



**THE
TURKISH ONLINE
JOURNAL
OF
EDUCATIONAL
TECHNOLOGY**

December, 2017
Special Issue for ITEC 2017

Prof. Dr. Aytekin İşman
Editor-in-Chief

Editors
Prof. Dr. Jerry Willis
Prof. Dr. J. Ana Donaldson

Associate Editor
Assist. Prof. Dr. Fahme Dabaj

Assistant Editor
Assoc. Prof. Dr. Eric Zhi - Feng Liu

ISSN: 2146 - 7242

Indexed by
Education Resources Information Center – **ERIC**
SCOPUS - ELSEVIER

A Proposal Suggested for Mathematic Teachers' Professional Development in the Kingdome of Saudi Arabia based on STEM Education

Ali Taher Othman ALI

College of education

King Saud University

alitaher@ksu.edu.sa

INTRODUCTION

the Ministry of Education in the Kingdom of Saudi Arabia has placed a significant importance on teachers' professional development, in an effort to cope with education reform worldwide. National strategy initiatives for public education development took many forms in order to ensure the best qualitative shift in the performance of Saudi educational systems (King Abdullah Project for Public Education Development, 1431AH). One of the most notable efforts of the Ministry of Education is STEM initiative launched on 2010 within a package of national strategies for public education development. This kind of education is based on the integration between engineering, technology, science, and mathematics; as well as the elimination of barriers among these cognitive areas. It also aims to find creative optimal solutions for real problems, and to develop students' on going learning abilities; encouraging them to create and innovate. The role of engineering is highlighted by the importance and effectiveness of finding several solutions with high, global efficiency; developing thereof critical thinking skills necessary for the modern life (Kennedy & Odell, 2014).

The Ministry seeks through STEM initiative to develop public education by enhancing students' understanding and acquisition of research and scientific skills; as well as increasing their achievement levels. The Ministry also spares no effort to improve teachers' competencies of effective teaching and expand opportunities of applying knowledge, and mathematical, scientific skills. The above-mentioned initiative concentrates on teachers' professional development through building global partnerships with pioneering universities and organizations in science and mathematics education, establishing scientific centers, and developing the digital content supporting teaching and learning process (Ministry of Education, 2010).

STUDY REVIEW

Several modern researches, literatures and studies highlight the importance of teachers' development in Saudi Arabia in light of STEM education; one of which is a study conducted by Aldossari (2015) "Diagnosing STEM Education in Saudi Arabi in Light of International Experiences" which recommended to establish pre-and in-service training programs to train mathematics and science teachers on STEM education. Moreover, the 1st Excellence Conference in Teaching and Learning of Science and Mathematics: STEM (King Saudi University, 2015) shed the light on the importance of conducting further researches on Saudi teachers' practices and performance, and developing various programs necessary for enhancing STEM teaching in public education in the Kingdom by improving teachers' capabilities.

Accordingly, this study provides a proposal for mathematic teachers' professional development in the Kingdome of Saudi Arabia based on STEM education as a new modern approach in mathematics education.

Question of the Study:

what is the proposal suggested for mathematic teachers' professional development in the Kingdome of Saudi Arabia based on STEM education?

Importance of the Study:

the proposal suggested in this study plays a key role in assisting education policy makers to design programs for mathematics teachers' professional development in accordance with STEM approach. It also helps colleges of education in Saudi universities to develop teachers' training programs based on that approach. Moreover, the proposal can guide educational supervisors to design in-service mathematics teachers' performance and encourage those teachers to develop themselves.

Study limitations:

The study was restricted to providing a proposal for mathematic teachers' professional development in the Kingdom of Saudi Arabia based on STEM education from the prospective of seventeen experts in mathematics education during the first and second semesters 2015/2016.

Study terminologies:

STEM Approach: it is the abbreviation of four cognitive learning areas: science, technology, engineering, and mathematics. These areas are integrated in the learning and teaching process through creating a learning environment that can help learners to listen and involve in educational workshops and projects; making them able to develop their skills and knowledge to comprehensively, coherently, easily and enjoyably understand the various sciences.

STUDY METHODOLOGY

the study used the analytical descriptive methodology through reviewing international researches, literatures, and experiences relevant to STEM approach. The proposal was formed based on the following:

- Reviewing STEM education's researches and studies.
- Investigating the reality of mathematics teachers' professional development concerning STEM education in Saudi Arabia.
- Reviewing international experiences in STEM education particularly with regard to STEM training programs for teachers in the United States and United Kingdom.

Accordingly, the initial proposal was established and a questionnaire was developed to receive feedback from seventeen experts in mathematics education using Delphi method via three intervals. After these intervals, the study suggested the following proposal based on five main themes; each one is linked with several sub-requirements:

The first theme: "Educational System Development"	
1	Developing educational systems to meet STEM requirements
2	Allocating enough budget to support and meet STEM requirements
3	Identifying professional development programs, times, and regulations of FTE for candidate teachers
4	Identifying incentives mechanisms and promotion systems for teachers enrolling to STEM programs
The second theme: "The Concentration of STEM Deep Cognitive Content"	
1	Realizing teachers' abilities and motivations to fully understand STEM concepts
2	Identifying components necessary for development through various experiences related to real-world problems relevant to STEM education
3	Emphasizing on building current teachers' capabilities in STEM by designing developmental programs based on appropriate contexts
4	Developing specialized materials in STEM for teachers such as digital simulations and videos
5	Providing teachers with all resources concerning STEM education
6	Publishing researches, and studies supporting STEM education
The third theme: "Educational Skills Necessary for STEM Professional Development"	
1	Developing teachers' accurate understanding of STEM education
2	Recognizing students' misconceptions regarding STEM, and identifying correctional methods by teachers
3	Encouraging students to research, design experiences, and process data in STEM education
4	Recognizing the optimal way to increase students' enthusiasm toward learning STEM topics
The fourth theme: "STEM Professional Development Strategies"	
1	Using various strategies to enable teachers to design and transfer experiences that reflect their scientific understanding of STEM
2	Improving teachers' teaching methods through ongoing discussions about STEM issues
3	Enabling teachers to use various tools of self-reflection such as peer coaching and portfolios
4	Encouraging the exchange of experiences among teachers through supervisors, trainers, and outstanding teachers to provide STEM professional development opportunities

5	Benefiting from high performance teachers to serve as STEM resources
6	Enhancing the use of technology to create direct and virtual learning communities for exchanging best practices
7	Providing learning opportunities and developing procedural research skills to create new STEM knowledge
The fifth theme: “Support and Assistance toward STEM Professional Development”	
1	Providing clear opportunities appropriate for teachers’ professional development within one school’s context
2	Creating appropriate affective STEM teaching environment inside and outside schools
3	Establishing partnerships between Ministry of education and local and international institutions to develop STEM professional development

RECOMMENDATIONS:

- Developing training programs for teachers in Saudi universities to meet STEM requirements and establishing new standards to ensure high quality of these programs in light of STEM education.
- Designing training programs for mathematic teachers in accordance with STEM education.
- Benefiting from partnerships between Ministry of Education and institutions of local and international society in concluding agreements to develop teacher’s STEM abilities.
- Designing the curriculum to consist with STEM approach.

REFERENCES

- Dossary, Hind (2015). The reality of the Saudi experience in teaching STEM in the light of international experiences. *Conference of Excellence in Teaching and Learning Science and Mathematics: Science, Mathematics, Technology and Engineering (STEM) held at King Saud University during the period 5-7 / 5/2015*.
- Honey, Margaret; Pearson, Greg; and Schweingruber, Heidi (2014). *STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research*. Committee on Integrated STEM Education; National Academy of Engineering; National Research Council: <http://www.chitech.org>
- Kennedy, T. J., & Odell, M. R. L. (2014). Engaging Students In STEM Education. *Science Education International*, 25(3), 246–258.
- King Abdullah Education Development Project (2010). *Draft national strategy for the development of public education*. Tatweer for Educational Services. Kingdom of Saudi Arabia.
- Ministry of Education Saudi Arabia (2010). *Draft national strategy for the development of public education*. Kingdom of Saudi Arabia.