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Nanotechnology Higher Education Belonging to a Path for Development of Human Society

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Abstract—*The present paper reports the "Nanotechnology higher education belonging to a path for the development of society". Nanotechnology is a multidisciplinary field of applied science , research and development identified as a major priority in the developed country. Progress in science technology and engineering at the nanoscale is critical for national security, prosperity of the economy, and enhancement of the development of our society. Nanotechnology will be major transition-al force that possesses the potential to change our society. Rapid and continued advancement in the field of nanotechnology is accelerating the demand for specific professional knowledge and skill. These continuous development of society approaches and practice to the further engagement to learners and enhances their ability to apply nanoscale related content knowledge must be continuous developed in order to modify itself as the primary builder of nanotechnology research and development .The steadfast development of new technologies leading to continuous transformation of society serves as a strong indicator that current educational practices should altered in order to prepare noble knowledgeable citizens. Hence society experiences itself its development based on nanotechnology higher education.*

Keyword*: L Nanotechnology, higher education and Simulation.*

1. INTRODUCTION

Here we give high-level content of pressing importance addressed through nanotechnology higher education belonging to a path for development of human society, is an identified necessity in educational systems.

Development and innovation are critical compo-nents of education in the developed countries; they promote the maturity of an educated, skilled, and creative general public. Emerging technologies, such as medical technologies, biotechnologies, and especially nanotechnologies represent pros-porous areas for the workforce and the economy, and therefore, they can be a driving force in career and technical education. According to trend analysis, the future will be largely dominated by amplified use of nanotechnologies (NA, 2006).

Although there has been a steady growth in global nanotechnology, this dominating trend is especially true for the developed countries as United States and Japan. The National Academies indicates that 33 percent of all nanotechnology patents awarded from 1990 to 2004 were granted to researchers in the United States and after that Japan, with 19 percent of the worldwide patents during the same period of time.

After that we are going to introduce that according Shelley. Shelley (2006) indicates that determined research and development for targeted nanoscience and nanotechnology has resulted in discovery and application now culminating in marketable products and new commercial appli-cations. As more products (e.g., sunscreens, cosmetics, clothing, upholstery, paint, bodywork of vehicles, computer components) utilize nan-otechnologies, it is only a matter of time until nanotechnology infiltrates consumer products holistically. Shelley (2006) further identifies the limitless possibilities that applying nanotechnol-ogy presents. He asserts that the span and reach of nanotechnology should become and remain a primary consideration not only in government and commerce but also in education. This con-sideration stems from nanotechnology's applica-tion to energy, medical, and information tech-nology, which are both essential and developing components of today's society. The purpose of this article is to introduce nanotechnology/nanotechnology higher education, its societal and econom-ic significance and its importance as an area of study, development of human society.

2. LITERATURE SURVEY

The field of nanotech-nology as focusing on the formation of purpose-ful materials, devices, and systems through the management of matter on the nanometer scale, and the utilization of new occurrences and attributes at the scale. Lakhtakia (2006) indicates that nanotechnology is not a solitary method; neither does it engage a precise variety of resources. Instead, nanotechnology encom-passes all facets of the fabrication of devices and systems by influencing material at the nanoscale. In education and the sciences, advances in nanotechnology and technology as a whole are blurring the lines between disciplines (Schank, Krajcik, & Yunker, 2007).

Nanotechnology is truly a multidisciplinary field that includes individuals from chemistry, physics, biology, materials science, and engi-neering all working in a collaborative manner to better understand and apply knowledge of objects that meet the scale classification (Clark Ernst, 2005). Advancements in bioengineer-ing, instrumentation, materials science, and manufacturing diminish the distinguishing char-acteristics of science and technological disci-plines (Jacobs, 1996). Rapid discovery, develop-ment, and advancement have resulted in rela-tionships among science, technology, and socie-ty becoming increasingly stronger. Unfortunately, schools find it difficult to mod-ernize curricula given the pace of innovation (Fourez, 1997).

Progress in science and engineering at the nanoscale are critical for national security, pros-perity of the economy, and enhancement of life quality for society as a whole. The National Science Foundation has identified that a major outcome goal of the United States is the devel-opment of "a diverse, competitive, and globally engaged U.S. workforce of scientists, engineers, technologists and well-prepared citizens (2004, p. II-7)." It has been projected that approximate-ly two million workers will be required world-wide during the next decade. Many science, engineering, and technology disciplines con-verge at the nanoscale, because they consist of many common principles and tools of investiga-tion (Rocco, 2002). By 2015, it is predicted that nano-related goods and services will be a mar-ket in excess of one trillion dollars (Ratner & Ratner, 2003). Thus, nano businesses will become the fastest growing industry in history, outranking the telecommunications and informa-tion technology industries combined.

Nanotechnology will have an impact on war, crime, terrorism, law enforcement, and commercial goods (Wilson, Kannangara, Smith, Simmons, & Raguse, 2002). The military has a broad interest in nanotechnology, which spans optical systems, nanorobotics, nanomachines, smart weapons, nanoelectronics, virtual reality, armors, energy-absorbing materials, and bio-nano devices. Quite possibly the most important areas of research and development concerning nanotechnologies are nano-optics and nano pho-tonics. Advancement in these areas has potential to create new industrial and manufacturing processes and uncover new ways to maintain a clean and sustainable environment. Although much of the benefit of nanotechnology is antici-pated, applications of nanotechnology are not all categorized as futuristic. Manufacturers are cur-rently producing products with nanoproperties. Many materials in current use are products of nano-related research, such as stain repellents, water repellents, and dental fillers. Much of the invention and innovation in nanotechnology is dependent on associated processes. In order to manufacture at a smaller and smaller level, instruments and chemicals must be used with extreme precision. Industrial and manufacturing process applications of nanotechnologies repre-sent the foundation of further discovery. These applications that merge biology, chemistry, med-icine, and fabrication are broad-based areas that exhibit great potential for cross-disciplinary approaches to education.

Heightened need for targeted knowledge and skill will most certainly have an imprint on the educational system at all levels. The identi-fied "blurring" of disciplines plays much into the emerging structure of an integrated systems approach in technology education classrooms across the country. Shields and Rodgers (2005) identified the need for heightened awareness of experimental technologies for technology educa-tion students. The competencies identified in their study are students' abilities to recognize the ramifications of green energy, efficient vehi-cles, biometrics, and nanotechnology, many of which demonstrate a direct relationship.

A key challenge for nanotechnology devel-opment is the education and training of a new generation of skilled workers in the multidisciplinary perspectives necessary for rapid progress of the new technology. The concepts at the nanoscale (atomic, molecu-lar and supermolecular levels) should pene-trate the education system in the next decade in a manner similar to the way the microscopic approach made inroads in the last 50 years. Furthermore, interdisciplinary connections reflecting unity in nature need to be promoted. Such education and training must be introduced at all levels, from kindergarten to continuing education, from scientists to nontechnical audiences that may decide the use of technology and its funding. (Roco, 2002, pp. 1247-1248)

Technological discovery and improvement continues to unlock new content to incorporate into the classroom. Elevated subject matter and classroom experiences that feature cutting-edge approaches are essential to develop knowledge and motivate students at the K-12 level (Sweeney, 2006). Sweeney further identifies that future progression in nanoscale science and engineering will rely on the content and quality of education in the K-12 classroom. Schank, Wise, Stanford, and Rosenquist (2009) conclud-ed from a recent study that suitable preparation and guidance for teachers, paired with well-designed and engaging nanoscience curricular activities are necessary to facilitate student con-cepts of the fundamental principles that preside over the performance of particles on the nanoscopic scale.

Curricular activities that incorporate real-world examples can enhance students' attitudes about science and emerging ideas. Jones, Andre, Superfine, and Taylor found in a 2003 study that students can increase their understanding of what the nanoscale is through development of high-quality three-dimensional graphics and uti-lization of virtual reality software. In a 2006 National Science Foundation project, Chizmeshya, Drucker, Sharma, and Carpenter identified that direct and virtual microscopy practice by students establishes scale knowledge at the nano level and provides a constructive source for computer modeling experiments. This grouping

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provides an opening for students to take part directly in nanoscale materials research at an appropriate age and with suitable content.

Scale remains one of the most difficult con-cepts for students to grasp regarding nanotech-

Table 1: Nanoscale is a strange scale

1nano meter = One billionth meters One inch = 25,400,000 nanometers(approx.)

Bacteria (single-celled microorganisms) = from a few hundred to 1,000 nanometers

1nm=10 hydrogen atoms in a line

A human hair having diameter of approximately equal to 50,000 nm.

nology. Relating nanometers to customary units of measure provides a minimum level of aware-ness of actual nanoscale objects. However, the relation of visible and tangible objects that stu-dents perceive as extremely small can accentuate this knowledge for students. Table 1 is an exam-ple that standardized units as well as tangible, visible, or represented objects as comparisons to the nanoscale.

Approaching scale through exponential means with a graphical representational basis is also an effective mode for approaching this type of material (Wiebe, Clark, Ferzli, & McBroom, 2003). Clark and Ernst (2005) report findings of a three-year study linking science and technolo-gy concepts through the creation of visualiza-tions. The study involved the creating, piloting, and field testing 12 instructional units for tech-nology education in grades 6 through 12 (typi-cally ages 11-18). The intent of forming instruc-tional units in the US educational system is to organize information on a topic into lessons, taking into consideration time, materials, and preparations. The instructional units cover topics on agricultural and related biotechnologies, medical technologies, nanotechnologies, and principles of visualization related to fields stud-ied in pre-engineering curricula. Study data indi-cates that students who participated in the instructional units involving the creation of visu-alizations significantly increased their knowl-edge in the identified content areas.Nano scale is a an astonishing scale is shown in table-1.

3. NANOITECHNOLOGY HIGHER EDUCATION IN UNIVERSITIES AND HIGHER INSTITUTIONS.

Universities are beginning to include nan-otechnology (i.e., content and practice) in their technology education teacher-preparation curric-ula. One specific program that includes a course partially dedicated to nanotechnology and its application is the Technology, Engineering, and Design Education Program at North Carolina State University in Raleigh: It is titled “Emerging Issues in Technology.” In this course, students explore contemporary medical, environ-mental, and biotechnological topics. They com-plete associated learning activities, experimenta-tion/data collection exercises, and modeling projects. The medical technology sequence consists of disease prevention and medical imaging technologies, investigating pasteurization, irradiations, sterilization, water treatment, sanitation, immunization, computerized axial tomography, ultrasound technology, magnetic resonance imaging, and endoscope technology.

The environmental sequence is composed of graphical weather patterns, Earth observation systems, green power, sustainability, cradle to cradle design, and renewable energy resources. The biotechnology sequence consists of DNA technology, gene detection, enzyme replace-ment, cell culture, and associated nanotechnolo-gies. A major portion of the biotechnology sequence is dedicated to the study of nanotech-nology. Table 2 highlights the targeted areas of exploration through computerized control sys-tems, controllers, automated machines, and robots. The Scientific Visualization offering enhances computer graphics application as a problem-solving tool. Ranges of software pack-ages are utilized to assist in the solution of con-ceptual and theoretical problems. In the Technical Animation course students must con-struct 3-D objects, spaces, and environments. The Scientific Visualization and Technical

Table 2: Some applications belonging to Nanotechnology

Nano Headings	Proportion in %	Content name
Nanoscale use	18%	Used as“nano” and nanometer, ,magnitude as
		a number and exponent, relative size
Carbon Material uses	9%	Physical properties, oxidation state, compounds,
		carbon form uses
Modeling and Simulation use	12%	Data structuring, process structuring ,Flash applicatios
		, Truespace application
Water Purification use	6%	Contaminants, microfiltration, porous nanoparticles,
		nanotubes
Nanorobotics use	8%	Biosensors, control design, controlled manipulation,
		bio-uses
Biomedical Applications use	16%	Drug delivery, bio-machines, biosensors etc
Future Application	16%	Fuel cells, solar cells, nanofibre armour etc
Risks and Benefits use	15%	Security, health, environment and other, mode.

study within nanotechnology, the proportional emphasis dedicated to the specific unit, and the content of each area. Some applications belonging to nanotechnology are demonstrated in table-2

The nanotechnology unit represents approx-imately 30 percent of the Emerging Issues in Technology course. Additionally,

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the Technology Engineering and Design Education Program offers courses in Mechatronics, Scientific Visualization, and Technical Animation. The Mechatronics course expands on nanorobotics

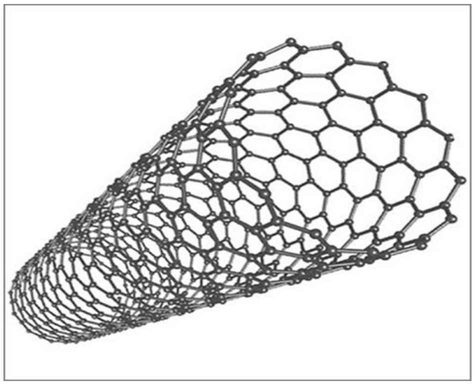

Fig. 1: Carboin nanotube

Material Science courses greatly contribute to the nanotechnology modeling and simulation require-ments in the Emerging Issues in Technology course and production of nano materials as a carbon nanotubes. Nanotechnology uses carbon nanotubes as a nanomaterials .A carbon nanotube is shown in

Fig. 1. Nanomanipulation, or the ability to move atoms individually and arrive at predeter-mined arrangements, is an important first step in realizing the potential of nanotechnology

A key to implementing the study of nan-otechnology content and processes into a tech-nology education teacher-preparation program is to provide an integrated and spiraling sequence of course offerings. These offerings should grad-ually build upon one another and establish lay-ered content knowledge and performance-based application that merges identified systems-based benchmarks in a logical and connected flow. Additionally, visual examples and simulated real-world applications should be used where possible to enhance students' engagement and understanding in technology teacher education. The use of intrinsically motivating approaches, such as visual and kinesthetic learning methods, creativity strategies, problem-based learning, and learning through design are particularly effective methods for reinforcing STEM-based material (Clark & Ernst, 2007). Problem-based and project-based approaches to student learning also have been shown to improve the under-standing of basic concepts and to encourage deep and creative learning despite academic content area (Powers & DeWaters, 2004). The identification of ideas derived from mathematics and science enables instructional sequences to visibly reinforce applications of concepts, skills, and principles through identified content. In this case, chemistry, physics, biology, materials, sci-ence, and engineering are all disciplines central to the study, experimentation, and further devel-opment of nanotechnologies.

4. CONCLUSION

As we know that nanotechnology higher education gives the great impact on the development of human society. Its continuous development belonging to the development of our society leading to continual transformation of society serves as a strong developer that current educational practices should be altered in order to pre-pare knowledgeable and engaged citizens. Contemporary approaches and practices to fur-ther engage learners and enhance their abilities to apply nanoscale-related content knowledge at the highest level must be developed continually, in order for the developed country solidify itself as the primary mover of nanotechnology research and development.

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