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Ensured Administrative Quality of the STEM Program at Higher Education Institution

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Abstract

This study aims at investigating the impact of (STEM) program on higher education institutions in developing the quality of pedagogical knowledge in science colleges. To answer the study questions and test its hypotheses, the researchers used a quasi-experimental design, As the work has been done to build the two study tools from a test, the quality of pedagogical knowledge and the study sample consists of (50) faculty of science, and it was divided into two groups: experimental, and control. The study concluded that applying STEM programs reflects its positive impact on developing the quality of pedagogical knowledge of science programs.

Keywords: STEM, Quality, Higher education, science programs.

Introduction

Mathematics, technology, engineering, and science subjects are the main pillars in all different professional fields, scientific, and others. It is important for faculty members in higher education to know these sciences with correct and deep knowledge, in addition to the ability to know about the correct and useful methods and strategies in order to apply them in real life and employ them in fields(Alliance,A,2011,p:45). It is evident that today's world development is based on an instrumental basis of science, mathematics, technology, and engineering. Consequently, the emphasis is placed on such fields regarding their educational programs. Alongside, anxiety has become prevalent, due to the scarcity of people qualified for technological jobs, especially graduates of mathematics and sciences not equipped for technological professions that are in line with the tremendous development in technology and the growing changes in this world(Watt,2013,p:40-48). The student will not be able to achieve this integration unless the professor himself has the knowledge in science, engineering, mathematics, and technology, to teach them together. That will add many benefits and advantages that enable the student to look at the materials positively. Based on that, the STEM trend emerged(Basham,2013,p: 8-15). Considering the four scientific fields (science, technology, engineering, and mathematics), and employing them together in education, this approach (STEM Education) seeks to develop and improve, students' comprehension, their acquisition of practical skills, scientific thinking, and to increase their academic achievement through a number of measures. These measures include developing activities, methodologies and projects, and seeking to achieve educational materials to support learning and teaching activities. Likewise, the measures aim at developing university professor's capabilities, so that they teach their students using all of the above subjects together rather than studying each science separately(Sotomayor,2013,p: 40-41). The emergence of the STEM as a trend came after the increasing calls for developing students' abilities, skills and research strategies in scientific fields that would lead eventually to improve their creative and critical thinking, in addition to developing their ability to solve problems(U.S. Department of the Interior.2013,p: 23).

Literature Review

The STEM approach works to integrate the different areas of knowledge with each other, also knowledge is actively built by the learners through the integration of new information and experiences with the previous, which contributes to the development of the learner's ability to form new cognitive structures, rebuild and formulate existing ones, and thus help him to use the appropriate knowledge in a correct manner when facing various situations and problems, and to prepare him for the proper discovery of knowledge(Green,2014,p: 16). Also, Burrelli(2007) explained "As the global economy becomes more dependent on technological industries, the need for a workforce that is skilled in science and math-related fields is rising. In order to meet the workforce needs, many countries, including the United States, have started to promote STEM education initiatives as a way to ensure future financial stability". (Jardine, 2006, p:172) showed that "STEM education is based on theories of curricular integration through a flexible curriculum that helps teachers teach integrated STEM subjects in contrast to divergent and discrete curricula". Kelso (2011,p: 76)added that "Developing the knowledge and skills is necessary to identify and interpret problems in the

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real world, and acquire a willingness to participate and think carefully about issues related to science, technology and engineering in the development of STEM by understanding and using facts, principles, and techniques to evaluate the problem, defining STEM Critical thinking to recognize the problem, and the use of concepts and this requires attention."

Experimental Design

The study adopts a quasi-experimental methodology in measuring the impact of linking science, technology, engineering, and mathematics and developing the quality of educational knowledge in scientific programs. The study sample consisted of a group of university professors, who amounted to (50) professors for the academic year (2017-2018). The study sample consisted of two groups of professors and the selection was done randomly. The experimental group included professors who underwent STEM program training in science, technology, engineering, and mathematics.(Moon,2012,p:57) The equality between the two groups was examined, in addition to the variance in the statistical analysis to control the differences that may result from the inequality of the two groups.

Data Collecting Instrument

The STEM Semantics Survey was adapted from Knezek and Christensen's (1998). On the other hand, the Teacher's Attitudes Toward Information Technology Questionnaire(TAT) is derived from earlier Semantic Differential research by Zaichkowsky (1985). Also, the instrument is adapted from (Tyler ,2010,p: 61). The present study has used the descriptive-analytical approach, whereby the researchers collect data and analyze it in order to make a judgment about the impact of linking science, technology, engineering, and mathematics and developing the quality of educational knowledge on scientific programs by implementing STEM programs. As showed in Table (1) and Table (2).

STEM Survey

To me Math is :

Level		1	2	3	4	5
1.	Fascinating					
2.	Appealing					
3.	Exciting					
4.	Means no thing					

To me Science is:

Level		1	2	3	4	5
1.	Fascinating					
2.	Appealing					
3.	Exciting					
4.	Means no thing					

To me Engineering is

Level		1	2	3	4	5
1.	Fascinating					
2.	Appealing					
3.	Exciting					
4.	Means no thing					

To me Technology is :

Level		1	2	3	4	5
1.	Fascinating					
2.	Appealing					
3.	Exciting					
4.	Means no thing					

STEM Survey (Table (1))

Groups	Number	Arithmetic mean/ before	Arithmetic mean/ after
Experimental group	25	81.32	13.44
Control group	25	80.40	16.40

STEM Survey (Table (2))

Table No. (1) shows an apparent difference in the arithmetic means of the achievement of the trained professors according to the STEM program. The arithmetic mean of the control group reached (13.44), and the arithmetic mean of the experimental group (16.40). Use the accompanying one-way analysis of variance as in the following table (2).

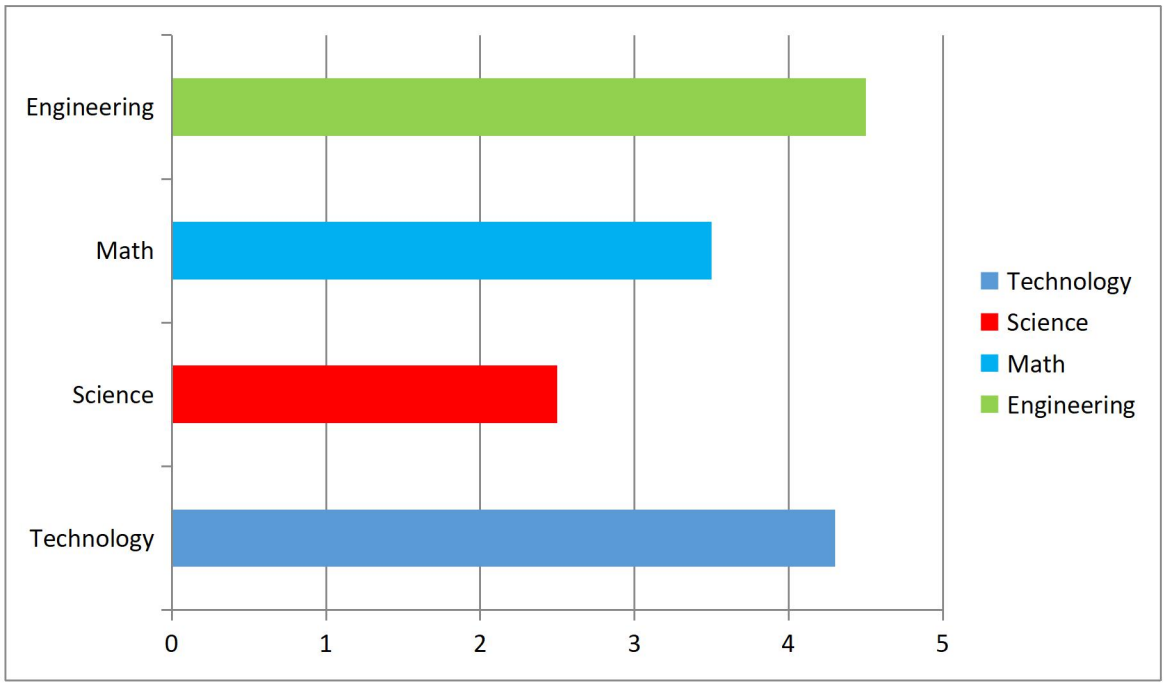

Table (3) showed the levels of the STEM

Results and Discussion

Table (2) shows that there are statistically significant differences at the level between the mean scores of the professors in the experimental group who applied the STEM and those in the control group who have not used STEM in their academic work. The above result reflect quite obviously that professors in the experimental group showed more flexibility when they are trained on (STEM) (Gonzalez & Kuenzi, 2012, 65). The reasons for the advantage achieved by the experimental group in training can also be attributed to the fact that the activities included in the STEM program achieve a real understanding of the concepts.

The results of this study demonstrate that the use of (STEM) education helps teachers improve their teaching process for students, and increase their knowledge of mathematics, engineering, science, technology and its teaching methods, as well as(Thomasian, 2011,p: 55) knowledge of means that help students solve problems. Table (3) of STEM items shows that the levels of engineering and technology are higher than math and science. Finally, the study is in favor of applying STEM systematically due to the advantages achieved in the teaching - learning process. It meets the demands of the teachers, students, curricula, and educational institutions.

Resources

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