

The Effect of Using the Directed inquiry Strategy on the Development of Critical Thinking Skills and Achievement in Physics of the Tenth Grade Students in Southern Mazar

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Abstract

The current study aimed at investing the effect of using the directed inquiry strategy on the development of critical thinking skills and achievement in Physics of the tenth grade students in Southern Mazar. To achieve the objectives of the study a teaching program using the directed inquiry strategy was built also an achievement test and the test of critical thinking were built. The sample of study consisted of (52) students that was intentionally selected and divided into two groups of (27) and an experimental group of (25) students that was taught using the directed inquiry strategy.

The results of the study showed that there was an effect of using directed inquiry strategy on the achievement and the development of critical thinking among tenth grade students in Southern Mazar educational directorate. In light of the findings of the study, a set of recommendations were recommended.

Introduction

Through the world change due to the technology developing and the cognitive explosion, it was difficult to deal with and control the vast amount of information. So, we have to help students through developing their thinking and skills to acquire the ability to deal with daily life problems and changes. Inquiry and discovery are important strategies helping students to develop their thinking skills. These strategies can develop students' cognitive memory, track their attention and encourage them to learn. Furthermore, these strategies help students to interact with learning, give them the chance to interest learning, help him to revise information and experiences well and save them a long time (Gibain, 2008).

Educators agree with integration of thinking skills into learning an curricula is educational aim. So, educators have to teach students thinking skills through developing curricula. The direct learning of thinking skills helps students to grow up their thinking (Mustafa, 2002).

Critical thinking including the ability of responding content and reinforcements through distinguishing the facts e.g. opinions, feelings, and distinguishing objectivity of personal judgments (Nofal & Saeifan).

To achieve instructional aims of science, we have to choose appropriate instructional strategies and ways. The most important strategy is inquiry through learning activities according projects of instructional developing of science e.g. Nafild (British project), USA project (Nashwan, 2001).

Direct inquiry is one of strategies which we can use as cooperative or singular. Educators interested in this strategy because of its ability to develop various skills and keep an environment helping students to operate giving information through analyzing it, synthesis it, doing appropriate changes to get new information or discover new relations without direct helping from teacher or school book. At the result, achievement the meaningful learning for a long time. Also, the students become more interactional and teacher is director and facilitator (Gerald, 2000).

Direct inquiry is a process of testing and analyzing any ideas or knowledge to sure any theories or results. This process consists of multiple activities concerning brain's thinking, categorizing information, giving generalizations, achieving conclusions and getting results (Alkhalwaldeh, Aabed & Naser, 1996).

The role of teacher is to direct his students. Teacher helps them to search, inquire and discover by giving problems or open questions. In spite of this process make student a doer, teacher doesn't leave his student to inquire alone. Teacher helps and encourage students through directing inquiry learning, planning, forming new thinking questions logically and scientifically (Zaitoun, 2001).

Statement of the problem

The researcher noticed as a physics teacher that the majority of learners save information traditionally and they don't be able to reflect and use it into their practical life. So, these information seems disconnect and affect student's levels. Also, international TIMSS tests illustrated low problems in Science and Mathematics. On the other hand, the researcher found that traditional ways of teaching physics are unable to achieve the desired lesson outcomes which lead Physics to be boring content by using traditional ways. In this case, Physics changes

from experimental practical content using search and discovery to boring content using traditional ways of teaching.

For previous facts, the researcher noticed that learning Physics according direct discovery strategy may help students to learn better. Also, this strategy develops their thinking and interact them to participate in learning. On the other hand, it saves students from boring and miserable experiences. Also, it grows up their experiences and encourages them to apply, analyze, synthesize, discuss, discover and solve problems for achievement self learning. At the result, achievement teaching aims of science effectively and develop learning. For these purposes, the researcher decided to study the effect of direct discovery in physics in developing the performance of 10th grade students.

Questions of the study

To achieve the purposes of the study , the following questions were formulated:

- 1- Are there any statistical significant differences at ($\alpha=0.05$) between means of critical thinking marks for the experimental and control groups from 10th grade students due to instructional strategy(inquiry, traditional way)?
- 2- Are there any statistical significant differences at ($\alpha=0.05$) on the performance between the experimental and control groups from 10th grade students due to instructional strategy(inquiry, traditional way)?

Purposes of the study

The study seeks to achieve the following

- 1- Investigate the effect of direct inquiry strategy in developing critical thinking skills on 10th grade students in physics content in the Southern al-Mazar?
- 2- Investigate the effect of direct inquiry strategy in the performance for 10th grade students in physics content in the Southern al-Mazar?

Significance of the study

Firstly: theoretical significance

- 1- Enrich educational literature concerning Physics learning through a program building towards direct inquiry strategy and critical thinking test for (movable electricity), to help educators developing curricula, teachers, another units and modules.
- 2- Track the attention of the curricula designers to inter curricula activities increasing critical thinking for students.
- 3- Invest theoretical framework about the significance of direct inquiry strategy in instruction process through illustrating the effect of using direct inquiry strategy in developing scientific performance and critical thinking for students.

Secondly: applied and practical significance:

- 1- Invest practical framework to use direct inquiry in physics learning and develop critical thinking for students.
- 2- This study encourages to apply inquiry strategy in different curricula.
- 3- This study emphasizes on connection between theory and applying in modern educational curriculum. It is noticed problems in our Arabic curricula generally; there isn't any integration between theory and applying.

Review of Related Literature

Koen, Woeter & Ton (2006) explored using direct discovery strategy in physics learning for secondary stage. A sample of (46) students assigned into two groups: the experimental group and the control group. Pre- test and post- test were applied for two groups. The results showed performance of the experimental group made significantly greater gains compared to the control group. There were no significant differences of performance of students.

Sawafteh (2010) investigated the effect of direct inquiry in physics instruction on performance and developing high thinking skills for students of 1st secondary comparing of traditional way . a sample (89) students distinguishing to four groups. They were assigned randomly into two groups: the experimental group consisted of two groups; included (43) students. They learned physics by using direct inquiry strategy. The control group consisted of two groups; included (46) students. The studied the same content by using traditional way. Achievement test and measurement for high thinking skills were used. The results showed that there were significant differences between means of students marks for two groups. All of these significant differences were for the experimental group. Also, there were significant differences between means of high students marks in the experimental group and means of students in the control group in measurement of high thinking skills. These significant differences were for the experimental group. On the other hand, there was no significant difference according mean and low performance.

Operational Definition of Terms

*Inquiry strategy: a thinking process consists of various brain skills help students to get meanings and concepts from experiences which students reflect, in this study is a strategy which prepares choosing Physics lessons

course using inquiry strategy. Teacher directs and participate to develop critical thinking and increase student's performance.

*Critical thinking: a set of skills which students can learn, train and apply. Playing role of ability to know assumptions and explain them to evaluate discussions, deduction and induction, in this study it is the ability of 10th grade students to gather information through deep analyzing view after applying the choosing unit's lesson for direct discovery.

*Achievement: the extent of student's understanding what they do from experiences through learning terms. It is measured by marks which students get in tests, operationally it is a set of information, experiences, skills and attitudes which students acquire through experience and applying. In this study, it is measured by marks which 10th grade students get in test which the researcher designed from the choosing unit for applying.

Limitations of the study

The results of the study are limited to the following:

*Place and time: this study was applied during the first semester (2012/ 2013) in the south Al –Mazar schools; in the secondary Al-Iraq school for girls.

*Human being limitation: a purposefully sample from students of the 10th grade females was chosen.

*The content: the content of the study consisted of the electricity unit in 10th Physics course during the first semester 2012/2013.

Design and Methodology

Study Design

Semi- experimental method was used to explore the effect of using direct inquiry strategy in teaching Physics content of the 10th grade female students.

Population of the Study

The population of the study consisted of all students of 10th grade during the first semester 2012/2013 which form (2125) female students..

Sample of the Study

The researcher used a purposeful sample which consisted of (52) students of 10th grade in Al- Iraq school for girls. The sample was divided into two groups randomly: the experimental group which consisted of (25) students and the control group that consisted of (27) students.

The Instrument of the Study

Firstly: an achievement test

Multiple choice test was used in the test to evaluate the extent of acquiring information by students. The test consisted of (25) items from Physics content of 10th grade according Bloom levels (knowledge, comprehension, application, analysis, synthesis, evaluation). Every question included introduction and four alternatives. The researcher designed the test following these procedures:

1- Identifying the unit to be taught using direct inquiry strategy.

2- Analyzing content of the unit.

3- Identify learning objectives.

4- developing the test to measure student's performance in Physics content of the 10th grade students according Bloom levels. The test consisted of (25) multiple choice items. The test was given to a jury of specialists consisted of (11) from university professors, supervisors and Physics teachers, whom they were asked to add, modify or omit any item of the test.

Test Correction

The test consisted of (25) items. Every item had one mark. The total marks of the test was (25) marks. The researcher applied the test to a pilot study of (35) students that was randomly chosen from the population and excluded of the sample of the study to identify the test time and sure clarifying of the meaning and the instruction. Also, ensuring the psychomotor characters of the test and its items as following:

a- Coefficient and difficult levels of the test items: student's answers were analyzed after dividing students into two groups according their marks; high group and low group. Coefficient between items was calculated for all items; more than (0.29) as following:

Item	coefficient	Difficult coefficient	item	Coefficient	Difficult coefficient
1	.77	.41	14	.64	.32
2	.30	.52	15	.45	.70
3	.55	.37	16	.33	.67
4	.63	.41	17	.51	.63
5	.55	.63	18	.49	.44
6	.39	.74	19	.72	.26
7	.43	.59	20	.35	.37
8	.32	.67	21	.33	.26
9	.65	.30	22	.30	.52
10	.40	.44	23	.66	.41
11	.65	.41	24	.72	.48
12	.41	.74	25	.39	.86
13	.54	.37			

Table (1) showed that difficult coefficient of items was between (0.26- 0.86) where the coefficient was between (0.30- 0.77). is appropriate according (Ebel) indicated in (Nabhan, 2010).

Validity of the Test

The researcher developed the test consisting of (30) items, and applied it to a jury. The test consisted of (25) items after comments and recommendations.

Reliability of the Test

To ensure reliability of the test, the researcher used Ritchardson Coder on a pilot sample which consisted of (35) students. Reliability coefficient was (0.81) which means that the instrument is reliable.

Secondly: The Critical Thinking Test

The critical thinking measurement of Watson and Glaser was used to build the test which consisted of (5) partial tests; knowledge of assumptions, explanation, evaluating discussions, deduction and induction. The test consisted of (56) items.

Validity of the Critical Thinking Test

To ensure validity, it was given to a jury of specialists (11) specialists from university professors, supervisors and physics teachers. The comments were taken.

Reliability of the Critical Thinking Test

To ensure reliability of the test, the researcher chose a pilot sample consisted of (35) students. It was computed using Cronbach Alpha which was (0.92).

The Instructional Material

1- learning content was studied using traditional way. Students of the control group studied a unit of Physics content of the 10th grade.

2- learning content was studied by using direct inquiry strategy. The researcher analyzed the unit content and identified the concepts, general objectives and instructional objectives. To analyze the content, the researcher used Physics content and rebuild the subjects according direct inquiry strategy in critical thinking and performance. Also, the lessons were studied during two classes every week. Every lesson included identify problem, assumptions, teacher's instructions and generalizations.

Procedures of the Study

1- developing the instructional unit to be studied into two ways and in the way which agrees with distribution of content according number of classes, activities and the time. The content was developed according to the direct inquiry strategy principles. Reviewing theoretical literature and experiences of specialists to prepare the unit. It distributed to a jury who were asked to add, delete or modify. The content was developed using the following steps:

- a- analyzing the content, the objectives of lessons and concepts were collected for every subjects.
- b- identifying general steps of the strategy, identifying plans, writing the content including choosing activities.
- 2- designing a test to measure performance of students and the extent of acquiring information.
- 3- dividing the sample of the study into two groups: the control group and the experimental group.

4- training students of the experimental group on previous experimental lesson and training them on steps of the strategy.

5- applying the achievement test and critical thinking test as a pre- test on two groups . Using t test for independent sample. Table(2) illustrates that:

Achievement Test		Group	No.	Means	Std	df	T	sig
		Control	27	5.92	1.96			
		experimental	25	6.76	1.81			
Critical thinking	Assumptions knowledge	control	27	6.35	2.30	-1.207	.233	
		experimental	25	7.12	2.28			
	Explanation	Control	27	6.03	2.30	1.745	.147	
		experimental	25	6.96	2.15			
	Evaluate discussions	Control	27	6.61	2.19	-1.455	.152	
		experimental	25	7.48	2.04			
	Deduction	Control	27	6.92	2.21	-1.758	.085	
		experimental	25	8.24	3.09			
	Induction	Control	27	6.77	1.84	-1.880	.066	
		experimental	25	7.72	1.77			
	The total	Control	27	32.69	10.13	-1.698	.096	
		experimental	25	37.52	10.17			

Table (2) shows that there are no statistical significant differences at ($\alpha=0.05$) between groups on pre- test . $t = 1.584$. sig (0.120). according the test of critical thinking, there are no statistical significant differences at ($\alpha=0.05$) between two groups on the previous measurement.

6- the researcher taught the two groups ;the control and the experimental.

7- after two weeks, the researcher applied the instrument of evaluation (the test) on the two groups to investigate the differences between them and ensure the effect of using direct inquiry strategy. The program was started in 17/11/2012 and finished in 30/12/2012. The achievement test was applied after three days as final test of the first semester in 3/1/2013.

Variables of the Study

1- dependent variables: two levels:

a- The achievement b- critical thinking of students.

2- independent variables: instructional strategy was two levels:

a- conventional way b- directed inquiry strategy.

Results, Discussions and Recommendations

The first question: Are there any statistical significant differences at ($\alpha=0.05$) in scientific program between the experimental and the control groups for 10th grade students due to instructional strategy (inquiry, conventional way)?

To answer this question. (t test) was used for independent samples to investigate statistical significant differences between the two groups on the achievement test. Table (3) shows the results :

Group	No.	Means	Std	df	T	sig
Control	27	6.79	3.55	50	2.27	.009
Experimental	25	7.25	3.70			

Table (3) shows that there were statistical significant differences at ($\alpha=0.05$) means of students' marks of the experimental group and control group. $T = 2.27$. sig = 0.009. these differences due to the experimental group. That indicates there was effect of direct inquiry on the students' achievement .

We can explain high marks of students of the experimental group who studied the content by using direct inquiry strategy comparing the control group who studied the content by using traditional way due to the effectiveness of direct inquiry strategy which helped students to learn physics concepts and increase their performance through including a set of steps and learning activities for this strategy. Also, this strategy makes students ready to acquire the information, concepts and principles. Furthermore, students become doer of learning which lead them to interact with the content. At the result, students got more marks.

Participation of students in recording notes, collecting information, analyzing it and getting results developed problem solving skills for students. At the result, the performance was increased.

Also, using scientific thinking helped students through purposive and various scientific activities and the connection these activities with the planned learning objectives. Also, the regulation inquiry questions, learning activities helped students to get results and generalization of the concepts which lead to develop student's performance.

The second question: Are there any statistical differences at ($\alpha=0.05$) between means of critical thinking marks for the experimental and control groups from 10th grade students due to instructional strategy (inquiry, traditional way)?

To answer this question. (t test) was used for independent samples to investigate statistical significant differences between two groups on critical thinking test. Table (4) shows the results of analyzing:

	Group	No.	Means	Std	df	t	sig
Assumptions knowledge	control	27	11.81	3.44	50	-3.802	.000
	experimental	25	17.16	6.26			
Explanation	control	27	11.92	3.24		-3.066	.004
	experimental	25	16.56	6.97			
Evaluate discussions	control	27	11.58	3.26		-3.143	.003
	experimental	25	16.64	7.03			
Deduction	control	27	12.88	2.67		-3.842	.000
	experimental	25	18.32	6.68			
Induction	control	27	12.19	2.88		-3.014	.004
	experimental	25	16.44	6.56			
The total	control	27	60.65	14.50	-3.611	.001	
	experimental	25	85.12	31.23			

Table (4) shows that there were statistical differences at ($\alpha=0.05$) means of student's marks of the experimental group "which studied the unit by using direct inquiry strategy" and the control group "which studied the unit by using traditional way in post- application for critical thinking test. $T = 3.611$. $sig = 0.001$, for fifth levels (Assumptions knowledge, explanation, Evaluate discussions, deduction, induction). (3.802-, 3.066-, 3.143-, 3.842-, 3.014-). Through means investigate that. These differences due to the experimental group. That indicates there was effect of direct inquiry on developing critical thinking for students of 10th grade.

Also, using this strategy on developing critical thinking for students through what this strategy includes brain's abilities e.g. (identify problem, observation, description, deduction, measurement, comparing and generalization) and agreement with this abilities which test of critical thinking includes (knowledge of assumptions, explanation, deduction, evaluation). Furthermore, this strategy helps students to search and explore and rich their needs and ambitious. Another distinction for this strategy is making learning more interesting and giving students the chance to take effective and good attitudes in learning. Giving students vast chance in thinking process. Brunner indicates that discovery helps students to increase practical and brain's skills and direct them to start working and discovery generally.

Recommendations

In light of the results of the study, the researcher purposed a set of recommendations among which are the following:

- 1- teachers have to use direct inquiry strategy to teach physics for its role in developing performance and critical thinking for students.
- 2- it's necessary the ministry of education have to train physics male and female teachers how they employ direct inquiry strategy in teaching.
- 3- directing researchers to make new studies about another populations and stages.
- 4- directing researchers to make studies about the effect of direct inquiry on another variables e.g. problem solving.

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