وعرضت فقرات الاختبار على مجموعة من الخبراء تخصص علم النفس وطرائق تدريس العلوم ، ونالت موافقة الخبراء(بنسبة ٨٠%) ، وبذلك تحقق الصدق الظاهري للاختبار، وحقت الصدق المنطقي كذلك.

وبعد التحقق من فرضية البحث إجرائيا اظهرت النتائج تفوق طلبة قسم الفيزياء من كلية العلوم على قسم الفيزياء من كلية التربية للعلوم الصرفة ، كما وأوصت الدراسة على إقامة دورات تدريبية لمدرسي ومدرسات الفيزياء حول تطوير وتنمية مهارات التفكير والاطلاع على الاساليب الحديثة في التدريس كما واقترحت عناوين لبحوث مستقبلية لاحقه .

problem of the Research:

Teaching is an idea moved from pure theory to practice at university for the development of thinking .

If we want from university student to play a vital role in his society and know how to face the requirements of life and complexity with an appropriate degree of thinking instead of facing those requirements with some kind of submission to those complexities and surrender for it.

At first , it was noted acceptance of the subject taught to them in traditional ways , they memorize the material and performed in the monthly tests, but the students were unable to some questions outside the subject that needs to think a little, especially if in the form of intellectual puzzles, the improvement has occurred after a period of time.

There is a clear deficiency in our students in the mastery of this skill, as they may improve the restoration of educational material as a result of reminders, but this at the expense of external inactivity in the other mental abilities of creativity, which negatively effects on the society , Several studies have supported the lack of thinking for the

students of university,(Abdullah and et al ,2007) that indicated the ratio of scientific thinking for the students of the college of Education and Science (Department of Biology and Chemistry) in Mosul ranged between(53-47%) and this ratio is low and gives an indication that students, despite being scientific disciplines and in an advanced stage and practicing scientific experiments in laboratories, They lack the skills of scientific thinking and its steps in terms of identifying the problem, selecting hypotheses and testing them, as well as interpreting, analyzing and generalizing the results (Abdullah, et al , 2007: 198).The results of Jawad,(2011), showed that (73.3% of the students of the first stage) and (83.3% of the students of the second stage) and 45% of the students of the third stage of the(college of Education, Department of Physics were classified at a level below the cognitive level of thinking (Jawad, 2011: 942).

Hence the current research aims to study the extent of the vertical thinking of the students of the Department of Physics, and accordingly the research problem was formulated by the following question :

What is the effect of vertical thinking for physics students with different training on it through an independent curriculum or during activities integrated with the courses?

Importance of the Research:

Knowledge is no longer an aim in itself, but has become the focus on the functional concept of that knowledge.

Modern styles of education have removed the method that relies on memorization, indoctrination and passive receptivity, and adopted the style of discussion, intellectual dialogue, understanding, analysis, criticism and conclusion to prepare generations capable of thinking and capable of researching the new not at the level of tradition but at the level of innovation for new things characterized by authenticity and modernity.

Modern trends in teaching emphasize the development of student thinking and the use of higher levels of thinking such as analysis, synthesis and evaluation, and urges teachers not only at the lower levels of thinking of conservation and memorization and invite them to diversify the aims of teaching so as to ensure a comprehensive growth of the mind of the learner.

Modern psychology research has confirmed that thinking grows by exercise and training just like the growth of muscles of the body with muscular training ,whenever the training increases on thinking and adoption the method

of discussion and intellectual dialogue, whenever they grow and improve their thinking (De Bono's , 1994 : 7)

The process of acquiring thinking skills is not an easy process, but complex and requires a lot of multiple programmer, there are two directions for the development of thinking, some of them see to teach thinking and develop skills through a separate approach to the same as the thinker (De Bono, 1986:34.) and some of them see the possibility of developing thinking skills through daily classes for subjects such as physics (Judith L et al, 1999), some of them combine both directions (Kubaisi, 2011: 9).

Thinking does not grow automatically, it is not automatically product for experience and study. This is evidenced by the analogy of normal everyday thinking with the ability to walk, whereas analogy of sophisticated thinking, which requires structured and purposeful learning and continuous exercise , to the ability to walk using certain and sophisticated tools and using special questions during education. (Fisher , 2005: 17)

Hong confirmed that the development of the thinking process for students , requires starting in the primary stages, by providing students with organized activities that enrich their creative and vertical thinking in a sequential manner, in addition to providing them with cognitive and social communication skills that start first from enabling the pupil to deal with the people around him (Hong, 2006: 13)

The research focuses on some kind of thinking, which is vertical thinking, it is a renewed way that may keep pace with the concepts of the times.

We see many invitations and educational programmers and ongoing courses, now taking place in our neighboring Arab countries such as, Jordan and the Gulf states which are not existed in Iraq . The importance of research could be summed up , as follows:

_A comparative study shows the preference of training to think in an independent curriculum or through activities given about the subject, may contribute to the development of the importance of choosing the most appropriate training methods to achieve increased achievement and development of thinking, which is one of the required educational aims .

-Adding qualitative studies that deal with the development of vertical thinking in public and university education.

_ Scarcity of studies that dealt with vertical thinking.

Aim of the Research:

The research aims to measure the level of vertical thinking for physics students in the colleges of (Education for Pure Sciences and Science).

Hypothesis of the Research:

There is no statistically significant difference between the average of vertical thinking for the students of the Department of Physics (College of Education for Pure Sciences) and the students of the Department of Physics in (College of Science).

Limits of the Research:

The current research is limited to the third year students (Physics Departments) in the colleges of Education in university of Mosul for Pure Sciences and Science for the academic year (2018-2019).

Terms Definition:

Vertical thinking: It means :

- An imaginative and creative way of solving problems that leads to changing individual perceptions of a problem (De bono, 1998: 2).

- A pattern of thinking based on the creation of the largest possible number of solutions and alternatives . It can be looked through more than one side in the problem or event and jump steps to solve the problem, that is, to retain all the information available, and does not depend in its steps on the clear path as it is in vertical thinking which goes in sequence and focuses on reality (Mahmoud, 2006: 189).

- A mental approach that includes the desire to try to look at things in multiple ways, as well as includes an understanding of how the mind is used and the need to get rid of the framed models of thinking to other models (Al Amer, 2009: 63).

- Thinking is characterized by research and started freely in multiple directions and angles instead of walking in one direction to solve a problem or clarify a particular event , and focuses on the generation of new ways to see things .If creativity is the way we use our minds ,Vertical thinking is the best way to use our minds as a tool of creativity and the possible development of its skills is in practice and drilling (Kubaisi, 2013: 108).

Vertical thinking : defined as :

Thinking is characterized by research and start freely in multiple directions and angles instead of walking in one direction to solve a problem or clarify a particular situation, and focuses on the generation of new ways to see things, and if creativity is the way we use our minds ,Vertical thinking is the best way to use our minds is a tool of creativity and possible development its skills in practice and training .

Procedural definition of vertical thinking :

A pattern of thinking based on the creation of the largest possible number of solutions and alternatives to a problem or event of life events and is measured by the test ,prepared by the researcher.

Previous studies:

Studies that deal with vertical thinking and the researcher presents some of them:

(Kumari & Aggarwal,(2012):

The study was conducted in India and aimed to find the relationship between vertical thinking, intelligence and achievement, 200 female students were selected from the college results indicate that there is no relationship between vertical thinking and intelligence . There is a statistically significant correlation at(0.05) moral between the achievement and vertical thinking. The study demanded to focus on the development of vertical thinking skills separately. (Kumari &Aggarwal , 2012: p.32-33)

(Leela ,& Sheila ,(2012):

The study was conducted in India and aimed at finding the impact of teaching English using vertical thinking techniques on achievement of intermediate school students in English . A sample of 120 students were divided into experimental and control groups. The experimental group studied by using vertical thinking techniques, one of the results of the research was the superiority of the experimental group over the control in the selection of after-achievement .

(Theeb, Omer, 2012):

The study was conducted in Iraq and aimed to identify the vertical thinking of college students, and personality traits for university students, and to know the correlation between them. The study included a test of vertical thinking and adopted the scale of the list of factors, prepared by Costa and Macri, 1990; the results of the research were the low level of vertical thinking among university

students in their different specialties and gender. The members of the sample have personal qualities, self-confidence, and decision-making power. There is no statistically significant relationship between vertical thinking and traits mentioned, while the results showed that there is a statistically significant function between vertical thinking and the trait of openness to experience (Theeb, Omar, 2012: 463-540).

The researcher prepared a test for vertical thinking and selected a sample of the first and second stage students from the Department of Physics.

The Research Procedures :

Research community and sample: The research community includes the third stage students in two departments of Physics (College of Education for Pure Sciences) (college of Science) whose number is (185) and 45% of the research community is selected randomly to represent the research sample as shown in Table: (1)

The table (1) explains the sample and the society of research:

The sample of the research				The community of the research			
Physics	Boys	Girls	Total	Physics	Boys	Girls	Total
Pure Sciences	19	22	41	Pure Sciences	48	54	102
Sciences	20	13	33	Sciences	50	33	83
Total	39	35	74	Total	98	87	185

Research Tool: Vertical Thinking Test:

Thirty-five paragraphs are prepared in the form of event or question requires a solution, in an easy language that require thinking and the paragraphs are taken from the book of vertical thinking Kutaisi,(2018), for example:

- ☒ How many months in the calendar year contains (28 or 29) days?
- ☒ How many times can you subtract the number 5 from the number 30?
- ☒ Give me three consecutive days without using the words Saturday, Sunday, Monday, Tuesday, Wednesday, Thursday, Friday?
- ☒ How can you drink milk as much as half the days of your remaining age?

☒ Lamb tied to a rope length (2) meters and wants to reach clover at 3 meters, how can it?

☒ You have twenty oranges and two bags How do you make in each bag twenty oranges?

☒ He marched without an umbrella in the rainy season in Geneva and did not have a rain coat or any hat or any protection from the rain and yet did not wet How?

☒ How much weight a cat if we know that it weighs half its weight plus 1 kg?

☒ Two workers fell in a chimney, and when they came out one of them had become black face because of smoke and the other face remained clean, yet a person of clean face went to wash his face whereas a person of dirty face did not go .Why?

☒ The traffic officer saw that the driver of the truck was walking in the opposite direction from the street in one direction, but did not try to stop him or give him a violation?

The test paragraphs were presented with the definition of vertical thinking to a group of experts specialized in psychology and teaching methods of science, and obtained expert approval (by 80%), thus achieving the external validity of the test.

And the researcher achieved logical validity, and this kind of validity was achieved through the definition of vertical thinking and skills, and was presented to the experts to indicate their views.

Statistical analysis of the data : The test is applied to a primary group consisting of (20) students from the non-research sample and after correction and descending order and divided into two sections To represent the upper and lower group and find the level of difficulty were ranging (0.66_0.79) and thus omitted(3) paragraphs because the level of difficulty exceeded (0.95) and adopted the criterion of difficulty between (0.20_0,80) (Nashif, 2001, 152), and divergent is more than (0.39) is good (Nashif 2001: 155) It is found that the divergent was greater than (0.41), except for two paragraphs, the divergent was weak and omitted from the test.

The reliability of the test: The test was repeated again on the same group after two weeks of the experiment. The obtained test reliability is (0.86), and thus the final test consists of (30) paragraphs, given 3 scores for the correct answer, and zero if not reached for answer, and when testing the sample and correcting the

papers by the researcher and by another researcher, the obtained correlation between them was (0.92), and found enough time for the test at (60) minutes.

Results of the test:

Verifying the hypothesis: There is no statistically significant difference between the average of vertical thinking for the students of the departments of Physics of the College of Education for Pure Sciences and the students of the college of Science.

To investigate the significance of the difference between the average score of the vertical thinking test for the two research groups, T-test for two independent samples is used and Table (2) shows:

Table (2) explain investigate the significance of the difference between the average score of the vertical thinking test for the two research groups, use the T-test of two independent samples

Physics department	Number	Stander defection	Variance	Freedom degree	T	Statistical significance at the level of 0.05	
Pure sciences	41	33.21	137.16	72	Calculated value	Tabular Value	significance
Sciences	33	42.15	113.98		3.357	1.99	

It is clear from Table (2) that the difference is statistically significant at the level of (0.05) and the degree of freedom (72) if the T-test value (3.357); greater than the T-test value (1.99), and thus refuses the H0 (null) hypothesis and H1 is accepted.

Results show that the , students of the Department of Physics of the College of Science exceed the students of the Department of Physics of the College of Education for Pure Sciences.

Discussion of the Results:

The superiority (exceed) of the students of the physics department of the College of Science on the physics department of the college of education for pure sciences could be attributed to their studying of the distinct mental skills in thinking; we will reach to unexpected results or solutions to the problems facing human, It is a skill because it can be acquired through drill and training.

Students were trained to overcome the traditional way of thinking and looking at the phenomenon from a new angle; it is often a close and direct angle; it is an excessive proximity and directness that is not perceived by the individual with the traditional view of thinking; this straightforward logical view is based on the sequence of introductions and results. Shifting from the center to the parties,

and most importantly to the least important. Like in the famous apple example ‘ Newton has discovered the law of gravity by turning the logical question into a question that some may regard as naive when he wondered why the apple was falling down and not rising.

Students enabled to use thinking skills through brainstorming and problem solving, until they reach the result themselves, after active participation in education, where more than one idea is discussed, and heard More of an opinion about the same idea with comment, reply, and feedback , all this makes it easier for students to learn, and thus led to increased thinking for them , which is not accessible to students by teaching it in the normal way that may be provided by teachers in the same way and content with the usual lecture in inclusive education, and thus shows that the methods were learned, were effectively increase the development of thinking for students of educational sciences as compared to the effect of the traditional method used by the students of the department of Physics.

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