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ENVIRONMENTAL EDUCATION: PROVIDING A CONTEXT FOR A MEANINGFUL SCIENCE EDUCATION

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Abstract. The paper initially highlights the main principles and methods of environmental education and the opportunities and challenges it offers to a fragmentary curriculum structure ... with special reference to science curricula in Malta. The results of a survey about teachers' attitudes about environmental education are then analysed in relation to the possibility of promoting environmental education as a cross-curricular unifying theme. The paper proposes specific guidelines for the development of science curricula that are both interdisciplinary and socially relevant.
Key words: environmental education, science curricula.

Introduction

A pitfall that threatens curriculum developers faced with the challenge of designing a relevant science curriculum is: deciding whether science is a *means to an end* or *an end in itself*. This is not just rhetoric; this dilemma addresses the crucial question: "What do we understand by science education?" … and it is at the heart of a paradigm shift in science education. For some, proficiency in science is still defined (and measured) in terms of the amount of scientific facts that one can recall, thus reducing science education to a struggle to endure years of force-feeding of facts until a particular certification is achieved. On the other hand, others define science as a process rather than a product and value an education process that helps learners experience science that is socially relevant to their experience.

After highlighting the need for a radical rethink of the way science education is perceived and implemented, this paper will suggest the infusion of environmental education principles as a means of providing the necessary support to contextualise the changes required.

The state of science education in Malta

In 1998, responding to the growing concerns about the apparent reduction of university science students, the Department of Maths, Science & Technical Education, Faculty of Education in collaboration with the Malta Council for Science & Technology initiated a two-year project with the aim of:

(a) gathering empirical data from various sources about the state of science education,

(b) identifying lacunae in the current provisions for science education, and

(c) providing informed and practical recommendations for the improvement of science education programmes in Malta (Pace, 2000).

The innovative aspect of this research project was its holistic methodology. To ensure that science education was explored from a variety of perspectives and educational sectors, the project team comprised education authorities, members from the Faculty of Education and the

Faculty of Science, representatives from Industry and parents. The project team was further subdivided into sub-committees, each focusing on a particular sector of science education. The research methodology, which varied depending on the sector being investigated, included consultation of curriculum material, official policy documents and other local research about science education, interviews and postal questionnaires.

The following are the main trends that emerged from the project's results (Pace, 2000):

- Contrary to what had been initially assumed, the number of students following science and applied science courses is increasing in all sectors – including university. Notwithstanding this steady increase, the number of science graduates gainfully employed is still behind the figures quoted for developed countries.

- There is an inherent fear of a repeat of the aftershock of past piecemeal educational strategies and policies, whose scars are still visible in the Maltese educational system. This fear is actively hindering any proposed innovation in science education.

- Current science curricula tend to be too content oriented and are catering only for students of high ability. Other students are demotivated through anticipated failure. The emphasis is on recall of knowledge rather than on understanding and internalisation of scientific concepts.

- Examinations have become an end in themselves and a form of extrinsic motivation. They have generated an examination-oriented pedagogy that is crippling the excitement and interest that science should generate in learners.

- Subject choice at secondary level is determined to a great extent by job prospects. Results have shown that this trend continues also at university level: the number of students following courses in pure sciences is decreasing, while registrations for applied science courses (i.e., having clear job prospects) are on a steady increase.

- The increase in the population of students opting for science and a desired reduction in the learner-teacher ratio have increased the need for science teachers. A promising feature is the fact that the population of science teachers is a relatively young cohort (approx. 70% are below 40 years) with a high percentage of graduates. However, results have shown a decrease in the number of science teachers graduating from the Faculty of Education.

Consequently, in order to ensure that the flow of science graduates (including science teachers) is facilitated and possibly increased, these results compel us to improve science education programmes by:

- developing holistic science curricula, that are contextualised in the learners' experiences. Curricula in which knowledge, skills and values are developed and built upon year after year at all levels of formal education (Millar & Osborne, 1998).

- exploring and developing alternative ways of evaluating proficiency in science - particularly at the early stages of education. There is an urgent need for evaluation strategies that promote learning rather than highlighting deficiencies … that generate elitist views of science (Millar & Osborne, 1998).

- adapting to the needs of learners and society. Educational institutions (particularly at tertiary level) tend to do the opposite; i.e., trying to modify learner and societal needs to fit courses that have been on offer for ages! Society and our understanding of how learning occurs are changing, but our ways of teaching science are not. The choice science programmes have to

face is very clear: either becoming meaningful to the learner and society or else risk becoming irrelevant.

Addressing these radical changes in the science curriculum is not an easy task. Even when empirical data provides ample support to claims for a review of the science curriculum, the very act of querying the 'trial-tested' educational value of traditional modes of teaching and venturing out from the 'safe' confines classroom routines is expected to generate some degree of fear and insecurity in the educational system that are not always easy to ward off. Shipman *et al*. (1974) aptly describes the curriculum development process as "*... a process of bargaining, negotiations and horse-trading*" in which curriculum developers juggle with this dilemma: to change or not to change.

Within the context of a changing society, the curriculum, particularly the science curriculum, has to be organic and the role of curriculum research is to inform curriculum developers: so as to avoid rushing into things (as fools do) and, on the other extreme, avoid grinding development to a halt due to excess caution.

Curriculum development opportunities promoted by environmental education

A lot has been said about what constitutes environmental education and its impact on the educational system. In this section, I will limit my discussion to three major characteristics of environmental education and how these can be conceived as ways of addressing the curriculum development issues about science education that were raised in the previous section.

(a) Process orientation

Although officially several authors acknowledge IUCN's (1970) definition of environmental education, this did not stop the inundation of research literature with alternative definitions reflecting different perspectives and interests (Disinger, 1985 and Tilbury, 1993) that at times tended to confuse rather than elucidate the educational process (Robottom, 1987; Smyth, 1995 and Leal Filho, 1996). On the other hand, there seems to be greater consensus about the aims of environmental education (UNESCO-UNEP, 1978). Keeping in mind, the fast rate of change characterising contemporary society, environmental education must equip individuals with the skills to become independent learners capable of adapting to new circumstances. This can only be achieved if environmental education is "*conceived more in terms of processes than contents, and in terms of widely applicable and adaptable skills rather than in specific disciplinary or professional ones*" (Francis, 1973).

(b) Holistic approach

Over the years, our perception of the environment developed from a static phenomenon waiting to be described and analysed into a sum of dynamic interacting components to be explored and experienced (Docter Institute for Environmental Studies, 1991). Inherent in this perspective is the implication that educational processes aimed at helping individuals to deal effectively with environmental problems need to mirror this complex multifaceted nature. In other words, approaching environmental education from a monodisciplinary perspective is at best myopic and gives a distorted (and at times irrelevant) view of what constitutes the environment.

Interdisciplinarity is against fragmentary learning and a compartmentalised view of life, hence enabling individuals to develop a holistic approach to problem solving and be more adaptable to the changing needs of society (Duguet, 1973). Moreover, de Felice *et al.* (1985) claim that students are more attuned to learning through interdisciplinarity than through a monodisciplinary approach. Consequently an interdisciplinary approach "*implies the need for a level of collaboration between disciplines which challenges traditional, compartmentalised academic structures*" (HMSO, 1993, p.23)

(c) Learner centredness

Traditional educational systems, particularly those dominated by an examination oriented pedagogy, attempt to homogenise the heterogeneous characteristics of learners, treating them as a whole class (group) and disregarding their individual needs. This was seen as an essential part in the socialisation process, which was interpreted as being an exercise in conformity, conserving and reproducing the existing social order (Stevenson, 1987). Environmental education values each learner as an individual, whose contribution toward the establishment of a sustainable society is essential. Its emphasis is on helping each learner to be actively involved in her/his learning process. This involves acknowledging the learner's environmental experience and providing situations that promote critical thinking, participation, creativity, autonomy and responsibility. These characteristics, in turn, lead to an internalisation and assimilation of educational experiences ensuring a lifelong learning process that continues beyond the learners' schooling.

Challenges and implications on the science curriculum

Environmental education has been considered as a basic form of literacy (UNESCO-UNICEF-UNDP-World Bank, 1990) and consequently one would assume that its implementation, at least within the formal education sector, has been a bed of roses. But experience has proved otherwise. There are several possible reasons that could explain why environmental education never really took off in the formal education sector, but the most probable explanation is that there is an incompatibility between the principles of environmental education and the predominant culture in the majority of educational institutions (Pace, 1997). Although the adoption of an education *through*, *about* and *for* the environment seemed fashionable, educational systems seldom addressed the radical transformation that environmental education necessitates.

The way environmental education is included in the curriculum of a country is dependent on the degree of centralisation of the formal educational sector and the prevailing definition of education. An analysis of various national curricula evidences a continuum of perspectives ranging from a natural science biased approach to a humanistic-ethical approach. However, the vast majority of the curriculum development initiatives studied aimed at creating new educational opportunities by which environmental education could be imparted, rather than creating a new subject.

In certain countries this meant the development of new curricula that specifically utilise environmental education concepts to educate pupils. Other countries opted for the introduction of environmental themes in the already established curriculum. Others provided guidelines for schools and teachers on how to foster environmental education and left the planning of environmental education activities in their hands. The main target of this approach is to infuse environmental education principles into the various established curriculum subjects, with the intention of attaining a symbiotic relationship between them. This is the essence of a cross-curricular approach to environmental education implementation.

As can be deduced from the previous two sections, there is an interesting overlap between the goals of environmental education and those of science education. Cross-curricular infusion of the two presents a possible strategy by which both sets of goals could be achieved. While acknowledging this relationship, the ASE (1998) puts science teachers at the centre of this innovation and expects them to help learners understand the environment and their role in it, acquire skills that promote learning and nurture an environmental ethic. Furthermore, it expects science teachers to take an active role in establishing the curriculum structures, on a micro and macro level, required to cement this infusion. The tasks set include:

(a) blurring of subject boundaries,

(b) relating content matter and context to the learners' community,

(c) adopting diverse and up-to-date teaching and learning experiences, and

(d) actively promote a whole-school commitment to environmental education.

Given that research results from various countries point out gross inadequacies within teacher education provision re environmental education (Tilbury, 1993), one is led to ask whether teachers are capable of living up to these expectations. A study conducted among 600 teachers attempted, amongst other things, to identify the predominant perceptions about the environment and environmental education and to assess the disposition of teachers to assume the role of curriculum change agents within the formal educational system (Pace, 1997). The following are the main results of the study:

- While viewing the environment as the sum effect of the interaction of various components, teachers still harboured a naturalistic interpretation of the environment (Lahiry *et al*., 1988) in which the natural environment is seen as the major component of the environment and hence the main concern of environmental education (also reported in Dorion, 1990 and Papadimitriou, 1995). This belief might explain why reference to environmental education initiatives in schools is frequently interpreted as matters concerning nature study that is usually associated with science.

- Although acknowledging the interdisciplinary nature of environmental education, the majority of the respondents still considered science as its basis. Some respondents were even of the opinion that environmental education and science are synonymous. Science is not only seen as the main tool for an 'objective' understanding of environmental phenomena, but also as the main instrument enabling human interaction with the environment. Responses also betrayed a positivist view towards the resolution of environmental problems.

- The vast majority of teachers, conscious of the already overloaded syllabi and the support needed to sustain an innovation, favoured an integrated approach for the implementation of environmental education rather than a single subject approach (Dorion, 1990).

- Teachers felt that schools should provide learners with experiences and opportunities to develop problem solving skills and the ability to think critically. The need for diverse teaching approaches and the use of a variety of teaching resources was acknowledged as an important step to ensure this process. Crucial to the notion of learner centred environmental education is the emphasis on first hand learning experiences and a sound interface with the community, particularly parents. The vast majority of the respondents endorsed both principles. Nevertheless, teachers opted for a more teacher-controlled learning programme as opposed to a more learner-controlled one.

- When reviewing the Maltese educational system, teachers identified the following major obstacles for the implementation of environmental education principles: (a) time constraints due to a curriculum that is overloaded with content matter, (b) rigid and detailed syllabi, and (c) the lack of a clear environmental education policy.

- When asked what kind of support would they require for the successful implementation of environmental education in schools, teachers identified: (a) adequate teacher-education programmes, (b) a national environmental education policy (also reported by Dorion, 1990 and Brijker *et al*., 1995), (c) increased availability of teaching resources, and (d) teacher involvement in curriculum development initiatives.

By and large teachers have shown that they are capable of initiating curriculum change. However, the proposal to utilise environmental education principles to make science education more meaningful needs to consider the following concluding reflections.

Conclusions

While science education has an educational tradition that spans several years and has 'earned' its space in the curriculum, environmental education is a relatively recent phenomenon. There is the danger that in the absence of a clear environmental education curriculum policy, the infusion strategy referred to in this paper could turn sourly bad. Instead of having environmental education principles and values serving to give the impetus for a reform in science education, environmental education could easily become subsumed within the traditional practices of a stale science curriculum.

Claims made by environmental education and science education research for interdisciplinarity, participatory learning and evaluation and increased interaction with the community invariably generate feelings of uncertainty, suspicion, frustration and insecurity among teachers. Experience and research have shown that success in curriculum innovation ultimately depends upon the active involvement of teachers in curriculum development. This necessitates (a) adequate teacher education programmes that develop a strong environmental ethic and equip teachers with the skills required to actively participate in curriculum development, and (b) particularly in centralised educational systems, the facilitation of grassroots initiated curriculum projects by the educational authorities (Pace, 1996).

Success in an enterprise necessitates the critical evaluation of one's objectives, the assessment of the current state of affairs and the careful consideration of the implications inherent in proposed actions in order to clearly define what is really worthwhile. Curriculum development in science education is no exception. Science that is not socially relevant and meaningful to the learners' needs is increasingly becoming obsolete. The question is not *whether* this change will affect us or not, but rather *when* will it hit us? In our efforts to make science education more worthwhile we should seriously consider the benefits of infusing environmental education within the science curriculum.

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Резюме

ОБРАЗОВАНИЕ ОКРУЖАЮЩЕЙ СРЕДЫ: СОЗДАНИЕ КОНТЕКСТА ДЛЯ ОСМЫСЛЕННОГО ЕСТЕСТВЕННОНАУЧНОГО ОБРАЗОВАНИЯ

Пол Пейс

Статья первоначально выдвигает на первый план главные принципы и методы образования окружающей среды. В статье проанализирована состояние образования по вопросам окружаюшей среды в Мальте. В 1998 году был подготовлен проэкт по исследованию состояния и перспектив естественнонаучного образования. В проэкте участвовал факультет Эдукологии университета и Совет Науки Республики Мальта. Цель

проэкта - проанализировать состояние естественнонаучного образования в целом и подготовить информативные и практические рекомендации по усовершенствованию естественнонаучного образования в школах Республики Мальта. Результаты обзора об отношениях преподователей об образовании окружающей среды проанализированы относительно возможности продвижения образования окружающей среды междисциплинарным /объединяющим тему/ способом.
Ключевые слова: образование окружающей среды, программы естествознания.

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