

# Developing the Creativity of School Students Interested In Engineering

Ziad A Obeidat<sup>a</sup>, Mohammad Obeidat<sup>b</sup>

<sup>a</sup> Directorate of education for Bani Kinana, Irbid, Jordan

<sup>b</sup> Wayne State University, Detroit, Michigan, 48202

Email: [ziadoo2@yahoo.com](mailto:ziadoo2@yahoo.com), [maobaidat76@yahoo.com](mailto:maobaidat76@yahoo.com)

## Abstract

This paper investigates the awareness of Jordan mathematics teachers regarding the importance of creative thinking and the development of its skills among mathematics students. Lack of such awareness in the educational system has negative impact on students' achievement especially in the basic stages of the course. This impact decreases the outcomes of students that are required at the end of course. This study has not been analyzed in Jordan even the students usually complain about the mathematic course and the old teaching methodologies. Students from Irbid schools in Jordan have been involved in this study. A survey Questions have been provided to the student to utilize the creativity problems of their teachers. The study finds that most of the interviewed teachers indicated a level of dissatisfaction towards the creativity levels of the students. The results have been analyzed statistically to measure the ability of the teachers to apply the appropriate techniques in the learning environment to achieve creative thinking among the students.

## I. Introduction

Creative thinking can be illustrated in many perspectives: specific thought processes which improve the ability to be creative and to be in an optimal state of mind for generating new ideas.

- To think deliberately in ways that improves the likelihood of new thoughts occurring.
- To maximize the ability of the brain to think of new ideas.
- The ability to think of original, diverse and elaborate ideas.
- The production of changes and developments of thought. In addition, the process of exploring multiple venues of actions or thoughts (Sometimes called divergent thinking because thought patterns and areas of belief are expanded) [1].

The problem of the study stems from the fact that most mathematics teachers lack the awareness for developing creative thinking skills among their students. Lack of such awareness in the classroom instruction has negative effects on students' mathematics achievement, thus minimizing students' scientific abilities in the different school settings.

Throughout the reviewed literature, stage school students show significant weaknesses in mathematic problems, and this weakness is attributed to teachers' low ability in explaining such a mathematical procedure for students [2,3].

The current research aims to understand the problems in mathematics topics learning among Jordanian students. This study also aims to identify the factors behind the lack of students' creativity in mathematics subjects. To achieve the above aims, the following objectives have been identified:

- 1- Investigate mathematics teachers' awareness for the importance of developing creative thinking skills among school students.
- 2- Identify common strategies used by mathematic teachers.

In reviewing the literature, the researcher found that most of the studies that have been conducted in Jordan have analyzed the math problem analysis creativity from a cognitive perspective, focusing mainly on analyzing external factors. Instead, the interest in this research comes from a developmental perspective. The aim of this research is to shed light on some heuristic assumptions with respect to all what have been assumed before from the Jordanian researchers in this field. This study attempts confirm or refute the following research assumptions:

- There is a significant correlation between the implementation of teaching methods and creative thinking skills development in the engineering mathematics classroom.
- There is a significant correlation between mathematics teachers awareness level for the importance of developing creative thinking skills among mathematics students interested in engineering [4,5].

## **II. Research Methodology**

This paper explicates the methodology employed to carry out the study explorations. A detailed account of the respondents and the research setting is provided. In addition, the design of instruments, procedures for data collection and data analysis are also outlined. A theoretical elucidation of the fieldwork methodology is also addressed wherever relevant.

The use of quantitative methods has generated attention among numerous researchers. Researchers increasingly utilized both quantitative and qualitative data collection techniques to gain in-depth picture of the subject matter, the respondents involved and the efficacy of programs. According to the reviewed literature and in order to gather facts during the research

exploration; quantitative approaches were implemented in this research. The population of the current study consisted of 1500 mathematics teachers who are currently teaching engineering mathematics classes in the Jordanian schools during the school year 2011-2012. The sample of the study was randomly chosen from the population of the study and they were (90) mathematics teachers who are currently teaching engineering mathematics in the Jordanian schools during the school year 2011-2012.

Using quantitative methods, an experiment can be designed to discover whether or not the teachers have learned anything, and, if so, how much of that thing. The quantitative technique was implemented in order to achieve the means ratings of mathematics teachers' responses towards issues stated in a 32 Likert scale survey targeted to investigate mathematics teachers' awareness for the importance of developing creative thinking skills to identify common strategies used by mathematic teachers.

In analyzing the mathematics teachers' responses to the survey, the discussion of the teachers responses the survey were accompanied with a tabulated display of teachers' numbers and frequencies obtained from teachers' responses on a 5 point Likert-scale ranging from 'I strongly agree' to 'I strongly disagree'. The results for each part are presented separately. It should be noted that the sample responses included the following options:

1. I strongly agree
2. I agree
3. Neutral
4. I disagree
5. I strongly disagree

Researchers argued that the reliability refers to the consistency of the measurement of a concept, and that there are three prominent factors involved when considering whether a measure is reliable. These factors are stability, internal reliability and inter-observer consistency [6,7]. In the current research reliability of the adopted instrument refers to the consistency by which the instrument has been tested and Cronbach alpha coefficients were computed.

### **III. RESULTS AND ANALYSIS OF QUANTITATIVE DATA**

In this section the results and analysis of quantitative data were presented and discussed in a systematic style taking into consideration all the variables of interest as obtained throughout a survey deployment in this study. This chapter also intends to answer the research questions and confirms or refutes its assumptions. The items of the survey are targeted to provide answers to the research questions.

Table 1 below presents the tested hypotheses in a descriptive statistics in line with the respondents' perceptions based on mean values.

#### **SECTION A: During the planning of teaching**

**Table 1**

No	Question	Mean	Std
1	In your lesson planning, do you determine goals at the higher levels of knowledge?	4.2	0.78
2	Using different teaching strategies that take into account individual differences among students.	3.1	1.2
3	Provides classroom activities that help students to think	3.6	1.1
4	Refer to books from outside the curriculum to enhance your information in order to teach the math problem analysis.	3.4	1.1
5	Identifies a variety of issues to help the development of thinking	3.1	1.2

From the table above, it is obvious that the mathematics teachers have positive perceptions towards the items in the lesson planning category. Moreover, this high mean rating of (4.2) indicates that the teachers determine goals at a higher level of knowledge in their lesson planning. It should be noted that, determining these goals will positively enhance creative thinking skills development in the mathematics classrooms.

Adding up, moderate mathematics teachers applied necessary classroom activities that help students to think mean rating of (3.6). Providing these activities will positively enhance creative thinking skills development in the mathematics classrooms. It is also obvious from the table above that few mathematics teachers refer to books from outside the curriculum to enhance their information in order to teach the math problem analysis mean rating of (3.4). In addition, this average mean rating of (3.4) indicates that still there is a lack of the needed extra activities that should be practiced by the teachers which is an important factor in the teaching process that reflects positively and /or negatively on creative thinking skills development in the mathematics classrooms. This uncertainty mean rating of (3.1) indicates the lack of important aspects in the teaching process that positively and /or negatively reflects on creative thinking skills development in the mathematics classrooms. And also indicates that teachers do not have the required level of awareness during the planning of lessons which in turns negatively reflects on creative thinking skills development in the mathematics classrooms.

## **SECTION B: During the implementation of the lesson**

Table 2

No	Question	Mean	Std
1	In the beginning if your lesson, you start with a question or a problem that attracted the attention of students.	2.8	0.98
2	Together with your students you try to devise a definition or formula and gives examples and applications with the reasoning	4	1
3	You request students examples of the concepts presented by the teacher which are related to math problem analysis	4	1.1
4	You work up to provide a variety and new methods to reach a good level of students ability in math problem analysis skills	3.3	1.1
5	You use the strategy of mathematical proof to teach the students	3.4	1.1
6	You work based on the principle of dialogue and discussion during the solution of issues in the classroom	3.6	1.1
7	You give a high attention to explain the solution steps during answer the examples	3.5	1.2
8	You provide some issues which encourage students' thinking and motivate them	2.8	0.98
9	You encouraging your students to give up some alternatives and multiple answers	2.8	0.99
10	You encouraged the students to create new answers to questions by different ways using the available mathematics information in their previous knowledge.	2.5	1.2
11	Avoid using phrases that limited students' thinking	2.8	1.1

12	You use motivation to stimulate thinking	2.6	1
13	Teaching math problem analysis in Islamic history has a big importance in students' live.	2.5	1.1
14	Using math problem analysis function in Islamic history encourages students' creativity?	3.9	1.1
15	Arrange students' seats in the classroom to make the good interactions between students	3.7	0.98
16	Enhance students' self-confidence	3.9	1.1
17	Provides psychological and social environments that encourage students to participate and interaction during the class	3.6	1
18	Students are encouraged to fair competition	3.8	1.1
19	He is not allowed the students to disconnect their colleagues' answers	4.1	0.98
20	He not interrupt the student during their participation in answering the questions	4	1.2
21	He has the ability to control the classroom	3.9	0.98
22	He works on presents his lesson to students by deliver interesting examples that enable students to enjoy the mathematics class.	3.9	0.99

The table above demonstrates that majority Mathematics teachers' did not interrupt their student during their participation in answering raised questions ( mean rating of 4.0 ) in the one hand and did not allow the students to disconnect their colleagues' answers ( mean rating of 4.1) on the other hand. Moreover, high percent of the mathematics teachers made the effort together with their students trying to devise a definition or formula and gave examples and applications accompanied with the reasoning and justification (mean rating of 4.0). Teachers also requested their students to provide examples related to math problem analysis and the use of math problem analysis techniques in Islamic history which is targeted to encourage students' creativity (mean rating of 3.9). Many others Enhance students' self-confidence and encouraged their students to be indulged in a fair competition with their colleagues (mean rating of 3.8). In terms of classroom physical arrangement it is indicated that many teachers arrange their students' seats in

the classroom to activate effective interactions between students in a conducive environment (mean rating of 3.7). Many teachers indicated that they provide psychological and social environments that encourage students to participate and interaction during the class (mean rating of 3.6).

### SECTION C: Use of information technology

Table 3

No		Mean	Std
1	Use technology information to assist students in the math problem analysis.	4	0.87
2	He needs for more workshops in using information technology.	3.9	1
3	Students are responding with the technology in high motivation.	3.9	1
4	There is no computerized program to help mathematics teachers in the math class.	4	0.87
5	Use the interactive whiteboard in mathematics class	4.3	0.78

It is clear from the table above that the Mathematics teachers perceived that they use technology information to assist students in the problem solving (mean rating of 4.27). In addition, the teachers indicated their need for more workshops in using information technology (mean rating of 4.21). Furthermore, high percentages of the teachers illustrated that their students are act in response towards the employed technology in high level of motivation (mean rating of 3.9). Even though students expressed high level of motivation towards technology it was indicated that there are no computerized programs to assist mathematics teachers in the math problem analysis class (mean rating of 4.0). In which the main technique employed to upgrade students creativity was in the teaching process was the use of the interactive whiteboard in mathematics class (mean rating of 4.3).

### IV. Discussions

Overall, the major findings which were obtained from the quantitative data suggest the mathematics teachers' were not adequately organized taking into consideration the students' math problem analysis creativity. This fact is highlighted throughout teachers' perceptions towards the issues raised in the survey which suggest necessary techniques for the development of student math problem analysis creativity which had means rating from (3.46) to (4.14). The results of the discussed quantitative data indicate that, there seems to be a high level of dissatisfaction on the part of mathematics teachers in their mathematics teaching lessons. In relation to each research question and hypothesis the discussion of the results is presented. In term of the obtained quantitative data, it was indicated that, there is a lack of important aspects in the teaching process that positively and /or negatively reflects on creative thinking skills development in the mathematics classrooms. And also indicates that teachers do not have the required level of awareness during the planning of lessons which in turns negatively reflects on creative thinking skills development in the mathematics classrooms. The findings suggests throughout the results of the statistical analysis on the items of the survey that, the mathematics teachers are basically unaware of the familiar techniques such as drills in their classrooms. This state of lack of awareness will negatively influence their students' creative thinking inside the classroom. Consequently, teachers are ill-equipped to apply the appropriate and requisite techniques in the learning environment thus impeding the transmission of these techniques to their learners.

This has a negative impact on learners' creative thinking as they are not properly sterilized to apply the appropriate techniques by their teachers who are unaware how to impart this knowledge. Hence, learners' performance is negatively impacted as successful learners are not characterized by their use of special techniques that others do not use; but rather by their ability to coordinate techniques with task demands [3]. Furthermore it was indicated that even though students expressed high level of motivation towards technology it was indicated that there are no computerized programs to assist mathematics teachers in the math class. In which the main technique employed to upgrade students creativity was in the teaching process was the use of the interactive whiteboard in mathematics class.

## **V. Conclusions and Future Directions**

The purpose of conducting this study was to investigate mathematics teachers' awareness for the importance of developing creative thinking skills among basic school students and to identify common strategies used by basic school mathematic teachers. One of the crucial purposes of this study was to examine the level of mathematics teachers' awareness towards the techniques necessary for developing student creative thinking. Similarly, to clarify students needs in developing the math problem analysis creativity in the mathematics topics. The quantitative findings of the study were collected throughout the mathematics teachers' perceptions towards the survey items.

Furthermore the quantitative data obtained in this study illustrated that, majority Mathematics teachers' did not interrupt their student during their participation in answering raised questions and did not allow the students to disconnect their colleagues' answers. Teachers tried to devise a definition or formula and gave examples and applications accompanied with the reasoning and justification.

In Jordan, there is limited research that investigates creative mental computation and strategies effectiveness. Thus, further research is needed to investigate Jordanian students' motivation to learn the mathematics topics and to examine the means by which students' motivation could be enhanced and developed.

## References

- [1]Taylor, J. (2000). Distance Education Technologies: The Fourth Generation, Australian Journal of Education Technology.
- [2]Tayseer, S. ( 1992). Talent and Creativity: Diagnosis Methods and Computerized Tools. Dar Al Tanweer, Amman- Jordan.
- [3]Chamot, A., and O'Malley. (1994). Language learner and learning strategies. In Implicit and Explicit Learning of Languages. Nick C. Ellis. (ed.): pp 371-392. London: Academic Press.
- [4]Samer, H., & Grundmeier, T. A. (2007). Prospective Mathematics Teachers' Views on the Role of Technology in Mathematics Education, IUMPST: The Journal, 3 (Technology).
- [5]Doyle, P. (2007). Developing statistical literacy with students and teachers in the secondary mathematics Classroom, The University of Waikato.
- [6]Kokot, S. (1997) .The Creative mode of Being. 3 (31), Pp. 212 -226.
- [7]Louis, M. E . (2005). Mathematical Creativity and School Mathematics: Indicators of Mathematical Creativity in Middle School Students University of Connecticut.