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# **I**nfusing Elements of National Education in Everyday Science Lessons

Lee Sing Kong &  
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## **INTRODUCTION**

The National Institute of Education (NIE) has dual roles to play in enhancing the role of National Education initiated by the government in 1996. First, it has the responsibility, like any other tertiary institutions, to create an awareness among students on National Education issues, by imbibing the values related to it. Second, it has to educate the trainee teachers on the art of teaching and inculcating National Education in the schools. A comprehensive programme was organized by an NIE committee to achieve these two objectives. Among the activities is the initiative on how to infuse National Education elements into the wide range of modules taught in the Institute.

This article highlights some of the ways in which the academic staff in the School of Science have infused National Education messages into their lessons. We hope that some of the ideas shared in this article may stimulate other educators to adopt similar strategies where appropriate. The approaches outlined below are by no means exhaustive.

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## **EFFECTIVENESS OF FORMAL TEACHING VERSUS INFORMAL APPROACHES IN VALUE INCULCATION**

When new educational initiatives are introduced into schools, there is always a temptation to develop a new subject through which such an initiative can be taught. The tertiary institutions are no exception. However, educational research has clearly shown that learning and inculcation of values can be more effectively achieved through informal approaches and active learning of the learners.

Ausubel's learning theory places great importance on what the learner already knows (Novak *et al.* 1983). New materials will then be subsumed into the existing propositions in the cognitive matrix of the learner. From the theory of cognitive structure comes the idea that an organizing experience (or "advanced organizer") preceding the main

learning can actually enhance subsequent learning. Piaget's cognitive theory explains the importance of idiosyncratic mixes of knowledge constructs, or conceptual hierarchies, held by each individual (Gibson 1998). While knowledge is socially constructed in communities, each individual belongs to many overlapping communities in a pluralistic modern world. Hence, the extent of assimilation of knowledge or values is very much influenced by constant exposure to different sources.

It was on the basis of existing research that the Ministry of Education proposed, for the purpose of inculcating environmental values, directly involving students in enrichment programmes which these students can identify with, rather than developing a new subject. The government therefore published the book "Greening Our Young Minds" and outlined a series of activities which students can participate in and identify with. These activities were aimed at involving the students in deep learning through their participation, hence helping them understand the importance of nature conservation and environmental cleanliness. Through their identification with the environment, the students will naturally imbibe the 'green' values and hopefully manifest the new knowledge in their subsequent actions.

National Education is also about understanding national issues and involves value inculcation. Six values it aims to inculcate are:

- Singapore is our homeland; this is where we belong
- We must preserve racial and religious harmony
- We must uphold meritocracy and incorruptibility
- No one owes Singapore a living
- We must ourselves defend Singapore
- We have confidence in our future

Through National Education, students will hopefully feel for Singapore, or 'home'. The inculcation of such values cannot be effectively achieved through formal teaching, but has to be done through approaches that stimulate both cognitive and affective domains of students.

The approach for infusing National Education into science modules at the secondary levels is described below.

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## INFUSING ELEMENTS OF NATIONAL EDUCATION IN SCIENCE LESSONS

Science modules include disciplines in Biology, Chemistry, Mathematics and Physics. Different elements of National Education can be incorporated into the respective modules. Some of these illustrations are highlighted below and are by no means exhaustive.

### **Biology modules**

- a) *The need for a pragmatic approach to nature conservation in Singapore.*

With the Green Peace movement bombarding the world with nature conservation messages, many of our students may also have asked questions about nature conservation in Singapore. Has adequate effort been put in to conserve our natural habitat? Can the government do more? Many of these questions can be answered in biology lessons, especially when topics on environment and ecology are taught. Our students need to be aware of the realities of Singapore and the rationale behind some of the approaches adopted here in nature conservation. Some statistics could be used to highlight the uniqueness of Singapore. For example, Singapore is an island of only about 650sq km. The Yellow Stone National Park in the US alone is 13.5 times the area of Singapore. Apart from this, Singapore has to support a population of about 5 million people and therefore needs land for housing, commerce, industries, infrastructures and recreational facilities. For this reason, Singapore has to maintain a balance between nature conservation and development. Therefore, it cannot adopt the approaches of countries with large land areas.

- b) *The need for optimal use of land.*

Most national parks around the world are protected by law and as a result, conserved areas are not open to the public. In Singapore, the nature reserves which are also protected by law, but are open to the public for nature walks, recreational and educational activities. Will such activities negate conservation efforts? This issue must be discussed bearing in mind the realities in Singapore. In view of our scarcity of land, land use must be optimized. Allowing the nature reserves to be used for the above activities is a way of optimizing land use, and

conservation efforts will not be affected if visitors are restricted to the paths and tracks. We could then use ecological principles which the students are taught to explain the situation. Such issues could be points for discussions during ecology lessons.

c) *The need for certain levels of sufficiency in food supply.*

This point can be raised in lessons on the various modes of growing plants, such as hydroponics and aeroponics. In land scarce countries such as Singapore, science and technology can be used to improve productivity and help overcome land constraint problems. We can then highlight the importance of research and development and how creative applications of science can help to overcome some of these constraints. For example, the development of the aeroponic technology has not only improved productivity in vegetable production, but it has also helped reduce water usage. Such illustrations will help our students understand the vulnerability of our island state and be motivated and engaged in science so as to contribute towards the development of our country.

## **Chemistry modules**

a) *Need for conserving water.*

Chemistry modules cover topics related to water. When such a topic is taught, discussion can focus on Singapore's problems with water resources and why these are important for our economic growth. Students can then be informed about why the Government needs to implement water conservation measures and increase rates for water to prevent excessive usage. Discussion can also focus on how Singapore could solve water problems in the long term. This could include the importance of research and development in solving this problem.

b) *Pollution and environmental issues.*

Singapore has imposed very stringent measures to control pollution of our air and the environment. Some penalties against offenders are harsh. Why is this so? Students need to understand that, because Singapore is small, the levels of

pollution must be carefully controlled, for its impact can be rather severe. This point can be highlighted when related topics covering organic and inorganic chemistry are taught.

- c) *Economic issue – semiconductors covered in Silicon Chemistry.*

Silicon Chemistry is covered under Inorganic Chemistry. The lesson could discuss the direction that Singapore is currently taking in promoting silicon wafer industry. It could also consider how such industries can help in the economic growth of Singapore. The emphasis on the importance of research and development that can help Singapore maintain her competitive edge in the world market can then be highlighted. This approach would hopefully help students identify the importance of science and technology, and thereby be motivated to engage in research and development. This message could be infused into several chemistry lessons in Organic Chemistry as well, and be related to the petroleum industries which contribute extensively to the economy of Singapore.

### **Mathematics modules**

While mathematics lessons may not deal directly with topics relating to National Education, they can however involve National Education messages. If data on cases that have National Education leaning are used as part of the problem solving processes, some discussions could be conducted to highlight the National Education elements. For example, when rainfall data are used for the teaching of statistical methods, the issue of water conservation and water resources could be discussed. When car growth statistics are used, discussion on the rationale of ERP could be touched upon. All these data can help our students to understand the rationale of various government policies, hence understand what makes Singapore tick. The use of population data can also provide an opportunity to discuss the rationale why Singapore requires foreign talents.

### **Physics modules**

- a) *No one owes us a living.*

Physics modules deal with several principles and phenomena and cover a wide range of topics, which can highlight different National Education messages. In the Design and Technology module, students are encouraged to be innovative and

creative. We can relate this to the message of “No one owes us a living”, for we must strive to be innovative and creative so as to contribute towards the growth of the economy so that we can survive and prosper as a nation.

- b) *Need to maintain the quality of our environment.*

The Physics module also covers computer modelling, in which one can simulate different environmental scenarios by adjusting certain factors. This lesson will show the students the importance of maintaining the quality of our environment, which can deteriorate rapidly if we are not careful.

- c) *Need for energy conservation.*

The teaching of Plasma Physics and Plasma Nuclear Fusion provides opportunities for discussing the state of Singapore’s energy source and the rationale behind why we need to conserve energy. It also highlights new opportunities for energy source and how in the long term, Singapore could develop our energy source through concerted research and development in Plasma Physics.

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## CONCLUSION

When elements of National Education are infused into different modules, many issues of national importance will constantly be highlighted to the students. Through reinforcement through lessons and topics which the students can identify with, a conscious awareness of issues of national importance can be achieved. This may in turn influence the affective domain of the students and encourage them to identify with their country. If this can be achieved, the students would have imbibed some of the values of National Education outlined above.

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