Modern Concepts in the Curriculum and the Teaching of Nanotechnology

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ABSTRACT

Nanotechnology is regarded as the technology of the 21st century. Due to the revolution of nanotechnology, its presence divides the world into advanced countries and developing. Nanotechnology education is now a domestic and international challenge to solve the problems facing society, while simultaneously making life and the future better. This study creates concepts in nanotechnology education, discovering modern concepts in the curriculum and teaching of nanotechnology, enabling educators to design an effective nanotechnology curriculum in addition to planning suitable learning environments, at the same time, helping academics to study and develop nanotechnology science effectively. Although the present study has adopted the descriptive approach to organize modern concepts in nanotechnology education, some researchers have pointed to the importance of integrating disparate nanotechnology concepts into curricula matrices and teaching activities through all educational stages to face the educational lack in this area internationally (e.g., Drane, Swarat, Light, Hersam, & Mason, 2009; Hersam, Luna, & Light, 2004; Meyyappan, 2004). This affirms that nanotechnology education must be treated academically to attain contemporary educational objectives.

Keywords: *Education, Nanotechnology, Nanotechnology Education, Nanotechnology Curriculum, Nanotechnology Teaching*

INTRODUCTION

Information technology has created a new science and knowledge forming a global information revolution. Nanotechnology is created as a contemporary concept based on the miniaturizing particles and grains of atoms to become the smallest possible with more and super characteristics. This has implication for many fields, for example, industry, agriculture, health, engineering, etc. Although nanotechnology encompasses various sciences, it may eventually include higher characteristics and processes as yet.

In this respect, developed countries have called to organize and manage nanotechnology practices for humanity development and international peace. Ernst (2009) and Davies (2004) suggest that the nanoscale progress is critical for national security, prosperity of the economy, and enhances the quality of life. This is according to nanotechnology potential as a major transitional force that has the power to change society. So, it is important to consider international nanotechnology laws that call to

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avoid the nanotechnology adverse damage to either humans or environments.

Education is one of the most effective systems to change peoples' behaviors, teaching them how to live and lead their lives through various learning phases and levels. In this field, at local and international levels, there is a need to incorporate nanotechnology concepts in both curricula and teaching in order to prepare learners to understand the nature and safety using of nanotechnology for development purposes.

In a close relation between education and society development, progressive institutes and universities have established nanotechnology education initiatives in order to get modern specific knowledge for nanotechnology future. Educators likewise are interested in research to discover the effective theory and practices of nanotechnology education including curricula, teaching methods, equipment, and evaluation practices. It is also necessary to focus on promotion of nanotechnology achievement and thinking toward advanced science in order to help learners to consider investing it in developing their societies.

According to the importance of nanotechnology education, some researchers have studied the integration of nanotechnology concepts into curricula and teaching activities through various education levels. For example, Drane et al. (2009) conducted a comparative study to evaluate the efficacy and transferability of a nanoscience module in Northwestern University to face the problem of a lace of instructional materials, and to add an effective instructional materials focus on nanoscience.

Uddin and Chowdhury (2001) examined the integration of nanotechnology into the undergraduate engineering curricula to provide an interdisciplinary education for engineering students to apply knowledge in design, analysis and manufacture of nanocomponents, nanodevices, and nanosystems fields. While Brockway, Libera, Kennedy, and Schreck (2009) developed Nanoscale Interdisciplinary Research Project (NIRP) at the Stevens Institute of Technology to develop, integrate, and pilot curriculum modules in high school science classes in order to rapidly growing trained personnel for occupations in business and manufacturing as well as research and development.

The conclusions of those researchers suggest the challenges which divide the world into developed and developing are smaller than expected. At the same time, these challenges confirm a global need to integrate nanotechnology concepts into education systems through curricula and teaching to help learners understand and apply concepts of advanced technology in developing their societies; therefore, although the educational objectives are to develop cognitive, psychological, and physical human domains, it is necessary to concentrate on the promotion of thinking toward advanced nanotechnology sciences. This study considers discovering modern concepts in both the curriculum and the teaching of nanotechnology.

THE PROBLEM OF THE STUDY

There are differing approaches towards developing nanotechnology theories and applications. Education should do the significant role to invest the nanotechnology power to develop both of people and society. Some researchers have indicated the importance of incorporating nanotechnology concepts into their curriculum and teaching in various education specializations and stages, while, at the same time, addressing educational lack in this area internationally mentioned (Scheufele & Corley, 2010; Zheng, Shih, Lozano, Pei, Kiefer, & Ma, 2009; Mehta, 2009; Winkelmann, 2009; Uddin & Chowdhury, 2001); therefore, and in response to these researches, it is essential to discover modern concepts in the curriculum and teaching of nanotechnology including the knowledge and the nature as well as the characteristics of it,

So the main question of this study: What are the modern concepts of nanotechnology education? This raises several sub-questions:

What are the modern concepts of nanotechnology curricula?

What are the modern concepts of nanotechnology teaching?