

**ENGINEERING EDUCATION  
FOR THE NEW WORLD ORDER**

Professor Alagaiah Thuraiirajah  
*Memorial Lecture - 2003*

11.06.2003

*Professor H. Sriyananda  
Professor of Electrical Engineering,  
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### **PROFESSOR H.SRIYANANDA**

It is a great privilege to have been invited to deliver the Professor A. Thurairajah Memorial Lecture for the year 2003. Professor Thurairajah spent the best years of his life at the University of Peradeniya, which he served in many capacities and most illustriously as the Professor of Civil Engineering. He later came over to the Open University as its first Professor of Civil Engineering and was elected as the first Dean of the newly formed Faculty of engineering Technology. Subsequently he served as the Vice Chancellor of the University of Jaffna. Generation of Engineering students loved him as a great Teacher and even though he had won many awards of distinction in his time the one he valued most is the gold medal given to him by the students of the Faculty of Engineering at Peradeniya on his departure to joint the Open University.

Professor Thurairajah was not only a great Engineer and teacher of engineering but also a world renowned researcher in his chosen field of soil mechanics. He was among the pioneers of the new science of soil mechanics at Cambridge University and contributes to its development until the time of his death. He also contributed towards the application of his knowledge and experience to the solving of practical problems in this country and was a leader of the team of scientists and

engineers that studied the problems associated with land slides.

In later life Professor Thurairajah found that it is not enough to be an Engineer, Teacher, a Researcher and academic administrator. He found that it is necessary to be an activist if he were to fulfil his role as a citizen. There were urgent issues related to development democracy, human rights & social justice that needed his intervention. These then are the fields of activity which covered the life and work of Professor Thurairajah.

### Introduction

The University Grants Commission had approved the setting up of a Faculty of Engineering at Jaffna number of years back and even a Professor was appointed at that time. I am aware that even though Professor Thurairajah attempted to build a Faculty of Engineering at the University of Jaffna. He could not complete this work due to the condition of civil conflict prevailing in the country. Professor Thurairajah's intention was to set up a Faculty that would complement the other Engineering faculties rather than duplicating their work so that it could develop as national Institution.

In view of its close relationship with the work of Professor Thurairajah, I have chosen to speak on engineering education in this memorial lecture. However it is not possible to speak of engineering (or any other) education in a vacuum, It has to be in relation to the society in which it is to exist. Today we are inundated

with news and views about globalisation and of the new world order and it becomes necessary to study any issue in relation to this process.

Obviously, the new world order does not yet exist. It is only just coming in to being. It will always be so for the moment it has become it is old. The new order is always becoming and we all have an opportunity to shape it. It is in this context that I propose to discuss this issue. There are of course other tendencies and influences other than ours an the new world order will come in to being with or without our intervention. We should look at these possibilities and examine what our contribution should be there are the classical theories about 'objective condition' that have to be met before any effort can bear fruit but on the other hand even with all the necessary 'objective conditions' no change will take place without conscious effort. There are further complications arising from the whether there is a sharp distinction between 'objective and subjective' that is whether there is an objective reality independent of an observer.

Before we examine the present (Old) and the emerging (New) world order we will look at how curricula are related to societal expectation.

### **Do curricula relate to objectives?**

One of the most written about curriculum reform movements is that which took place in the United States during the post-war years, spanning a period of more

than two decades. A major incentive for the curriculum reform movement is thought to be the report on the state of Science in the US presented to president Roosevelt (Bush, 1945). The objectives that drove the reform movement, especially in relation to the teaching of science (and mathematics), in comparison with those of earlier periods of American history (Atkin, 1983) is presented in concise form in Table 1.

<b>Period</b>	<b>Objective Situation</b>	<b>Educational Objectives</b>	<b>Curriculum and Methodology</b>
Early Nineteenth Century	Family centred God-fearing community	Teaching of Science used as a vehicle to impress upon the existence of God, and to inculcate values of thrift, punctuality, civic virtue and the importance of respecting and obeying one's elders.	Contrived, story based narration of science information, of great detail.(ex. the parts of a compound flower), but designed to show the smallness and relative helplessness of man and thus the need for (a) God to create such a complex world.



<p>Late Nineteen century</p>	<p>Colonisation (and empire building)</p>	<p>Development of the various faculties of the mind, such as observation, generalisation, reasoning and memorisation. The prevalent theory at the time suggested that young children are not capable of reasoning and generalisation, but they could observe and memorise.</p>	<p>Object teaching: The children brought various objects such as rocks, metal wire, wax, stuffed birds, seen, leaves, camphor, ivory, India rubber etc. Through observation, they were described using a standard set of words such as astringent, acidulated, calcareous, ductile, effervescent, laminated etc.</p>
<p>Early Twentieth Century</p>	<p>Major problems associated with rapid urbanisation</p>	<p>Encourage children to love nature to such a degree that they would</p>	<p>Nature study (Invented at Cornell University: Draft towards biology, books</p>

		be unhappy unless surrounded by trees and animals, to develop an emotional attachment to country life.	strongly anthropomorphic with birds talking to trees and flowers talking to one another.
1920s	Powerful impact of science on daily life	Helping children to understand the impact of powerful developments such as electrification.	Emphasis on technology-books described, and students were expected to memorise things such as the four stroke cycle of the motor car engine, the refrigeration cycle etc.
The post-war years	The bi-polar nature of the political world, the competition between the US and the USSR.	Enable students to see the world as the top-most scientist and mathematicians saw it, to encourage	The reform movement: The Physics programme emphasised topics like the nature of light, the Biology programme the

		inquiry and the nurturing of future scientist. Also to emphasises the aesthetic qualities of science.	molecular view of biology, etc. Better, it was believed, to know fewer basic topics in depth than to aim for coverage.
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**Table I-** The relationship among social conditions, educational objectives and the curriculum in American Education over the last two centuries.

We see above how both the curriculum and the way it is taught relates to the conditions of society and the aspirations of its dominant sectors. This is not a phenomena limited to either the United States or to the nineteenth and twentieth centuries. We should note how the education system in (then) Ceylon during the British period was designed to produce the personnel needed to run the lower rungs of the imperial administrative service (Jeyasuriya, 1977)

We will look at another example, closer to us in both space and time.

The following is an extract on Singapore's curriculum renewal for national goals (The Task Force on Higher Education and Society, 2000)

In the summer of 1999, The National University of Singapore (NUS) launched its new curriculum for selected undergraduates. This was the result of lengthy consultations that began in 1997, and brought in the views of leading scholars drawn from several elite Universities around the world.

Singapore sought to ensure that its future graduates could walk proudly alongside any graduate from the more established schools. They strove to develop the personal, intellectual and leadership qualities of students to equip them to excel in life.

Key to the new curriculum is exposing students to various schools of thought, helping them to understand, for example, how a physicist, a biologist and a historian approach problems. Students select their core area of study, but are also obliged to select courses from an area outside their field.

The Curriculum attempts to:

Synthesize and integrate from diverse disciplines, to establish a connection between all human knowledge, and

Infuse students with a concrete understanding of the process of human creativity.

It includes these subjects:

One module each from the Writing Program and History

Select modules from the Humanities and Social Sciences and from areas of Science and Mathematics.

The new curriculum has already drawn praise from the private sector. "The core Curriculum program at NUS is designed to deliver well rounded graduates, who are lateral thinkers, innovative, articulate and groomed to lead," said S Nasim, Managing Director, Meinhardt (Singapore) Pte. Ltd., "comparable to the best graduates of Harvard or MIT. They will be snapped up as hotcakes by industry."

We will need to clearly define what our broad, long-term objectives are, before we can even begin to plan a curriculum.

### **The new world order**

I said before that a new world order is coming into being, or becoming, with or without our intervention. Let us examine what that world is going to be like.

It has been shown (Toussaint, 1999) by reference to United Nations Development Program and World Bank sources, that the world has been moving towards a greater concentration of power and wealth for a period of at least two decades, and that Poverty has been growing at a phenomenal rate, not only in the poorer countries, but throughout the world. Household incomes have been falling, and debts increasing, even in the United States, while the largest companies have been becoming

bigger (mostly by mergers) and the richest individuals have been becoming richer. The problem with this, apart from the obvious, is that it is unviable, even in the medium term, especially with a regime of market dominance.

When the production of goods and services are determined by market forces and when a large proportion of people are unable to participate in that process, then the whole system collapses. We have seen this happen in East Asia in the late 1990s, and more recently, and perhaps even more dramatically, in Argentina. The human cost of these has been enormous.

The global economy has been maintained against collapse by forceful interventions. The most recent event is the war and subsequent occupation of Iraq. Huge contracts are being given out to large corporations, mainly American, for the "reconstruction" of Iraq. They are to be paid for by Iraqi oil exports of the future. The "reconstruction" in effect is to construct facilities for the exploitation of this very resource. Without this bonanza, the economy of the United States would have faced a very bleak future. It is not very difficult to see what has happened. The big corporations, facing financial collapse due to the inability of consumers to consume, forced the Government of the United States to manufacture a crisis, and then invade Iraq on that pretext. The invasion paved the way for renewed exploitation, thus saving them for the day.

The same process is going on in other countries, including our own. The new development paradigm is encapsulated in the Poverty Reduction Strategy Papers (PRSP). These are supposed to be proposals worked out by the government in consultation with the people, and in particular, the affected people. However the proposals have never been openly discussed. This has happened in country after country. It has been shown (Joy et al, 2003): "that little has changed in the substances. Form and process of World Bank and IMF Programmes. "Poverty" is used as window dressing to peddle more or less the same Structural Adjustment Programmes (SAPs) to low income countries that led them into a state of chronic economic crisis to begin with."

The "Strategy" aims to achieve by agreement what has been effected by force in Iraq, that is, make us pay the cost of our own exploitation.

The demonstration effect of Iraq, together with the development of new Weapons of Mass Destruction (WMD) by the United States is assumed sufficient to coerce us, and the rest of the world, into submission. The most lethal and frightening weapons are the new generations of "small nuclear weapons" (Scott Kariya and William Sweet-2003), which may be deployed against non-nuclear states and communities.

The PRSP has just one solution to the problems of poverty, the solution that has been tried out for more than 20 years in this country and failed. Failed, according to the UNDP and the WB, for both incidents

and the depth of poverty has increased during this period. The solution proposed is even greater integration to the world economic system based on production of the World market relying solely on market mechanisms for pricing and other decision opening up all natural resources (including water), and services( including education and health care) for exploitation by the largest companies in the world and providing attractive infrastructure for such exploitation at our own expense. The trickle -down effect is expected to alleviate poverty. This of course has not worked in Sri Lanka or anywhere else in the world.

#### **The new world order as we would like it to be**

If we do not like this new vision, then what would be wish the new world to be like, and how do we plan our education to prepare for the world we want?. Let us first look at the short comings of the new world order, as it would evolve if we do not intervene in the first place, it is unsustainable. It is also inequitable . It can not satisfy the basic human needs of most people.

We need a world order that is sustainable, equitable and which is capable meeting the needs of people.

As whole new literature has grown up in recent time (ex: Wheeler, Keith A and Anne Parraca Bijur(Ed), 2000) on education for sustainability. IUCN - The World Conservation Union has drawn up (Heselink, Frits, Wendy Goldsten, 2000) nine principles for sustainable living.



- Respect and care for the community of life
- Improve the quality of human life
- Conserve the Earth's vitality and diversity
- Minimise depletion of non-renewable resources
- Keep within Earth's carrying capacity
- Change personal attitudes and practices
- Enable communities to care for their own environments
- Provide a national framework for integrating development and conservation
- Create a global alliance

Note that these are in Stark contrast to the development model proposed by the WB/IMF/WTO, and are in agreement with our traditional cultural values.

We also would like the new world to be egalitarian. Some of the above principles also support egalitarianism, and none conflict with it. As for meeting the needs of people, such a society is more capable of doing so than the one that is otherwise evolving.

Can we achieve such a society on our own, in one country?.

Aldus Huxley in "Island" (his utopia, in contrast to his Brave New World ) presents a picture of an Island, which has developed a human-friendly society. However, it is not possible for it to survive, as the outside world walks in with guns firing. I have written a short play (Sriyananda, 1998) where the new society

converts (rather than fight) the rest of the world to its view point, using the information and communication technologies today. It is only a fantasy, and whether it would be possible would depend partly on the success of the new education. Education, especially engineering education, should produce people not only with the correct attitudes (for a sustainable and egalitarian world order) but also with the necessary technical capabilities to shape the new world. For this, we need to meet the achievements of the present technologically advanced societies at their own level.

We then need a system of education capable of producing excellent scientific technological capability, but with conservationist rather than consumerist attitudes. Is this possible?

### **A curriculum to meet the objectives**

We will attempt to draw from the previously discussed models (post-war US and Singaporean) to design a curriculum to meet our needs.

Period  
The present  
Objective Situation  
Hostile outside world

We have already discussed the global environment, where the forces of globalisation spearheaded by the World Bank, International Monetary Fund and the World Trade Organisation, supported by

the bullying power of the armed forces of the United States is forcing an agenda of subjugation and exploitation on the rest of the world.

#### Apparent lack of material resources

I refer to an apparent lack of resources, for this is very much a matter of perception. It is possible to set up the equipment necessary for learning / teaching / research at a fraction of the cost of purchased equipment, with the added advantage of building confidence and developing skills, with available resources. The entire Applied Mechanics Laboratory at Peradeniya was equipped in this manner by Professor Mahalingam, and Professor Thurairajah constructed the equipment required for his research in Soil Mechanics at Cambridge.

#### Defeatist attitudes

I believe that this has been deliberately 'fostered and developed among the people of this country (and among those of other countries in a similar situation) during the last fifty years. I have commented elsewhere that when the Original University of Ceylon was set up in the 1940s, it was expected to develop as a centre of excellence, not just nationally or even regionally but globally. Such a vision would now be regarded as far too goodly. We have come to (and made to) believe in our own incompetence. This is of course a self-fulfilling belief. A major part of our educational strategy has to do with overcoming this burden.

**Educational Objectives** Let us start here with the US, Singaporean and IUCN models.

- Enable students to see the world as the top-most scientists and mathematicians saw it .to encourage inquiry and the nurturing of future scientists. Also to emphasise the aesthetic qualities of science
- Synthesise and integrate from diverse disciplines , to establish a connection between all human knowledge, and
- infuse students with a concrete understanding of the process of human creativity
- Respect and care for the community of life
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- Provide a national framework for integrating development and conservation
- Create a global alliance

We can compare these with the objectives of the engineering programme at the Open University :

- Develop creative and analytical ability , innovative thinking and commitment in the student.
- Provide the student with access to knowledge
- Motivate the students in using the above to influence society for the better.

Even though the objectives seem to be more or less correct, we have not been able to overcome the problems associated with the "Objective situation", most notably the defeatist attitude of both the staff and the students.

The reasons for our failure are complex. Some of these may be had from the work of Paulo Freire. Who has argued (Freire 1979) that ignorance and lethargy of the "poor" are the result of the whole situation of economic, social and political domination. The situation is complicated by the existence of a large number of levels of domination. Sri Lanka as a "poor" country dominated by the International Community and within Sri Lanka, the domination by the English speaking elite, domination of the minorities by the majority community gender domination etc., and also domination within the University itself.

He has also argued that the oppressed themselves will reject a liberating curriculum, for they will initially see their liberation only in terms of being the oppressors themselves, rather than the dismantling of the process of oppression.

### **Curriculum and Methodology**

Let us again start with the US and Singaporean models:

- The Physics programme emphasised topics like the nature of light, the Biology programme the molecular view of biology, etc. Better, it was

believed, to know fewer basic topics in depth than to aim for coverage.

- One module each from the Writing Program and History
- Select modules from the Humanities and Social Sciences and from areas of Science and Mathematics.

These concepts are similar to the ideas incorporated into the (new) Year 2000 curriculum in engineering at the Open University. It included general studies (including liberal arts, environmental and philosophical studies) and emphasised learning through doing, in the form of both individual and group projects. However, even before it could be put into practice, it has been mutilated and deformed almost beyond recognition. We need to learn from our failures, and the beginning of that process is a study of the reasons for the failure. I believe that most of these reasons may be found by reference to the work of Freire.

For a more practical, and perhaps less philosophical approach to this problem. I would like to refer to the Brazilian experiences of Professor Richard Feynman, Nobel Lauriat in Physics (Feynman, 1997). (Professor Feynman spent a sabbatical year in Brazil)

- “ I through at first that I would give my lectures in English, but I noticed something ..... So I realized that if I were going to talk to them and try to teach them, it would be better for me to talk in

Portuguese, poor as it was. It would be easier for them to understand.

- "I was invited to give a talk at the Brazilian Academy of Sciences about some work in quantum electrodynamics that I had just done ... I got to the Brazilian Academy of Science meeting, and the first speaker, a chemist, got up and gave his talk – in English. Was he trying to be polite?"

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