Proceedings

Motivating Physics for post-16 Students

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Summary. *There is a new curriculum development project, the Supported Learning in Physics Project (SLIPP), based at the Open University which aims to tackle the problem of decline in the numbers of students opting for Physics at post-secondary level. This project focuses on control over and use of contexts for learning.*

Keywords: Supported Learning in Physics Project, SLIPP, post-secondary physics, context and control.

Science education in the UK has undergone considerable change in recent years. With the introduction of the National Curriculum, students have an entitlement to science teaching and learning during the years of compulsory schooling - 5 to 16 years, and in all State schools (the majority of schools in Britain) students must by law study all the sciences up to GCSE (the 16+ examinations), rather than select one or two science subjects out of three. Some schools teach the sciences as separate subjects and students must do all three, others teach them in an integrated way as broad and balanced science. However, this compulsion to study science, and physics in particular, has not led to large numbers of students deciding to continue with these subjects at post-16 level and the decline in numbers of students taking physics at post-16 level has continued despite the introduction of the National Curriculum in 1988.

The reasons for this persistent decline in the numbers of students taking physics post-16 has been widely reported and need not be repeated here. However, it may be useful to draw some parallels between some of these reasons and some similar issues that I am aware of in Malta.

In both educational systems, students are more used to a transmission mode of learning, to being spoon-fed by teachers, and so they are unused to taking responsibility for their own learning and for finding things out for themselves. Sometimes the teachers themselves are under-qualified to teach at this level, or perhaps are de-motivated after several years of teaching to students who are not very committed. Physics has a particular image of being a difficult subject and it also requires quite a high level of mathematical ability, so parents may suggest to their children that there are easier routes to a qualification than via physics. The traditional image of physics is also one that is unappealing to many girls (Whitelegg, 1992).

In addition, in Malta, there are the problems of poor communication skills, particularly the requirement to learn science in a foreign language (English), over-large classes, and lack of practice in learning through investigative work.

These issues can lead to poorly motivated students, who are unlikely to counter the trend of declining numbers and opt for a subject that they will have to struggle with, rather than something that holds more of a guaranteed route to success.

This is a multi-faceted problem that contains fundamental issues that are grounded in economics, demographics and society's image of science and scientists, (and physics in particular), so there is only so much that can be done to improve the situation by particular educational initiatives.

However, in this paper, I wish to outline one particular initiative that is being developed in the UK that aims to have some effect on this decline in the popularity of physics, and which I hope may also be of interest and of use in the Maltese situation where similar issues confront students and their physics teachers.

The Supported Learning in Physics Project

Considering all the factors that contribute to this poor uptake of physics at post-16 has led me to the conclusion that a key issue that can be tackled by educational initiatives is students' *motivation* for learning physics. A new curriculum development project, the Supported Learning in Physics Project (SLIPP) based at the world's leading distance learning university - the Open University in the UK, aims to tackle this key issue in two ways.

Firstly, the A-Level Information System (ALIS) based at Durham University, UK, has found that A-level students have greater motivation if they are given more control over their own learning. Secondly, students are also more likely to be motivated by a subject if it relates to activities and hobbies that they are interested in during their out-of-school activities. This latter factor is particularly true for girls who have been found to pay much more attention to the context a science problem is set in than do boys who tend to disregard context and treat problems in more abstract ways (Murphy, 1994).

SLIPP has focused on these two factors - control over learning and use of contexts for learning, as a means for increasing motivation for learning physics and has designed a learning programme for post-16 students that makes use of these two factors.

SLIPP is a package of self-study materials that covers the core of the physics A-level. It is also appropriate for those taking the new post-16 vocational programmes (General National Vocational Qualifications - GNVQs). SLIPP consists primarily of text-based resources which develop physics learning through self study of the materials using active learning strategies developed by the Open University. It consists of eight units of supported self study material and incorporates some CD-Rom activities and other audio-visual resources where appropriate (these are commercially-available materials which must be purchased separately). The recommended mode of use of the SLIPP materials is for teachers to plan routes through the materials with their students and to manage a time-table for study with the students. However, after setting targets for the students' learning, teachers should then withdraw and allow students to study the materials independently but arrange to meet students for small group or individual tutorials and problem solving sessions. This approach frees the teacher to help those who are struggling and to develop more advanced work with others who need further challenges. Practical work is integrated into the texts and although full instructions are given for the majority of experiments students are encouraged to hypothesise, plan and carry out experiments for themselves and the end-of-unit projects encourage this in particular. For safety reasons, teachers should supervise the practical sessions and be available to offer help when asked. However, teachers should not be delivering the learning, the study texts do this, so teachers should develop more of a tutoring role offering advice and assistance when requested and withdrawing at other times. Obviously teachers must monitor students' progress at regular intervals and the material contains lots of questions of different sorts - both to develop and to test students' understanding. A teachers' guide offers advice on the way to use the materials and contains tests which teachers can administer to their students to check their learning at the end of a unit.

The second feature of the project is the way the physics content is introduced and developed. Each unit is written around a real-life context, a context which we hope will be interesting and attractive to young people and one that is inclusive of girls' interests. The physics learning is embedded within these contexts and so the contexts determine the order in which the physics concepts are covered. This leads to a rather non-traditional coverage of some of the physics concepts and also some concepts being covered in more than one context so appearing in more than one unit. This is felt to be a positive feature, we do not all learn everything first time around, and presenting energy transfers for example in the context of transport and in the context of rock climbing will help reinforce that concept and appeal to a diverse range of students in different ways. The eight units and their associated contexts are listed below:

Title	Context	Content
Physics, jazz and pop	Listening to a concert in a modern concert hall	Oscillations, s.h.m., Waves, ideal gases, communications
Physics on the move	Safe transportation of people and goods	Statics, dynamics, energy, kinematics, Newton's laws, forces
Physics for sport	Rock climbing, springboard diving, scuba diving	Forces, vectors, oscillations, s.h.m., Ideal gasses, energy transfers, materials
Physics on a plate	Cooking and eating food	Thermal physics, electromagnetism, geometrical optics, energy, electricity, structure and properties of solids
Physics of space	Space exploration and images of science and scientists	Quantum physics, light, nuclear processes, geometrical optics, radioactivity
Physics phones home	Development and use of the mobile phone	Electromagnetism, electric and gravitational fields, electricity
Physics in the environment	Energy use, recycling, pollution, life and death of the car	Thermal physics, fission and fusion, nuclear processes, electricity
Physics of flow	Measurement and control of fluid flow	Fluid flow, electricity, electromagnetism

The materials are currently in various stages of production and the first one, *Physics, jazz and pop* is due for publication this November. The others are scheduled to follow over the next few months and all should be available for use by the start of the next academic year. The materials are being marketed by Heinemann Educational Publishers and will each cost about £8.50. For further information please contact the author at the address above, or for information on availability of the materials or to order inspection copies please contact the publishers at Inspection Department, Heinemann Educational, PO Box 380, Oxford, OX2 8BR, England.

References

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