

Investigating the Relationship between Guided Discovery Strategy and the Enhancement of Creative Thinking Skills of Vocational Education Students at the University Level: Evidence from Al-Balqa Applied University, Jordan

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ABSTRACT

This study aimed at investigating the effect of teaching vocational education courses in the university phase utilizing the guided discovery strategy on developing the creative thinking compared to the traditional teaching method.

The study sample consisted of (50) female students in the specialization of vocational education at Al-Balqa Applied University (BAU), who were distributed into two groups; the experimental group which consisted of (25) female students who were taught using the guided discovery method, while the control group consisted of (25) female students who were taught the same content using the traditional method. The results revealed the existence of statistically significant differences between the mean scores of the students in both groups on the creative thinking measure used in the study, in favor of the experimental group students who were taught using the guided discovery method.

Keywords: Guided discovery, Creative thinking skills, Vocational education.

INTRODUCTION

Education in general aims at contributing to developing learners in an integrated manner; in all knowledge, skill and psychological aspects. So, the main task of teaching different subjects should be teaching learners how to think, not how to memorize. In light of the knowledge explosion and the tremendous technological revolution witnessed nowadays in all aspects of life, it has become necessary that education experts search for ways that ensure the development of thinking of learners, as well as teaching them how to discover knowledge and apply it in solving their daily life problems.

This is the main aim that education should endeavor to achieve. Achieving the objectives of teaching the subjects of vocational training requires suitable teaching methods and strategies that ensure learning soundness and quality. One of the most important and efficient strategies in this field is the discovery strategy through educational activities, in which the learner discovers the concept through the activities organized by the teacher, where these activities are characterized by appropriateness and diversity (Leutner, 1993; Kennedy, Baxter & Belpaeme, 2015).

It is known that learning is more comprehensive and more efficient when students endeavor to gain and discover knowledge by themselves instead of receiving it.

This tendency has been found by educational experts since centuries. Guided discovery is considered as one of the learning methods that adopt this tendency, in which learning is an intentional process that is

achieved through problem-solving under the supervision of the teacher, who provides the students with the educational materials to gain knowledge through them by themselves (Abdisa & Getinet, 2012).

Guided learning by discovery is defined as a strategy which is based on preparing and organizing a set or a series of educational activities performed by the students under the supervision and guidance of the teacher. Researchers also define guided discovery strategy as a set of activities presented to students in systematic steps using the discovery strategy with the teacher's guidance toward a certain problem with a hint pertinent to its way of solution (Baroody et al., 2015).

Numerous studies have investigated the efficiency of guided discovery in enhancing many of the learning process outputs, particularly students' achievement. What has been absent in these studies was the investigation of the impact of guided discovery on developing creative thinking and its skills. The following presentation displays the most important studies that have been conducted on the topic of this study.

Literature Review

Udo (2010) conducted a study aiming at comparing the efficiencies of the guided discovery teaching method, the student-centered teaching method and the traditional teaching method and their impacts on students' performance in chemistry. The study used the semi-experimental approach with an experimental group and a control group. The study sample consisted of (118) students (62 males and 56 females), selected using the intentional method from three mixed public schools in Nigeria. The results showed that the guided discovery method was the most efficient one in enhancing the students' performance in chemistry, followed by the students-centered method, with the traditional method being the least efficient method.

Khalifah and Al-Dibsi (2011) conducted a study with the aim of investigating the effect of teaching the human body unit from the science curriculum for the sixth grade using the guided discovery method in the laboratory on the students' studying achievement compared to the teaching methods followed in teaching this curriculum. The study sample consisted of (70) sixth elementary grade students in the city of Tabuk, KSA, distributed into two groups.

The experimental group consisted of (35) students who were taught the human body unit using the guided discovery method in the laboratory, while the control group consisted of (35) students who were taught the same content using the ordinary method. The equivalence of both groups was verified by referring to the students' scores in the study semester prior to the final experiment on the sample members through the results of applying the pre-test of study achievement prepared by the researchers. The researchers designed the study program pertinent to the human body unit according to the guided discovery method in the laboratory. Furthermore, they prepared an achievement test for the aforementioned unit. After the implementation of the study program, the achievement test was applied to the study sample members. The research findings revealed the presence of statistically significant differences at the significance level of (0.05) between the mean scores of the students in both groups in the achievement test, in favor of the experimental group, the students in which have been taught using the guided discovery method in the laboratory.

Abdisa and Getinet (2012) conducted a study with the aim of investigating the efficiency of using guided discovery strategy compared with the traditional method in students' achievement in physics for secondary-stage students in Ethiopia. The study sample consisted of (114) students; (73) males and (41) females, who were chosen using the intentional method and divided into two groups. The experimental group studied using the guided discovery, while the control group studied using the lecture method. The

study results showed statistically significant differences in the students' achievement scores in both groups, in favor of the experimental group students who were taught using the guided discovery method.

Rashid (2013) investigated the impact of guided discovery method on technical works in the course of manual handicrafts for female students of vocational education in the middle stage in Ba'qouba city. The study sample consisted of (15) female students who were randomly selected from the study population. The results revealed the presence of a positive impact of the guided discovery method on the quality of manual handicrafts of the study sample members.

Al-Ansaria (2016) studied the efficiency of guided discovery in developing science processes and studying achievement in science for fourth basic grade students. The study sample consisted of (57) students in Al-Batina governorate in the Sultanate of Oman. The sample members were divided into two groups. The experimental group (n=29) was taught using the guided discovery method, while the control group (n=28) was taught using the ordinary method. The results revealed statistically significant differences in the achievement test results between the two groups in favor of the experimental group. Furthermore, statistically significant differences were found in the total score of the test of science processes, in favor of the experimental group.

Al-Fatlawi (2017) attempted to investigate the effect of mathematics teaching for fourth basic grade students using the guided discovery method on the students' achievement compared to the traditional teaching method followed in mathematics teaching, as well as on the persistence of learning effect. The study sample consisted of (90) students from An-Najaf governorate, who were equally divided into two groups. The experimental group was taught using the guided discovery method, while the control group was taught using the traditional method.

The research results revealed the existence of statistically significant differences in the means of both groups in the achievement test and slightly in the persistence of learning effect, in favor of the experimental group students who were taught using the guided discovery method.

Study Importance

The importance of this study is associated with:

- The efficiency of using the guided discovery method in teaching the courses of vocational education, where students learn to think as scientists; observing, experimenting and discovering.
- The recentness of the study, where it is considered one of the few studies in the field of teaching methods of vocational education subjects at the university level, to the best knowledge of the researcher.
- The study might contribute to the development of teaching vocational education courses and accordingly to the achievement of vocational education teaching goals.

Study Problem

The modern age is characterized by knowledge explosion, where traditional methods of dealing with knowledge are no longer sufficient to face the needs of learners, meet their requirements and enhance their attitudes.

Therefore, it has become a necessity to think of non-traditional methods to contribute to face this challenge. Accordingly, the current study came to take part in enhancing vocational education teaching using teaching methods other than traditional ones, so that vocational education goals are achieved.

To realize this, the content of vocational education courses should be taught using efficient teaching methods in order to realize students' self-development and make them continuously investigate and discover. Doing so, the purpose of teaching vocational education curricula becomes: work is the basis of understanding.

This is because of the nature of vocational education courses which are characterized by the applied aspect that relies on skills. In order to implement the vocational education content in a manner that realizes the educational outcomes, appropriate teaching methods should be used, where one of the teaching methods in this context is the guided discovery method.

Study Objectives

This study aims at realizing the following objectives:

- Measuring the impact of guided discovery method on developing creative thinking skills of vocational education courses' students.
- Developing teaching methods of vocational education courses at the university level.

Study Population

The study population consisted of the bachelor students in the specialization of vocational education at Al-Balqa Applied University, who were registered in systematic study in the first semester of the academic years 2018/2019

Study Sample

The members of the study sample were chosen from Irbid College for Girls-Al-Balqa Applied University. The researcher selected the students of two study classes to represent the study sample. The final sample was divided into two groups each of which consisted of (25) students.

The experimental group was taught using the guided discovery method, while the control group was taught using the traditional method. Table 1 shows the study sample distribution according to the teaching method used.

Table 1. Study sample distribution according to the teaching method used

Group	Number	Teaching method
Experimental	25	Guided discovery
Control	25	Traditional method

Study Tool

The researcher used the Torrance scale of creative thinking skills to measure the creative thinking skills of the study sample members.

Torrance Scale

The researcher used in this study the Torrance scale version which was modified to suit the Jordanian environment (Ayasrah and Hamadneh, 2010) to measure the ability of creative thinking. This scale was used in numerous studies in Arab contexts. It is applicable for any educational level from the fourth elementary grade level to the university level (Ayasrah and Hamadneh, 2010).

The scale consists of six tests measuring the following skills for students:

1. Fluency, which is represented in the number of potential answers for a certain situation in a fixed time unit.
2. Flexibility, which is represented in the variety of potential answer categories for a certain situation in a fixed time unit.
3. Originality, which is represented in the number of new and unique answers for a certain situation in a fixed unit.

These skills form the elements of creative thinking, the answering of each of which needs seven minutes, in addition to the time required for instructions and guidelines.

The test as a whole has a good stability coefficient of (0.82), while the stability coefficients of the skills of fluency, flexibility and originality have the values of (0.85, 0.76 and 0.80), respectively.

The scale is corrected as follows:

- The examinee is given the total score in the verbal version "A" of Torrance test from the sum of total scores obtained in the dimensions of: fluency, flexibility and originality.
- The examinee is given scores for fluency, flexibility and originality from the sum of sub-scores obtained for the skills of fluency, flexibility and originality in each of the six sub-tests.
- The examinee is given a score for fluency according to the number of ideas on each test, amounting to seven ideas. With regard to flexibility, the examinee is given a score based on the number of response categories responded to by the examinee in each test, amounting to three categories.

The sub-score for originality is calculated from the sum of originality scores obtained by the examinee for each response, where a score is given for originality ranging from zero to three degrees according to the following criteria:

1. The answers are familiar and ordinary.
2. The answers are somewhat strange.
3. The answers are completely strange and rarely found in the answers of examinees.

Study Procedures

This study was implemented in steps including preparing theoretical and experimental material, selecting the study sample, applying the pre-test for measuring creative thinking, implementing the teaching process for the experimental and control groups, preparing the study tool and applying it and formulating the final form of the study; according to the following steps:

- Collecting the theoretical framework materials, translating the related previous studies and employing them for the purposes of the current study.
- Preparing the study tool and verifying its appropriateness for achieving the objectives of the study and answering its questions.
- Preparing the scientific material for the teaching program relying on theoretical and practical literature.
- Selecting the study sample from among the students of vocational education discipline at Al-Balqa Applied University and verifying the equivalence of both experimental and control groups.
- Pre-applying the creative thinking scale to each of the experimental and control groups.
- Teaching the control group using the traditional method and the experimental group using the guided discovery method.
- Post-applying the creative thinking scale and determining the impact of guided discovery method on the students' creative thinking level.

Study Methodology

This study adopted the semi-experimental research approach with pre- and post-measurements for two groups; experimental and control, as illustrated in Figure (1).

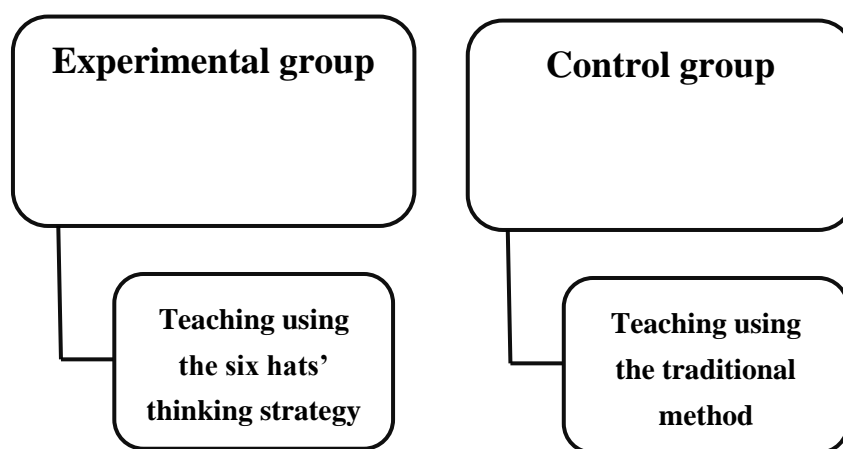


Figure (1): Research design

Study Results

This section includes a presentation of the results obtained by the researcher in order to answer the research questions through applying the appropriate statistical analyses to the study data.

Before answering the research questions, Torrance test for creative thinking was applied to all members of the experimental and control groups, in order to verify the equivalence of both study groups in creative thinking skills prior to implementing the teaching process. The results are depicted in the following tables.

Table 2. Arithmetic means and standard deviations of the performance of the members of the experimental and control groups in the skill of fluency in the pre-application of Torrance test for creative thinking

Group	Fluency	
	Arithmetic mean	Standard deviation
Experimental	29.8800	1.01325
Control	29.9200	1.22202
Both groups	29.9000	1.11117

Table 2 shows that the arithmetic mean of the performance of the experimental group members in the fluency skill in the pre-test was (29.8800) with a standard deviation of (1.01325), while the arithmetic mean of the performance of the control group members amounted to (29.9200) with a standard deviation of (1.22202), which indicates the equivalence of the level of both groups in the fluency skill before applying the teaching process. The table also shows that the total arithmetic mean of the performance of both groups in the fluency skill in the pre-test was (29.9000) with a standard deviation of (1.11117).

Table 3. Arithmetic means and standard deviations of the performance of the members of the experimental and control groups in the skill of flexibility in the pre-application of Torrance test for creative thinking

Group	Flexibility	
	Arithmetic mean	Standard deviation
Experimental	27.8800	1.39403
Control	27.7200	1.39403
Both groups	27.8000	1.42857

Table 3 shows that the arithmetic mean of the performance of the experimental group members in the flexibility skill in the pre-test was (27.8800) with a standard deviation of (1.39403), while the arithmetic mean of the performance of the control group members was (27.7200) with a standard deviation of (1.39403), which indicates the equivalence of the level of both groups in the flexibility skill before applying the teaching process. The table also shows that the total arithmetic mean of the performance of both groups in the flexibility skill in the pre-test was (27.8000) with a standard deviation of (1.42857).

Table 4. Arithmetic means and standard deviations of the performance of the members of the experimental and control groups in the originality skill in the pre-application of Torrance test for creative thinking

Group	Originality	
	Arithmetic mean	Standard deviation
Experimental	7.2000	0.64550

Control	7.2400	0.77889
Both groups	7.2200	0.70826

Table 4 shows that the arithmetic mean of the performance of the experimental group members in the originality skill in the pre-test was (7.2000) with a standard deviation of (0.64550), while the arithmetic mean of the performance of the control group members was (7.2400) with a standard deviation of (0.77889), which indicates the equivalence of the level of both groups in the originality skill before the application of the teaching process. The table also shows that the total arithmetic mean of the performance of both study groups in the originality skill in the pre-test was (7.2200) with a standard deviation of (0.70826).

Table 5. Arithmetic means and standard deviations of the performance of the members of the experimental and control groups in the pre-application of Torrance test of creative thinking as a whole

Group	Torrance test	
	Arithmetic mean	Standard deviation
Experimental	64.9600	2.07123
Control	64.8800	1.66633
Both groups	64.9200	1.86088

Table 5 shows that the arithmetic mean of the performance of the experimental group members in the pre-application of Torrance test was (64.9600) with a standard deviation of (2.07123), while the arithmetic mean of the performance of the control group members was (64.8800) with a standard deviation of (1.66633), which indicates the equivalence of the total level of both groups in the creative thinking skills before applying the teaching process. The table also shows that the total arithmetic mean of the performance of both groups regarding the level of creative thinking skills in the pre-test was (64.9200) with a standard deviation of (1.86088).

Study Questions

The main study question is:

- What is the impact of application of guided discovery strategy on developing creative thinking skills in the vocational education specialization students at Al-Balqa Applied University?

The sub-questions of the study are as follows:

- What is the impact of application of guided discovery strategy on developing the fluency skill of vocational education students at Al-Balqa Applied University?

To answer this sub-question, arithmetic means and standard deviations of the performance of the members of the experimental and control groups were calculated in the fluency skill in the post-application of Torrance test of creative thinking. Table 6 shows the results.

Table 6. Arithmetic means and standard deviations of the performance of the members of both experimental and control groups in the fluency skill in the post-application of Torrance test of creative thinking

Group	Fluency	
	Arithmetic mean	Standard deviation
Experimental	31.0800	0.99666
Control	30.0400	1.13578

Table 6 shows that the arithmetic mean of the performance of the experimental group members in the fluency skill in the post-test was (31.0800) with a standard deviation of (0.99666), while the arithmetic mean of the performance of the control group members was (30.0400) with a standard deviation of (1.13578), which indicates the presence of a difference in the level of both groups in the fluency skill after the application of the teaching process, in favor of the experimental group.

- What is the impact of applying the guided discovery strategy on developing the flexibility skill of vocational education students at Al-Balqa Applied University?

To answer this sub-question, arithmetic means and standard deviations of the performance of the members of the experimental and control groups were calculated in the flexibility skill in the post-application of Torrance test of creative thinking. The results are shown in Table 7.

Table 7. Arithmetic means and standard deviations of the performance of the members of the experimental and control groups in the flexibility skill in the post-application of Torrance test of creative thinking

Group	Flexibility	
	Arithmetic mean	Standard deviation
Experimental	28.6000	0.91287
Control	27.6800	1.06927

Table 7 shows that the arithmetic mean of the performance of the experimental group members in the flexibility skill in the post-test was (28.6000) with a standard deviation of (0.91287), while the arithmetic mean of the performance of the control group members was (27.6800) with a standard deviation of (1.06927), which indicates the presence of a difference in the level of both groups in the flexibility skill between both experimental and control groups, in favor of the experimental group, after the application of the teaching process.

- What is the impact of applying the guided discovery strategy on developing the originality skill of vocational education students at Al-Balqa Applied University?

To answer this sub-question, the arithmetic means and standard deviations of the performance of the members of both the experimental and control groups were calculated in the originality skill in the post-application of Torrance test of creative thinking. Table 8 illustrates the results.

Table 8. Arithmetic means and standard deviations of the performance of the members of both experimental and control groups in the originality skill in the post-application of Torrance test of creative thinking

Group	Originality	
	Arithmetic mean	Standard deviation
Experimental	7.8000	0.50000
Control	7.2400	0.66332

Table 8 shows that the arithmetic mean of the performance of the experimental group members in the originality skill in the post-test was (7.8000) with a standard deviation of (0.50000), while the arithmetic mean of the control group members was (7.2400) with a standard deviation of (0.66332), which indicates the presence of a difference in the level of originality skill between both groups, in favor of the experimental group, after applying the teaching process.

- What is the impact of applying the guided discovery strategy on developing the creative thinking skills of vocational education students at Al-Balqa Applied University?

In order to answer this question, the arithmetic means and standard deviations of the performance of the members of both the experimental and control groups were calculated in the post-application of Torrance test of creative thinking. Table 9 shows the results.

Table 9. Arithmetic means and standard deviations of the performance of the members of both experimental and control groups in the post-application of Torrance test of creative thinking

Group	Torrance test	
	Arithmetic mean	Standard deviation
Experimental	67.4800	1.32665
Control	64.9600	1.59374

Table 9 shows that the arithmetic mean of the performance of the experimental group members in the total result of the post-application of Torrance test of creative thinking was (67.4800) with a standard deviation of (1.32665), while the arithmetic mean of the control group members was (64.9600) with a standard deviation of (1.59374), which indicates the presence of a difference in the total level of creative thinking skills between both study groups, in favor of the experimental group, after applying the teaching process. To verify the statistical significance of the differences between the experimental group and the control group, ANCOVA analysis was used for the difference in the means of both groups in the post-test on Torrance scale of creative thinking skills. The ANCOVA analysis results are shown in Table 10.

Table 10. ANCOVA analysis results of the difference in the means of both experimental and control groups in the post-test of Torrance scale of creative thinking

Source of variance	Degrees of freedom	Sum of squares	Mean sum of squares	F-value	Level of significance
Teaching method	1	13.520	13.520	11.842	0.001

Table 10 shows that the teaching method (guided discover) had a statistically significant effect on the amount of enhancement resulting in the experimental group in the level of creative thinking skills on Torrance scale. The F-value was (11.842), which is statistically significant at the (0.05) significance level. This means that teaching using the guided discovery method had an impact on developing creative thinking skills in the experimental group. This impact was remarkable as confirmed by the clear difference in the performance between both research groups, in favor of the experimental group.

Discussion of Results

The study results revealed the existence of statistically significant differences in the fluency skill between the scores of the experimental group, the members of which were taught using the guided discovery teaching method, and the control group, the members of which were taught using the traditional method. The experimental group scored an arithmetic mean of (31.0800) with a standard deviation of (0.99666), while the arithmetic mean of the control group was (30.0400) with a standard deviation of (1.13578).

The study results also showed differences between the performance of the experimental group members and that of the control group members in the flexibility skill, in favor of the experimental group members who were taught using the guided discovery teaching method. The experimental group scored an arithmetic mean of (28.6000) with a standard deviation of (0.91287), while the arithmetic mean of the control group amounted to (27.6800) with a standard deviation of (1.06927).

Regarding the originality skill, the results showed differences between the performances of both study groups, in favor of the experimental group, the members of which were taught using the guided discovery method. The experimental group scored an arithmetic mean of (7.8000) with a standard deviation of (0.50000), while the control group scored an arithmetic mean of (7.2400) with a standard deviation of (0.66332).

Moreover, the results revealed differences between the performances of both study groups in the total level of creative thinking skills (fluency, flexibility and originality) according to Torrance test, where the arithmetic mean of the experimental group was (67.4800) with a standard deviation of (1.32665), while the arithmetic mean of the control group was (64.9600) with a standard deviation of (1.59374).

The researcher attributes the previous results to the possibilities inherent in the guided discovery strategy of directing the student's attention to multiple aspects of an issue or a problem, which leads him/her to acquire the skill of thinking about the situations he/she encounters from numerous and different angles and dimensions (objective, emotional, critical, positive, creative, directive).

This is thought to contribute to free students from the negative aspects of thinking and encourage them to collect information about a problem or a situation. Furthermore, guided discovery strategy enhances criticism, evaluation, balancing, analysis, presenting ideas of multiple potentials and positive thinking.

It also encourages discovery, research and investigation, as well as innovation, creation, orientation, organization and implementation. At the same time, guided discovery strategy helps teachers discover the levels of mind reserves of their students and gives teachers a comprehensive idea about the means used by their students to treat diverse ideas in educational situations.

The importance of the previously mentioned gains and benefits of guided discovery strategy in the field of vocational education teaching can't be overlooked.

Recommendations

Based on the study findings, the researcher presents the following recommendations:

- Encouraging teachers of vocational education courses to utilize the guided discovery method because of its positive role in developing creative thinking skills of students.
- Conducting more research studies to investigate the impact of teaching using the guided discovery method on other variables, such as motivation and achievement of vocational education students.
- Conducting specialized studies on the effect of guided discovery teaching method on the achievement and creative thinking skills of students at the university level in Jordan.
- Holding specialized workshops to train faculty members in the field of modern teaching methods, including guided discovery strategy as well as other strategies.

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