Chapter 18
Utilization of Simulation for Training Enhancement

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ABSTRACT

Engineering system design, operation, and maintenance has been handled for a long time through mathematical and real time models. The advent of computers, multimedia age, and improvement in visualization has further proved the reality of fact that picture speaks more than words; also, research in education and training has proven that visualization has a great effect on improving learning. The complexity of real world situation of engineering education has obvious limitations of instructional presentation and training. Simulation gives result from theoretical representation of complex phenomena when hardware for the task is lacking, or in situations when enough time is not available for explanation. This chapter discusses opportunities brought about by simulator as a tool in the training and certification of the Malaysian Maritime Academy cadets training program. The usefulness of simulators in a continuous education program to amplify and enhance competency-based education and instructional training to meet goals of safety, cleaner ocean, and protection of marine environment are highlighted. The chapter also presents the potential of simulators as training tools in other fields of knowledge for enhanced outcomes and competency-based education.

INTRODUCTION

The world of man and the quest for knowledge to facilitate human activities including developing things that surround us has gone through various phases of development. The early man, used memorization as a tool, and wrote information on leaves, trees and mountains to store knowledge which was to be passed to the next generation. The main tools for everything related to learning has likewise gone through various phases of change and the most significant of these changes has been the emergence of ICT in the last one decade. Today, the developments in ICT have greatly

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accelerated the pace of knowledge delivery and the Simulation-Based studies and training is one typical example of such an evolution.

Simulation refers to the application of computational models for the study and prediction of physical events or the behavior of engineered systems. The development of computer simulation has drawn resources from a deep pool of scientific, mathematical, computational, engineering knowledge and methodologies. From the depth of its intellectual development and wide range of applications, computer simulation has emerged as a powerful tool, one that promises to revolutionize the way research in engineering and science are conducted in the twenty-first century. Simulation has long been identifies in several areas of knowledge and it is playing a remarkable role in promoting developments vital to the health, security, and technological competitiveness of the nation. Engineering and scientific communities have become increasingly aware that computer simulation is an indispensable tool for resolving a multitude of technological problems.

Basically, computer simulation represents an extension of theoretical science in that it is based on mathematical models. Such models attempt to characterize the physical predictions or consequences of scientific theories. With simulation engineers are better able to predict and optimize systems affecting almost all aspects of our lives and work, including our environment, our security and safety, and the products we use and export. The use of computer simulations in engineering science began over half a century ago, but only in the past decade or so has simulation theory and technology made a dramatic impact across the whole engineering fields.

That remarkable change has come about mainly because of developments in the computational and computer sciences and the rapid advances in computing equipment and systems. Clearly, the use of simulation is quickly becoming indispensable for goal based engineering education.

Simulation is an important feature in engineering systems or any system that involves many processes. Most engineering simulations entail mathematical modeling and computer assisted investigation. Mathematical model used to dominate simulation world however mathematical modeling is not reliable and the incorporation of physical model often help to improve today complex system simulation. The development and use of such frameworks require the support of inter-disciplinary teams of researchers, including scientists, engineers, applied mathematicians, and computer scientists.

Maritime industry due to its nature and need for safety to maintain Cleaner Ocean has institutionalized and incorporated opportunity offered by simulation to training of marine personnel to fulfill objective of having competent personnel to man the ships that sail the ocean of the world. Encouraged by belief that knowledge, understanding, application and integration which are requirement for outcome and competency based education could enhance traditional instruction delivery method, through incorporating audio visual and multimedia tools, led the IMO to adopt resolution to use simulation as part of STCW requirement. Simulation is thus becoming central to advancement in maritime competency based training and education as well as educational training in biomedicine, nanomanufacturing, microelectronics, energy and environmental sciences, advanced materials, and product development. And there is ample evidence that developments in these new disciplines could significantly impact virtually every aspect of human experience (Don et al., 1995; Roger, 1999).

This chapter explores potentials and prospects of incorporating simulation in engineering and science education structure. Good practice and experience enjoined by maritime industry will be discussed. The authors will also discuss the core issues of simulation, the major obstacles to its development and the impact of simulation on training, educational and research.