Proceedings

Science Education in Malta: *Quo Vadis?*

Paul Pace
Department of Mathematics, Science & Technical Education, Faculty of Education, University of Malta, Msida.

The low number of students who choose science and who eventually pursue a career in science (Cauchi, 1996) is a clear indication of the need to revise our present policy regarding science education. In our strategy to improve the situation we should be extra careful not to waste too much energy on attempting to cure the symptoms of this problem. What we really need is to recognise our responsibilities, be bold enough to address the deep rooted causes of the problem and to do our utmost to resolve them even though solutions might imply radical changes in our present educational policies.

A major issue that emerged during this forum was the need to rethink the decision making processes that influence the curriculum. We are aware of decisions that were hurriedly taken and which had adverse repercussions in schools. Besides, fostering a piecemeal approach to curriculum development, management by crisis and remedying mistakes that could have been avoided, involve a waste of energy and resources, not to mention a waste of opportunities when one considers the number of students being influenced by these decisions. Curriculum development should be a participatory exercise with representation from a variety of educational sectors - especially teachers who will eventually be entrusted with the task of implementing the innovations. Particularly important for the development of the science curriculum is the formation of partnerships with industry. Traditionally, industry's involvement with students starts once they have left school, making full use of the skills and knowledge developed by students throughout the years of schooling. A close partnership with industry would ensure that schools continue to supply industry with an efficient workforce, and that industry shoulders this responsibility by financing particular educational projects and offers its resources for use by the various educational institutions.

Science education has been defined as a process which "*develops an enquiring mind and a scientific approach to problems*" (Schools Council, 1977). Therefore, when judging proficiency in science one should be aware of the process of learning rather than just its end product. Unfortunately, our educational institutions - think otherwise and a lot of importance is attributed to examination grades. Evaluation is predominantly of the summative type and syllabi abound in endless lists of isolated chunks of scientific knowledge with examinations, more often then not, testing students on their ability to recall these facts. At times, particularly at tertiary education level, the main objective of examinations is to measure what students do not know rather than what they do know. It is a well known fact, among university students, that the prestige of certain science courses is measured by the percentage of students failing the course. A high percentage of successful passes is considered as a '*watering down of expectations*' or a '*softening of course content*'. It is no wonder that students do not choose science as they associate it mainly with a lot of hard work requiring a lot of study and memory work (Cauchi, 1996).

In schools, science teachers have to struggle between finding time to allow their students to discover, discuss and assimilate concepts while trying to cope with an overloaded syllabus. Hence, for most of the time the teaching mode adopted is of the expository type (Abela and Buhagiar, 1993). Learners are rarely engaged in 'time consuming' investigations which induce them to apply learnt knowledge and to devise solutions. Most of the science being done in local educational institutions (ranging from primary schools to university) is of the recipe type - where learners are expected to follow instructions and fit in their observations into expected and previously predicted answers. It has been shown that this is one of the major sources of dissatisfaction in science (Gatt and Vella, 1990; Cauchi, 1996). The tragedy of it all is that students, knowing full well what is expected of them at the end of the course, accept the situation and end up demanding this examination-oriented pedagogy from their teachers (Abela and Buhagiar, 1993).

This distorted view of proficiency in science might be the symptom of an underlying ideology, which has certainly influenced teacher recruitment and certain educational policies, that considers a sound knowledge base as the most important requisite for making a good teacher. Besides undermining teaching as a profession, this ideology continues to shift attention away from what is really needed We need to recognise teaching as a profession with its particular line of expertise, and with its own specific training programme. This awareness is surely hindered by attitudes which consider students, who opt for the teaching profession, as lying at the *trailing end of the spectrum of science* or at the shallow end of the dream pool.

Without diminishing the importance of a sound knowledge base, this ideology is the remnant from a time when teaching was characterised by mere transmission of knowledge. However, we are now in an era in which knowledge is continuously evolving and hence education should strive to develop independent learners. Hence, teachers need to be equipped with the skills that would help learners to actively participate in their learning. We have already sought to improve science teaching by exposing science teachers to more science content with no significant improvement to the situation. What we need to do now is to recognise the crucial role of pedagogy in effective science teaching and be ready to invest in teacher education programmes which provide a sound pedagogical base.

However, training science teachers to adopt a more learner-centred approach is not enough. There is an urgent need to balance this training with adequate support that would alleviate some of the problems of everyday teaching. For example, this support could include:

a) an effort to ensure that all laboratories are specifically designed and well resourced to facilitate science teaching,
b) a reduced number of students per teacher to facilitate the organisation and management of practical sessions, and
c) a restructuring of syllabi in order to reduce the amount of topics to be covered and increase the possibilities for investigative projects.

Certain changes in teaching conditions may be delayed by an apparent lack of science teachers. The problem could be alleviated by a more coordinated deployment exercise of new recruits between the Education Division and the Faculty of Education. Concurrently, efforts should be initiated to achieve a balance between supply and demand. The present course structure of the science content units in the B.Ed. (Hons) programme deters students from choosing particular science main subject combinations. The result is that the product of the teacher education course is not quite what is required in our schools.

The issue of subject choice is not solely restricted to the tertiary level of education. Students are expected to make a subject choice, which will determine their future career, early in their secondary education. In most cases, children experience problems in making the choice and rely heavily on their parents' advice as well as their guidance teachers (Gatt and Vella, 1990) who may not always be aware of the career opportunities available for science students. Opportunities are further reduced by certain subject combinations that still have inherent gender bias. Furthermore, the latest innovation concerning science in area secondary schools is such that students cannot dream of covering the MATSEC science examination syllabi, except maybe through private lessons, hence making it more difficult for them to take up science at post-secondary education.

Schools should be sites of opportunity and hence, subject choice and specialisation should be deferred till the end of secondary school, when students are more capable of making better and more informed choices. The need for specialisation really starts at the post-secondary stage. A truly integrated science course could replace the present specialised science courses. Care should be taken to avoid a fragmentary type of programme, made up of bits of biology, chemistry and physics and to propose a truly integrated course based on multidisciplinary themes. Besides exposing learners to a better concept of the scientific method of discovery, an integrated science course allows students to explore and experience a wide range of possible career opportunities in the scientific world.

Such an innovation in the educational system would certainly require some additional support before it is fully implemented. MATSEC examination syllabi will need to be revised to suit a more flexible style of science teaching. Syllabi will probably consist of a compulsory core that would introduce learners to basic scientific principles and a set of investigative projects which can be chosen by the learners depending on their interests. In order to create further opportunities, the MATSEC examination board will also have to rethink their present policy of offering 2A and 2B papers and start offering a single paper catering for a wide spectrum of abilities and offering a whole range of grades. Pre-service and in-service teacher education programmes will also need to be revised. The main emphasis of these programmes should be that of equipping teachers with the methodological skills required to help them teach in an integrated fashion, rather than focusing on imparting very specific and isolated scientific knowledge.

If we are going to be offering a relevant educational setup, which would allow students to deal with the challenges of the 21st century, we need to develop skills to rapidly adapt to new situations and to be able to build up new structures which would help us to satisfy our needs. However, we should also be equally ready to tear down these structures in order to build new and improved ones which would satisfy our needs better.

References

Abela A and Buhagiar S (1993) *A Survey of Teaching Techniques in Biology in Maltese State Schools.* Unpublished B.Ed. (Hons.) dissertation, Faculty of Education, University of Malta.

Cauchi MN (1996) *Science and Medical Education in Malta.* Dept. of Pathology, University of Malta.

Gatt N and Vella J (1990) *Science Choice and Achievement.* Unpublished B.Ed. (Hons.) dissertation, Faculty of Education, University of Malta.

Schools Council (1977) *With Objectives in Mind: Guide to Science 5-13.* Macdonald Educational Ltd., London, UK.