ELPSS: e-learning in Physical Science through sport

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Background

e-Learning in Physical Science through Sport, the ELPSS project, is one of the first generation of institutional education projects supported by the project strand of the National Teaching Fellowship Scheme. Its main aim is the creation of a large number of free-standing interactive teaching packages that will introduce a wide range of important ideas in the Physical Sciences (Physics, Chemistry and Materials Science) using examples taken from the world of sport. When completed, the teaching packages will be made freely available to the entire HEFCE-funded sector as reusable learning objects (RLOs) that can be incorporated into lectures, courses, and programmes. The intention is that the packages will be sufficiently interesting that students will find them more engaging than conventional approaches, and that lecturers will find them sufficiently effective and easy to use that they will employ them in preference to developing their own materials or buying others.

The ELPSS project began in mid-2007 and will be completed at the end of July 2010. This 'half-time' report describes the original intentions, what has been achieved so far, some of the lessons learned and the challenges that lie ahead.

Initial aims

The production of RLOs is at the heart of the ELPSS project but there are a number of ancillary aims that must also be met. These include the following:

- To conduct and update a national survey of the wants and needs of potential users so that we can be sure that the objects we are producing are the kind that lecturers want
- To create an Open University course for presentation in 2009 that will incorporate approximately 50% of the ELPSS RLOs so that they can be trialled with a large number of students before their finalisation and release
- To ensure that several of the RLOs incorporate an element of problem-based learning by starting from a question for which the student must acquire specific information in order to solve it
- To include some training in scientific information skills in each of the RLOs.

Progress to date

The project is making good progress on all fronts, though the demands of producing the RLOs have been significantly greater than expected. Management of the project is mainly in the hands of Kevin Mayles, the manager of the hosting body, piCETL. An initial 'wants and needs' survey was carried out and will soon be updated. The survey showed that the most suitable medium for producing ELPSS RLOs would be Adobe Flash, a popular platform for the development of web-based interactive packages that is largely free of incompatibility problems. The results also indicated that the final RLOs could be distributed via an online repository. The survey included a number of quite detailed questions about preferred package durations and so on, but the main response was along the lines of "give us something of good quality, that works, and needs the minimum of intervention". Many of those responding had not made great use of RLOs in the past and did not have strong feelings about the form they should take.

A review of the relevant literature (Rehak et al, 2003) and discussions with others involved in the production and use of RLOs showed that there were so many definitions of 'reusable learning object' that the term could be interpreted very freely. Our decision was to accept a rather 'fat' definition of RLO as a computer-based teaching package that has a specific science learning outcome. In the case of ELPSS RLOs there would also be a high level of interactivity, an information skills outcome and one or more sporting contexts. To ensure that the science learning outcome is met, assessment would have to be included in each RLO.

Gaining approval for a new Open University course is highly non-trivial, so our first great success was getting the go-ahead for the production of OU course S172 – a 10-point, Level 1 Science course that we originally hoped to entitle "Olympic Science", though that particular title could not be used owing to trademark restrictions. Finding a title is not the only challenge S172 presents. Chaired by ELPSS team member Mark Bowden, it will be the OU's first Level 1 Science Faculty course based on an e-book rather than a printed text. Each chapter will concentrate on a single type of Olympic sport (running, swimming, jumping, diving, cycling etc), so the sequence has had

to be arranged to introduce science concepts in a rational order; one-dimensional linear motion leading to two-dimensional linear motion leading to rotation and so on. At three or four key points in each chapter students will be referred to an ELPSS RLO which will introduce the next concept they will need to understand. Ensuring the effective integration of the e-book and the RLOs remains a focus of attention.

At the time of writing, about 20 RLOs are at various stages of completion. Topics covered range from speed, acceleration, force and energy to Poiseille flow and the interpretation of graphs. In the early stages of the project much time was devoted to creating a flexible but clear template that could be applied to the great majority of RLOs. An RLO devoted to the concept of centre of mass provides a good example of this approach. The first draft was prepared by Derek Raine of the University of Leicester, who has been included in the ELPSS team as a special consultant on problem-based learning. After some agreed modifications by other members of the writing team, the script was passed to the project's main software developer, Jianfan Xie.

Jianfan was soon able to create an 11-screen learning object that quickly posed the problem: "Why do élite high jumpers show a preference for the Fosbury flop technique?" This question is illustrated by BBC footage of an athlete using the technique. The screens that follow allow students to use a sequence of simple but increasingly sophisticated models to gather data about the energy required to jump over a barrier, taking account of the orientation of the jumper's body. This sequence makes it clear that a crucial factor is the location of the jumper's centre of mass since, for the purposes of an energy calculation, the jumper's entire mass may be regarded as being concentrated at that point. Some interactive exercises emphasise the fact that the centre of mass may be outside the object. So, by appropriate bodily flexions jumpers may ensure that their centre of mass is outside their body. A re-examination of the BBC footage then leads to the final answer: the Fosbury flop involves exactly the movements that place the centre of mass outside the body and ensure that it passes under the bar while the jumper's body passes over the bar. The technique therefore provides maximum clearance for a given input of energy.

Lessons and challenges

The search for topics for RLOs has shown that sport is indeed a rich field for interesting science teaching contexts. The greatest challenge that we face arises from our own limitations as teachers. We were determined from the outset to ensure that ELPSS RLOs would be highly interactive. Our belief in the value of this has not diminished; an enormous body of educational research literature (Laws et al, 1999) shows the advantages of active as opposed to passive learning. However, devising effective activities is hard work. It is generally much easier to find clear ways of telling students facts than it is to develop efficient methods of enabling them to discover those facts for themselves, and the new pedagogy of RLOs is extremely demanding in this regard. It should be emphasised that this is primarily a problem of design rather than implementation; we have been relieved by the speed with which our designs have been implemented.

Another challenge arises from our determination to include science information activities as natural outgrowths of student science learning in each of our free-standing RLOs. There have been many successful attempts to teach science information skills progressively in the context of a particular course, but we face the challenge of teaching some part of such a programme within each RLO without the assurance that students will have covered any other element of the programme. Our team specialist in this area, Clari Hunt, has helped us to identify an appropriate range of skills to teach and has furnished many examples of good practice.

Conclusions

The ELPSS project has provided a valuable opportunity to develop teaching resources in an interesting and engaging area. In this case the development of the resource goes hand in hand with the development of new pedagogy and the new pedagogical practice. The implementation of the RLO scripts has been remarkably trouble-free, but the creation and refinement of the scripts has taken a surprisingly long time, partly reflecting the novelty of the task but mainly owing to the great attention to detail that is required. The challenge ahead is still significant and success is not guaranteed; the next 18 months will be exciting.

References

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