

"Perception on sustainable development among new first year engineering undergraduates"

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Abstract

Engineering educators recognize the importance of acquiring knowledge about sustainable development for engineering undergraduates to be more responsible engineers in future. However, most new engineering students neither realize the real meaning of sustainable development, nor understand its importance. Therefore, it is of major interest for many engineering programs to design educational curricula that embeds sustainable development. Having a high population of young engineers, Malaysia faces the challenge to educate them and to make them recognize the social, economic, and cultural dimensions of the environment in order to achieve a sustainable future. By sustainability, we mean moving beyond an add-on, token acknowledgement of the widely accepted definition that sustainability means "meeting the needs of the present without compromising the ability of future generations to meet their own needs". The purpose of this study is to investigate students' perception at the beginning of the semester about their knowledge on sustainable development. The research used qualitative method like interviews and observations conducted for engineering students in a university in Malaysia. At the beginning of the semester, 10 respondents were selected from an engineering faculty. The interview protocol are divide into three categories: (1) previous education background, (2) student's perception and definition on sustainable development (3) student's daily activities and receptiveness towards sustainable development initiatives, such as earth hour, recycling, green technology, climate change etc. The results showed that mostly students are clueless at the entry level about sustainable development. Most of the them did not know how to explain or elaborate the definition about sustainable development because they have not been exposed previously. Students also unsuccessfully explain the definition of sustainable development but most of them involve some aspects of their daily activities and are receptive towards sustainable development initiatives such as earth hour, recycling, green technology, climate change etc. The result of this study can be used as a guideline to teach first year engineering students to develop their knowledge about sustainable development.

Keywords: perception, sustainable development, first year, engineering undergraduates;

1. Introduction

Engineering educators in Malaysia is aiming to improve the universities level of environmental performance after they recognize the importance of acquiring knowledge about sustainable development for engineering undergraduate students in future. Although it has a range of environmental practices and initiatives in place it aims to make considered improvements towards achieving sustainability in Malaysia. As engineering educators with just over 80,000, conceptually we are ideally suited to adopting sustainability when compared to larger, less and conservative educators (Shriberg, 2002; Holmberg and Samuelsson, 2006).

The teaching of Sustainable Development is not new, and present-day academics have the benefit of a solid foundation which has already been laid by prior guides and reports, such as the guiding principles of Engineering Sustainable Development, and the outcomes of four year initiative of the Higher Education in Malaysia for Sustainability programmed in Learning and Skills for Sustainable Development Knowledge is embed or integrating in curriculum for engineering students now days, Developing a sustainability literate society (Forum for the Future,

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2. Theoretical Background

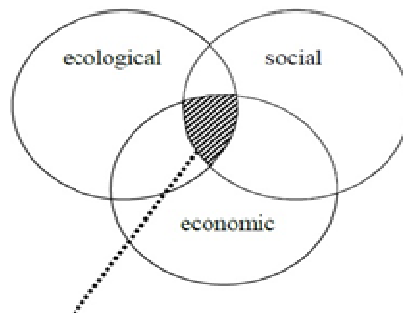
Engineering for Sustainable Development is a wide-ranging topic and, as such, may be considered to mean different things to different people. For this reason broad definitions of sustainable development provide a good starting point, such as Our Common Future, the Brundtland Report of the World Commission on Environment and Development (United Nations, 1987):

“Meeting the needs of the present without compromising the ability of future generations to meet their own needs.”

Both personal action and leadership are required in equal measure if graduate engineers are to meet the needs of society, even when society itself may not be taking action (Blincoe, 2009). Readers of this guide should, therefore, feel empowered toward personal action and leadership in the encouragement of their future graduates in becoming effective global engineers.

2.1. The Brundtland and Rio model of sustainable development.

Sustainable development is defined as the intersection of three components of equal weight: social, economic and ecological sustainability:



When all three conditions are simultaneously fulfilled we have SD. The “conflict between ecology and economy” is said to be resolved by this model. Economic growth is considered not only necessary for resolving social and environmental problems but the goals are also considered to be intrinsically compatible. The existence of win-win solutions is the basis for assuming that there is in fact an area of overlap between all three sustainability components.

2.2 Engineering for Sustainable Development fit within the curriculum

Engineering for Sustainable Development has a motivational value, which means that it may be used to broaden the learner's perspective. The linking of learning with professional formation and the recognized need for graduates to be self-reflective has led Mitchell, Carew and Clift (2004) to propose the following principles:

- i. Help the learner appreciate why consideration of sustainability is in their interest
- ii. Use appropriate pedagogies for active engagement with issues
- iii. Help learners gain plural perspectives
- iv. Encourage learners to continue thinking about issues beyond their formal education.

A wider study (Dawe et al., 2005) of education for sustainable development (ESD) identified that skills and attributes which support teaching and learning in ESD are, however, not easy to teach by traditional means. Their research identified three orientations in the teaching of sustainable development:

- i. the educator as a role model
- ii. experiential learning by focusing on real and practical life issues
- iii. Holistic thinking.

2.3 Intellectual Development - Jean Piaget

The focus of this issue on engineering sustainable development is Jean Piaget's theory of intellectual development. His interest in cognitive development came from his training in the natural sciences and his interest in epistemology. Piaget was very interested in knowledge and how children come to know their world. He developed his cognitive theory by actually observing children (some of whom were his own children). Using a standard question or set of questions as a starting point, he followed the child's train of thought and allowed the questioning to be flexible. Piaget believed that children's spontaneous comments provided valuable clues to understanding their thinking. He was not interested in a right or wrong answer, but rather what forms of logic and reasoning the child used (Singer, 1978).

After many years of observation, Piaget concluded that intellectual development is the result of the interaction of hereditary and environmental factors. As the child develops and constantly interacts with the world around him, knowledge is invented and reinvented. His theory of intellectual development is strongly grounded in the biological sciences. He saw cognitive growth as an extension of biological growth and as being governed by the same laws and principles (London, 1988). He argued that intellectual development controlled every other aspect of development - emotional, social, and moral.

2.4 Behaviorism as a Learning Theory

Behaviorism is an approach to psychology based on the proposition that behavior can be researched scientifically without recourse to inner mental states. It is a form of materialism, denying any independent significance for mind. Its significance for psychological treatment has been profound, making it one of the pillars of pharmacological therapy. One of the assumptions of behaviorist thought is that free will is illusory, and that all behavior is determined by the environment either through association or reinforcement.

Behaviorism, along with several newer variations that have names like information processing theory, emphasize the learning of facts and skills that authorities, such as teachers or school boards, have decided are important. While these theories have many different names we will use the term behaviorism here. Names associated with behaviorism include John Watson, an American psychologist who was very influential in the 1920s and 1930s, and B. F. Skinner another American psychologist who had a tremendous impact on education in the 1950s and 1960s. Behavioral approaches to teaching generally involve the following:

- i. Breaking down the skills and information to be learned into small units.
- ii. Checking student's work regularly and providing feedback as well as encouragement (Reinforcement).

- iii. Teaching "out of context." Behaviorists generally believe that students can be taught best when the focus is directly on the content to be taught. Behavioral instruction often takes the material out of the context in which it will be used. Direct or "teacher centered" instruction. Lectures, tutorials, drills, demonstrations, and other forms of teacher controlled teaching tend to dominate behavioral classrooms.

2.5 "Tinto's Theory of Freshman Development"

Stages of Adjustment for New Students

Separation

First-year students distance themselves from membership in past communities, homes, schools and work places. New students may go through a process of questioning the values of previous communities in order to adopt values perceived as appropriate to college.

Transition

This stage is a "bridge" between the old and the new. New students may not yet be fully integrated into their new college environment. They may be searching for a connection with their new environment (norms, values, relationships). When the differences between the old and new are extreme, adjustment might be more difficult.

Incorporation

First-year students become fully involved in the social and academic communities at their new campus. They establish connections with other students and professors, thereby avoiding the risk of dropping out. Students enjoy success with the new situations they encounter.

3. Methodology

This empirical studies investigate "Perception on sustainable development among new first year engineering undergraduates" was conducted from September 2011 to January 2012. It was realized with the help of a group of students under the supervision of the local university research staff and encompassed the following steps: determination of the axes of investigation, design of the interview question, data collection, coding, observation and finally communication of the results.

In the exploratory phase we conducted (around 10) in-depth interviews exploring this topic. The interview protocol are divide into three categories: (1) previous education background, (2) student's perception and definition on sustainable development (3) student's daily activities and receptiveness towards sustainable development initiatives, such as earth hour, recycling, green technology, climate change etc.

Respondents were selected on a random basis in the first year undergraduate classroom. The interview was made up by 3 main items attempting to define the individuals' opinion about sustainable development. In particular, we addressed some question in order to evidence what is sustainable development, who should act in favors of its main behaviors should supported to achieve its main objective. Hypothetical scenarios have also been presented in order to provide further elements of analysis leading to policy-making suggestion.

10 people responded to the interview, 50% men and 50% women. Age classes are between 19 to 20 years old. As whole, previous background educations of the sample are representatives of the education background parameters is influence student knowledge about sustainable development.

4. Result from interview survey

Themes from the theoretical background informed the intellectual development Jean Piaget theory of an extended interview for students delivered through randomly through on about student previous background education and also on theory of behavior about student daily activities on sustainability. Three items with five part of question were explored in the interview through a mixture of 21 closed and open questions (Box 1). As a precursor to questions about their perception on sustainable development among new first year engineering undergraduates, students were asked about their previous education background, student's perception and definition on sustainable development and lastly student's daily activities and receptiveness towards sustainable development initiatives, such as earth hour, recycling, green technology, climate change etc.

BOX 1: Themes explored in the student questionnaire
Background information (about student)
Theme 1: interview introduction
Theme 2: understanding about sustainable development
Theme 3: activity on sustainable development
Theme 4: perception on sustainable development
Theme 5: reaction on sustainable development

Background information about student respondents

Of the 10 students who responded:

- a. 80% perceived themselves to be studying an 'academic' course while 20% categorized their course as technical course.
- b. 50% were female and 50% were male.

Theme 1: interview introduction

Students introduce their self, family and education background. The main item on interview is education student background and most of them from academic school especially in matriculation. There are 2 students from vocational school. They represents their education background influence by their family and teacher, so on intellectual development theory, family and teacher as a role model for student to choose their field on the future.

"Able to achieve/to be employed by any company. I study for my future".

Theme 2: understanding about sustainable development

Students were given the opportunity to summarize their understandings of the term 'Sustainable Development', ticking any number of proffered definitions that had resonance, or by offering their own definition. As might be anticipated, the emphases of student definitions of Sustainable development varied. Most of students agreed with environmentally focused definitions of ESD while 10% students defined ESD as education that focused primarily on people and human capital in sustainable development. 90% agreed that ESD was 'education that promoted sustainable use of resources, without damaging the planet for the future'.

"I rarely heard about this in the secondary school at MRSM, but I never take deep understanding on it that moment"

Theme 3: activity on sustainable development

Of the students interviewed, only a few student concern about on global warming issues and most of them involve in this activity but they didn't realize the real meaning of this activity. Education for sustainable development is important nowadays, because if they know the activity about current issues in sustainable development, but they don't know the meaning of sustainable development.

“Yes it is about the enhancement a temperature in the glob due to certain aspect such as building, open burning and others”

Theme 4: perception on sustainable development

When students were asked about it is necessary to include sustainable development in education system especially for first year engineering student, a range of student were suggested that it is necessary. These emphasise the importance of pedagogic approaches that encourage student to participation and opportunities for discussion about nature sustainable development, because most of them still clueless at the entry level. Most of them did not know how to explain or elaborate the definition of sustainable development.

“As the future engineer they should aware about this not just concern on how to develop the world but also to take care of the nature itself”.

Theme 5: reaction on sustainable development

When asked whether they could identify a specific definition about sustainable development (or number of learning experiences about current issues about sustainable development)the reaction that they considered had a clueless about all of this in the beginning of semester, but they try to leran after they get a project about waste to wealth.

“yes, firstly im clueless about all of this but after but i try to learn, because i realise that sustainable development is important elements in my study”

5. Conclusion

The survey revealed differing understandings of "Perception on sustainable development among new first year engineering undergraduates" A strong theme evident in students' understanding about sustainable development is when they can explain about their activity on daily life as their rutin, but they dont undrstand the meaning of sustainable development. The results showed that mostly students are clueless at the entry level about sustainable development. Most of them did not know how to explain or elaborate the definition about sustainable development because they have not been exposed previously. Students also unsuccessfully explain the definition of sustainable development but most of them involve some aspects of their daily activities and are receptive towards sustainable development initiatives such as earth hour, recycling, green technology, climate change etc. The result of this study can be used as a guideline to teach first year engineering students to develop their knowledge about sustainable development. Areas for further investigation in focus groups and further research include the nature of the create a structural model of assessing students' knowledge-attitudes towards sustainabilty for guideline for engineering educators to teach in the future.

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