

Empowering primary teachers to teach science

Science at primary level has always been the Cinderella of the educational system in Malta. Even though local legislation, the Education Act of 1988 and the publication of a National Minimum Curriculum (NMC) for primary and secondary education binding all schools in Malta – state, church or privately run – recognised science as one of the principal aims of primary education, very little science is actually being done in schools. The main reason for this state of affairs is that science is not examined unlike the other core subjects: English, Maltese, mathematics, religion and social studies.

The Maltese educational system is very similar to the English model. The current system caters for primary education from ages 5–11 (six years of primary education). Annual examinations in the core subjects start in the fourth year and pupils are streamed according to their academic achievement in their annual examination in the last two years of primary schooling. It is understandable that parents are concerned about their children's examination performance, since managing to be promoted to the 'A' class would increase the probability of passing the 11-plus examination and, consequently, being admitted to grammar-type secondary schools.

This state of affairs has been a cause for concern to educators for some time, since parents have become obsessed with examination results, giving less attention to the need of a quality education. Parents had put so much pressure on teachers that many teachers tended to dedicate most of their effort on the core subjects at the expense of the other subjects such as science. In view of this situation, the Minister of Education started

a review process of the local National Minimum Curriculum. The exercise started with a project on a future view of schools and the educational system in Malta (Members of Consultative Committee, 1995). Over the next four years, extensive consultations led to a revised version of the National Minimum Curriculum (Ministry of Education, 1999).

The revised National Minimum Curriculum (NMC) emphasises the importance of science and the need of its inclusion within the primary curriculum. It also promotes the different aspects of doing science. Whereas the 1988 National Minimum Curriculum referred only to scientific knowledge, the revised version includes knowledge, process and attitudes in science and technology. Should the type of science advocated in this document be eventually implemented in primary schools, science would have made a major step forward. This, however, will only be possible if teachers are empowered through training to develop the scientific and pedagogical skills required to deliver such a curriculum.

The University of Malta is the only university on the island and its Faculty of Education is responsible for the training of pre-service teachers. All primary teachers in Malta need to be fully qualified with a B.Ed. (Hons) degree from the University of Malta or equivalent qualifications in order to be recruited as a teacher in state schools. In view of the changes proposed in the revised version of the National Minimum Curriculum, the Faculty of Education felt that it needed to restructure its teacher training programme to suit the new demands being made on teachers.

Before considering changes implemented in the course structure, one needs to first

analyse the National Minimum Curriculum. This is done in order to identify the range of competencies that primary school teachers need to develop in order to be able to implement the new Curriculum with respect to science.

Demands of the NMC on initial teacher training degree

Graduating teachers need to have several abilities relating to science education in order to fulfil the demands of the NMC. These abilities involve competencies in the various aspects of science: knowledge; skills; and attitudes; as well as pedagogical skills required for developing these aspects in young children.

Graduating primary teachers, thus, need to develop a number of competencies:

■ **Science knowledge**

Teachers need to:

- master basic scientific knowledge and the processes (observation, classification, etc.) involved;
- be aware that science manifests itself in different areas of specialisation – physical, natural, medicine technology, etc. and how they are still interconnected;
- be able to ask questions and attempt to answer them through systematic observation;
- be aware of developments in technology and to make use of them;
- understand the relationship between schoolwork and its application to everyday experiences; and
- be familiar with persons from the past and present who have distinguished themselves in science, how they managed to solve problems and their way of communicating their work.

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■ Skills

Teachers should be able to:

- recognise concepts, use scientific language, observe, measure, analyse, solve problems, gather and interpret data, make generalisations, create models, communicate, work in a team and design experiments;
- apply knowledge to everyday situations;
- make effective use of scientific and technological apparatus both in laboratory and everyday settings; be able to use computers, audio-visual aids, security devices etc; and
- safeguard the natural environment in a sensitive manner.

■ Attitudes

Teachers should:

- understand their responsibility in relation to the natural environment and animals;
- be aware of the changing nature of scientific knowledge, that it cannot offer clear answers to anything;
- appreciate the importance of science and technology to life;
- develop a positive and critical attitude towards scientific and technological developments;
- recognise the limitations of science and scientific attitudes;
- be ready to engage in experimentation in different aspects of science and technological developments;
- be ready to work to ensure that everyone benefits from the positive results of science and technology.

■ Pedagogical ability

In addition to developing content, skills and attitudes directly related to science, teachers are also required to know how to develop these aspects in the young children entrusted to

them. Consequently, they need to develop pedagogical skills. This means that they would need to be able to:

- help children understand basic ideas in science;
- help children link schoolwork to everyday applications and experience;
- present science as a systematic means of asking and attempting to answer questions about them;
- integrate educational content in order to adopt a multidisciplinary approach;
- help children to learn how to ask questions, exchange ideas and collaborate with others in order to clarify their thinking;
- organise group work;
- help children to understand their responsibilities in relation to the natural environment and animals;
- arouse children's curiosity concerning natural phenomena;
- provide examples of models of persons from the past and present who have distinguished themselves in science, how they solved problems in science and how they communicated their work;
- make children aware of the different ways in which science is manifested, for example physical, natural, medicine, technology, etc;
- understand that different children experience science differently;
- understand and use technology in the process of teaching science;
- help children engage in experimentation;
- help children realise the changing nature of science and its inability to provide answers to everything;
- help children develop a positive and critical attitude to science.

(Ministry of Education, 1999)

As one can note, the list of competencies required is extensive. Teachers need to have a sound basis of training in science. The Faculty of Education has recognised this need and has responded by restructuring its four year B.Ed. (Hons) course.

Changes in primary science teacher training

Up to a few years ago, as part of the early and middle year's course, one credit was dedicated to science education. A credit is equivalent to 14 hours of lectures and to 50 hours of work.

The Faculty of Education was unhappy with the state of affairs in the case of teacher training at primary level. As a result, the system was changed and B.Ed. (Hons) trainees were given the opportunity to decide whether they would like to focus on secondary or primary at the end of their second year of studies. The first B.Ed. (Hons) trainees with a primary specialisation graduated in 1998. The number of credits in primary science increased from one – which all trainees did in their second year – to two, due to an additional credit in their fourth year.

The primary specialisation was very successful and the Department of Primary Education within the Faculty of Education decided that it was time to offer a Primary B.Ed. (Hons) course that focused only on primary education. This course started in October 1999 and the first trainees graduated in summer 2003.

Training in science in the new B.Ed. (Hons) primary course

The new B.Ed. (Hons) primary course has the advantage of catering for those trainees who specifically decide to become primary school teachers. In the

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application to the classroom.

The other course 'Producing IT resources for Science' focuses on the production of IT resources in science. The credit was introduced in view of all primary class teachers being provided with a laptop and classrooms having a big screen to which the laptop can be connected. Most classrooms also have about four computers for pupil use. Trainees review professionally developed software. They also have time to produce on-screen activities themselves, either in terms of *PowerPoint* presentations or activities that children can do on the classroom computers. Trainees also discuss how IT can be integrated within science lessons, complementing rather than at the exclusion of actual experiments and investigations.

The course in the last year focuses on the role of the science co-ordinator. Although no science co-ordinator as yet exists in local state schools, the Faculty seeks to be proactive in forecasting the introduction of such posts in the future. The role and responsibilities of such a post are tackled within this course, providing these science specialist teachers with the basic competencies for providing support to colleagues at work.

The new primary course ensures that trainees have 6 out of 116 credits in science and environmental education. Those who choose to teach juniors take 7 credits. The highest proportion of training in science goes to those who specialise in science with a total of 15 credits maximum, a significant percentage of their overall training.

The Faculty of Education still enjoys full autonomy in determining the design and structure of teacher training, within the limits of University regulations. The government

does not in any way interfere with the structure of the academic programme or the amount to teaching experience given. The Department of Primary Education has made great strides in establishing science as part of the pre-service teacher training course. Obviously, one can only measure the effectiveness of such changes once this new type of primary teachers graduate and go out in school to teach.

So far, although the revised National Minimum Curriculum has given science a more prominent role, the National Curriculum Council entrusted with overseeing its implementation (Ministry of Education, 2001) has not as yet taken any decision regards any form of assessment that is to be implemented. However much teachers are trained and equipped with the competencies necessary to teach science effectively, if teachers were still faced with the examination-orientated culture that still persists in our educational system coupled with the low level of accountability required, it would be easy for teachers to succumb to these pressures. Notwithstanding the effort put in by the Faculty of Education in training teachers, the educational system has to ensure that primary level children are provided with the opportunity to learn and experience science. The key to making science an integral part of the local primary education would only be possible through the support provided by the various players in education, these being the University of Malta, the Education Division (central education institution), the schools, teachers, parents and finally the children.

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