

Research Article

The Potential for the 'Physics for Science Teachers Project' (PST) from the Open University (OU) in the U.K. to Contribute to Solving the Problem of the Shortage of Teachers of Physics in Maltese Secondary Schools.

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Summary. *Given the nature and extent of the shortage of teachers qualified in physics, there are many features of the Physics for Science Teachers Initiative described in this paper, that could be utilised, adapted and reconciled to devise and implement programmes of retraining to meet the needs of Maltese Schools.*

Keywords: Physics, science teachers, Open University, Malta.

The effective delivery of physics within the Maltese Science Curriculum is threatened most sharply by teacher shortages amongst those appropriately qualified to teach this scientific discipline. There exists a mismatch between the expertise of individual teachers in particular areas of science, most notably biology, and the need for teachers of physics.

There is the resultant danger of the physics-oriented curriculum being under-represented in the secondary school curriculum in Malta.

This is likely to exert a damaging effect on the future of Maltese science, industrial and commercial efficiency and competitiveness in the world market place.

A similar story from England

In the late 1980's and early 1990's, a DES and British Petroleum funded project was able to make a major contribution to alleviating the 'crisis' in physics teaching by training science teachers with experience in other science disciplines to deliver the physics curriculum with confidence and enthusiasm. This was done by devising distance learning teaching materials which would:

- (i) improve teachers' understanding of key areas of physics included in GCSE science.
- (ii) provide a context of teaching physics within the secondary school curriculum, with opportunities for developing relevant school-based and classroom skills.

There was also the recognition, from the OU, that forms of local tutorial support and elaboration of written/video/audio materials would be essential in realising a fully effective training programme. In particular, the need to provide opportunities for associated practical and laboratory skills. Such local support utilised local Education Authority (LEA)-based expertise (through Science Advisory teachers) and facilities of other Institutions of Higher Education active in the field of In-service Training for practising teachers.

The PST resources

A series of texts were compiled in which comprehensive

physics content was explicitly related to the physics curriculum. In some cases this was drawn from existing OU undergraduate science texts, but much was newly written, by teams of teachers and OU academic staff acting as co-authors. In two of the texts (Blocks A and F, see Figure 1), broader issues of secondary science teaching and curriculum reviews were included. Throughout Blocks B-E considerable attention was paid to assisting science teachers to develop both the background subject knowledge alongside appropriate competencies and strategies for the classroom.

Block A - Issues in science teaching
Block B - Mechanics; temperature and heat
Block C - Electricity and Magnetism
Block D - Energy; atomic physics
Block E - Electronics; waves and rays
Block F - School science in focus

Mathematics support material; PST audiocassette and videocassette; local support, including practical activities and discussions at group sessions
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Figure 1. The structure and mode of delivery of the PST package. Blocks B-E consist of a number of individual booklets and their titles have been abbreviated here for convenience.

A variety of cost-effective patterns of use were negotiated by consultation between members of the PST Course Team (and in particular two Academic Liaison Advisers to the project) and local providers of training. The central feature of the various training programmes established through various collaborative schemes, was that training was achieved without removing scarce teachers from the classroom for long periods.

A selection of the training initiatives which evolved is described below, along with some of the key observations drawn from the early stages of the project. These have been taken from a paper by Tresman and Whitelegg (1989): 'In-service at a Distance: The 'Physics for Science Teachers Project'.

Modes of delivery of the PST resources

By the summer of 1989, some 650 teachers were studying the package. Within this overall number were 41 groups of teachers being sponsored by 59 local authorities through the provision of release time and local group tutorial provision (in some instances through a local HE College). An additional 15 LEA's plan an Autumn 89 start. Authorities have faced difficult choices in balancing the need for release time to attend group tutorial sessions, with the expense of providing and obtaining distance learning material that can be supported and extended by a wide variety of tutorial back-up arrangements. Thus we have seen the following types of enterprising course structures in operation.

- Weekly meetings alternating practical sessions with tutorials. Cover arranged for practicals that are full day sessions (9.30-4pm). Tutorials are twilight sessions (4.15-6pm). Also 4-5 hours release time per week for private study.
- Half a day per week release time for private study, a full day each half term for practicals plus a residential weekend every term.
- Release for 1 day per week plus 6 practical days at a local University with a University tutor. Fortnightly meetings with a local teacher for tutorials.
- 20 hours tutorial support per term plus week long Easter and Summer schools, totalling 30 hours, for practicals.
- 11 tutorials spread throughout the year and practical classes each half term at local HE College. (Teachers from State and Independent sector attend this scheme).
- Release for half a day per week for private study plus 6 tutor-led practical days.
- 3-4 evening meetings per term with a tutor from a local University plus involvement of heads of physics. No release time.
- 6 Saturday practicals at 5 different schools with a tutor from each school, plus telephone tutor available for about 2 hours per week. Half a day per week private study in school time.

The partnership of a large number of local authorities with the Open University has realised the objective that this science INSET resource should be equally accessible to all practising science teachers, irrespective of geographic location. The job of bringing the University to would be participants in the PST schemes was taken up by two Academic Liaison Advisers appointed to the Project. These were available to work with authorities and institutions to establish the most appropriate form of inclusion of PST within INSET courses to cope with the problem as perceived in that specific area.

Observations from the first year of PST

* The package:

- (i) *attracted teachers from a wide variety of scientific specialisations.* Most participating teachers were biologists, but there were many chemists and some earth scientists and home economics teachers.
- (ii) *needed to be flexible in structure.* There was an

advantage in offering a package that was sufficiently flexible in structure that it could be approached via a number of routes, forming study programmes of varying emphases and duration.

- (iii) *provided a means of fully integrating key physics content with pedagogic issues.* This helped place physics in a wider scientific context and provided teachers with fuller understanding of contemporary developments in the teaching of science in schools. In addition to covering in depth the key areas of physics, blocks B,E addressed the practical problems of the classroom teacher, helping teachers to consider and develop teaching styles and strategies which enabled them to approach physics teaching with increased confidence. Blocks A and F considered key issues of science teaching such as curriculum planning and design, problems of providing continuity throughout the secondary science curriculum, language and concept development, assessment and practical work, liaison with industry and curriculum models to deliver balanced science.
- (iv) *allowed for more intense periods of study at less busy times of the school year.* Since the choice of starting date resided with the participating teachers and the supporting LEA, episodes of concentrated study could be arranged to coincide with such periods in the school year, for example in the summer term, particularly after the examinations.
- (v) *enabled teachers to concentrate on particular parts of the package to support their weaknesses in certain topics.* The blocks are all self-standing, allowing those teachers who are more experienced in the teaching of physics to select those areas which are in need of support.
- (vi) *enabled the materials to be integrated into a University or Polytechnic scheme to provide a postgraduate qualification.* One consequence of the production of such a flexible resource was that Open University accreditation was not an integral part of the package. However, many LEA's and local institutions of higher education worked together to provide certification for those teachers studying the package in full and sometimes as part of a broader course of study.
- (vii) *overwhelming need for group sessions embracing practical work to support theory provided in the distance learning texts.* Although the frequency of tutor-led sessions has varied substantially according to the extent of resource the LEA is able to commit to PST led schemes, all the teachers placed an extremely high priority on the provision of practical work. The need for experienced teachers of physics to be on hand to provide a supportive environment in which teachers could develop confidence in handling unfamiliar apparatus was universally expressed.

* *The materials appeared to motivate the participating teachers.*

Given that some of the participating teachers may have been turned off physics during their own school career, the materials try to interest this audience by including consideration of the social implications of the subject and discussing technological applications wherever possible. We were also aware of the need to make the text as applicable to women as to men and this approach has been validated by some of the female teachers who say that they did not feel that they were studying material that was inappropriate for them, and did not address them, as so much physics material in the past has not done.

* Participation in courses based on PST materials appeared to influence considerably the view of individual participants of their ability to teach physics effectively.

Hands on experience with physics apparatus in the group sessions combined with a thorough grounding of the theory behind the experimental work has increased the confidence of the course participants.

* Where local tutorial provision for PST has been provided by a local institution, different forms of accreditation have developed.

29 schemes are offering local accreditation for PST through a university, polytechnic or college. A few examples are given below:

Edge Hill College of Higher Education

Reports on the practical sessions plus a 4,000 word essay lead to the award of an *Edge Hill Advanced Certificate* equivalent to 1 module from Lancaster University.

York University

PST is built into their 2 year course to form a *Diploma in Physics Teaching* assessed by a 10,000 word written report.

Sheffield Polytechnic

The Polytechnic will award a *Vocational Diploma in the Teaching of Physics*. The course (which also included 3 additional booklets produced by the Poly) will be continuously assessed and have examinations at the end of each section. It is deemed to be approximately equivalent to half a year's full-time study at Master's level. (Under CATS such a course would attract 60 credits at Master's level.)

Kings College, Centre for Educational Studies

A certificate from the Centre is awarded for satisfactory completion of 1 assignment of about 3,000 words, equivalent to 20-30 hours work.

Thames Polytechnic (2 year course)

The Poly awards of a *Postgraduate Diploma in Physics for Teachers*, if teachers pass an examination at the end of each year and fulfil coursework and laboratory requirements that are based on continuous assessment. The course uses PST in the first year only.

Homerton College, Cambridge

The College offers a *Certificate of Further Professional*

Study (CFPS) and a *Diploma* – the latter based on a more extended scheme of assessment. The *Diploma* offers 80 credits towards the *Modular Advanced Diploma in Educational and Professional Studies*. Students decide by the end of the first term which of the two levels of assessment they wish to follow.

Conclusions

Over 600 packs of resources were sold in the first year of the Project, with nearly 60 LEA's entering into training schemes of some kind, using Government funding designated as a 'National Priority Category' of funding to cover some or all of the costs.

During the following two to three years, this rose to around 1200 sales, reaching between 50 and 60% of the predicted shortage of 2000 physics teachers (Smithers and Robinson (1988).

In establishing related programmes of local face-to-face tuition and support, the degree of collaboration between the OU, other Institutions of Higher Education and LEA's was extensive and highly innovative, enabling large numbers of teachers to study OU materials and experience input from experienced tutors and fellow teachers of physics who helped to mediate the OU materials through face-to-face instances of enhancement.

There was evidence of substantial progress from a wide variety of backgrounds and starting points for teachers. Through a variety of forms of assessment and evaluation, they displayed increased knowledge of physics concepts and how to teach them and improved knowledge of resources and equipment. Teachers greatly valued the chance to come together for practical and study sessions, but, since the OU resources used distance learning strategies, they did not require a great deal of time away from the classroom.

Teachers' perceptions of their ability and confidence to teach physics effectively were radically altered in many cases. Through the provision of OU resources, they were left with a valuable resource for future teaching and support of colleagues.

References

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