



Working in Partnership with Students: The Summer School at Cambridge

a Case Study from the UK Centre for Materials Education

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JISC





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Foreword

This is the first of a series of case studies that UKCME will produce this year that look at the outcomes of the Supported Change Programme developed with Departments across the Materials community. This case study focuses on the University of Cambridge Summer School, where academics and students work together to develop e-learning resources. It provides a wonderful example of meaningful student engagement. As the sector increasingly moves towards a student-focused approach to enhancement, it will need exemplars such as this.

I often hear criticism that national funding streams lack co-ordination with other initiatives, only belatedly addressing sustainability after funding dries up. What this case study shows is how initiatives can be combined to build on each other, over a number of years, so adding value to each of the funding streams. In this case, original funding, from HEFCE and from a UKCME Teaching Development Grant, provided a foundation for the UKCME Supported Change Programme to be established in the Department of Materials Science and Metallurgy at Cambridge. This then gave a firm base for the Academy/JISC 'Distributed e-Learning' (DeL) funding, channelled through UKCME, to support an annual national Summer School involving students and academics from a range of institutions.

There is clear evidence here of how JISC and the Academy can work together at multiple levels, including sector-wide change, disciplines, departments, individual academics and students. For those who wonder about the success of national initiatives and the effect Subject Centres have in their academic communities, this case study provides a very clear demonstration of positive impact.

There is much to celebrate in the lessons of this case study. It provides an excellent start to the series of reports that will be published by UKCME.



David Sadler
Director (Networks)
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Introduccio

Introduction

Over the period 2004–2007, the UK Centre for Materials Education (UKCME) has worked in collaboration with its community on a variety of developments, each of which has been subject to a detailed external evaluation.

In addition, the UKCME has embarked on a programme of research to explore issues pertinent to Materials Science education.

The outcomes of this work will be published in a series of reports. The first of these focuses on the practices and achievements of an ongoing initiative at the University of Cambridge. Here, academics have worked in partnership with students to develop a range of e-learning resources.

Companion titles will focus on the new materials lecturer experience; post-graduate support; and employer engagement.

In 2004, the Department of Materials Science and Metallurgy at the University of Cambridge initiated a Summer Programme, funded by UKCME. This involved staff working in partnership with students to develop e-learning resources; resources which have achieved international recognition for their quality and educational value. Since then, the programme has evolved and expanded, and with joint funding from UKCME and JISC was extended in 2007 into a Summer School which incorporated e-learning developers from other institutions.

In 2006, and again in 2007, the initiative was subject to a detailed external evaluation by UKCME. It is clear from this that the Summer School represents excellent practice, both in terms of developing e-learning resources, and also in relation to forming collaborative partnerships with students. This document tells the reader why.



1 Background

It is important to realise that the Summer School is not a ‘one-off’ isolated development. It builds on the experience and expertise of colleagues who have engaged in a number of projects, made possible through a variety of funding agencies. This initiative represents a logical extension of what has gone before, and an increased commitment from the Department to develop computer-based resources to enhance student learning.

The ‘journey’ undertaken by the Department in recent years is represented below:

Date	Activity
1980s	A small number of enthusiasts appreciated the learning potential of emerging computer technology – and developed interactive animations of Materials concepts
1990s	External funding (from HEFCE) made clustering of expertise possible – a national MATTER project was established at the University of Liverpool (www.matter.org.uk) The emergence of the Internet provided a means of disseminating resources
2000 to 2003	External funding (again from HEFCE) promoted a ‘consortium approach’ to meet needs identified by the Materials community. The DoITPoMS (Dissemination of Information Technology for the Promotion of Materials Science) project at Cambridge promoted development of small-scale e-learning resources to complement MATTER outputs – with a micrograph library and Teaching & Learning Packages (TLPs) emerging
2004 and 2005	Teaching Development Grant support (from UKCME, as a national Subject Centre) consolidated and sustained output at Cambridge, and promoted ‘students-as-developers’ in a Summer Programme to meet Departmental teaching needs
2006 and 2007	A structured Supported Change Programme (from UKCME) widened departmental participation to create a critical mass of staff at Cambridge, and expanded the library of TLPs
2007 and 2008	Joint UKCME-JISC funding shifted development at Cambridge towards a national Summer School, and diversified output to include a video-clip library to supplement the TLPs

The 'journey' can be summarised in the Table below:

Aspect	FROM	→	TO
Developer	Small number of enthusiasts	→	Critical mass of staff
	Academics only	→	Academics and students in partnership as developers and co-developers
Process	Isolated	→	Organised with processes formalised
	Ad-hoc – resources driven by individual interests	→	Planned production – resources defined by themes and the need to cover the curriculum
Product	Narrow type and range of resources	→	Wide type and range of resources
	Limited visual appeal – learner passive	→	High level of visual appeal – learner active / interactive

It is clear that external funding from UKCME, and more recently jointly in partnership with JISC, has placed e-learning development within the Department on very strong foundations.

There is **now both permanence and continuity**; a strong commitment to this approach from senior colleagues, with an increasing number of academic staff becoming actively involved.

So, how has all this time and funding been spent? What practices have evolved in relation to the development of e-learning resources? What lessons can be learned about staff working in partnership with students as developers?

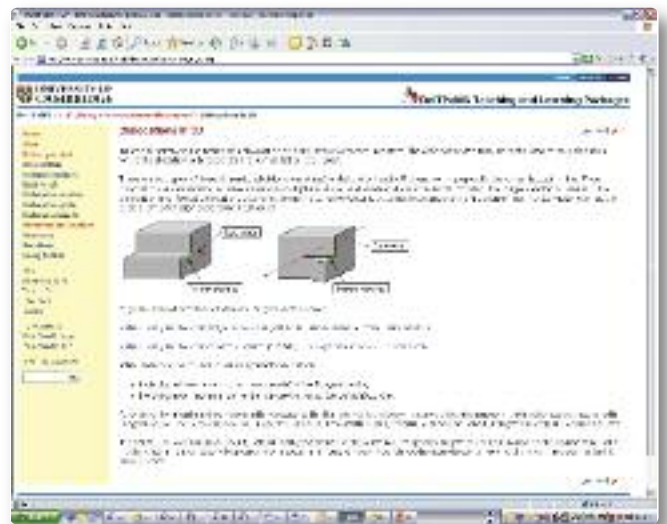
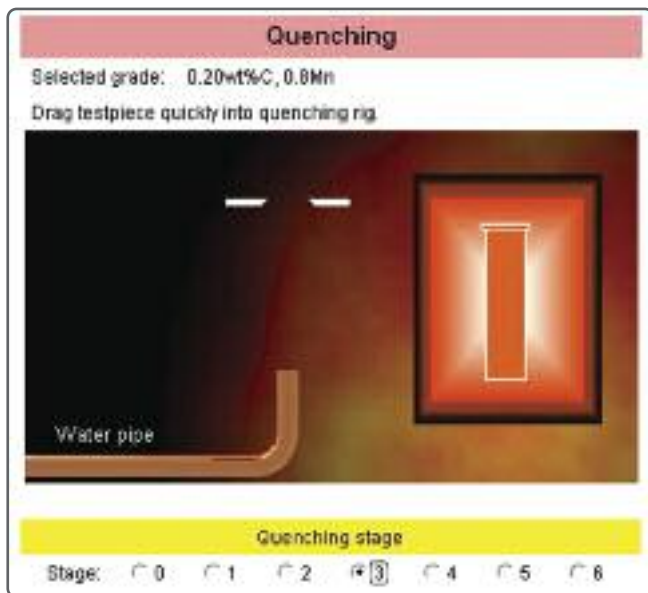
The answers to these questions form the remainder of this document.

2 Teaching and Learning Packages (TLPs)

A Teaching and Learning Package (TLP) is a flexible web-based resource, suitable for use in various ways by students or academic staff. Each TLP can be considered either as a complete entity, or as a source from which component parts can be extracted and used. All elements of a TLP are thus designed to be separately downloadable and to be completely free of any copyright limitations. Interactivity and animation are key to the TLP.

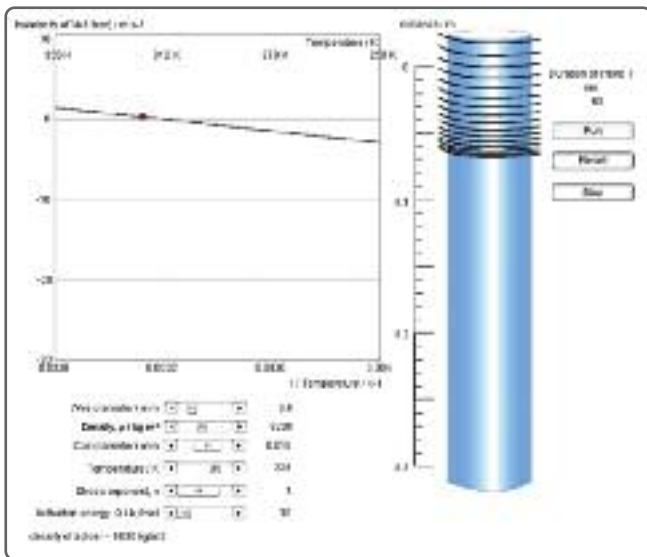
Each TLP covers a specific topic within Materials Science. It is designed to be fairly self-contained, and not dependent on prior familiarity with other TLPs. However, there is some cross-referencing between them, and it could be recommended that another TLP should be studied first.

The format for each TLP follows the same recognisable pattern, so that the user knows what to expect and where to look for information. These always begin with aims, which are the learning outcomes to be expected from working through the TLP. Full use has been made of the web as a delivery mechanism, and hence text is kept to a minimum, and much information is relayed in the form of animations, simulations and video clips. All TLPs end with questions which are interactive.



and Learning

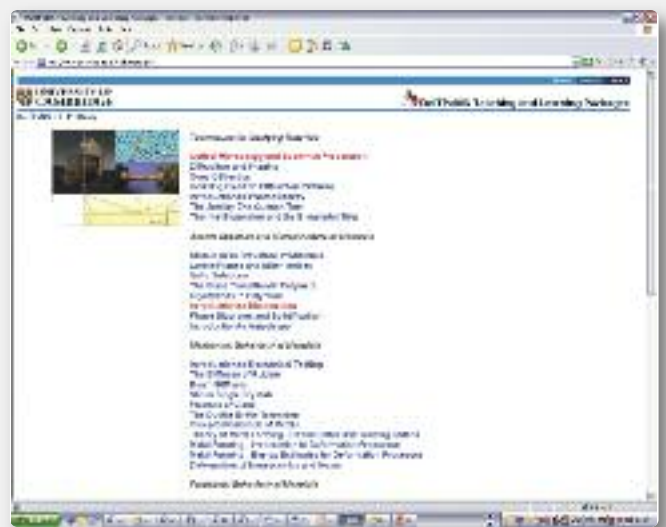
Interactive simulations allow users to interrogate them by changing different parameters to see how they affect the outcome.



The development of a TLP pairs a student with an academic. This combination ensures that typical learning difficulties, as found by learners, will be addressed, whilst academic accuracy is maintained. An innovative learning experience results.

The two collaborators agree on the structure and detail of the material to be included. Areas are identified where suitable photographs, video and interactive elements are needed, and arrangements made to source or produce them.

While the student does the majority of the writing and experimentation, there are regular meetings between student and academic during the development period, to ensure that objectives are being met. In addition, weekly progress meetings of the whole TLP development group enable other staff and students to suggest improvements and solutions to problems as development proceeds. Between six and twelve new TLPs are produced each year, over a two month period in the summer.



A3: Worthwhile

A Worthwhile Initiative

It must be pointed out that the Department of Metallurgy and Materials Science at Cambridge sees Teaching and Learning Packages (TLPs) as something additional to what is normally on offer. They provide an opportunity to present course content in a different way, in an alternative mode to textbooks. Staff have become convinced that to enhance the student learning experience they must provide alternative resources, which promote interaction and which capture course content through visual representation. They also stressed that what is on offer must be of high quality.

Students are also convinced of the value of TLPs as a learning resource.

The evaluation explored a number of issues:

The Issues

Several students talked about the struggle they face when attempting to cope. They may emerge with some sort of record from the lectures, but can be some distance away from understanding what was presented. The two students below refer to this:

'In a lecture, you might just get a line about a concept, and all of a sudden, you say "Wooh, where has that come from?" Then, it all moves on, before you have time to hold on to it.'

'Lectures on any course are always rather brief. There is so much to get through. You just focus on getting some sort of record. You don't have full explanations. As a result, when you start looking at your notes later, you start to ask yourself "How does this fit in with this; and so on?"'

The expression, 'Wooh, where has that come from?' captures accurately the response of many talking about their experience of lectures, where the pace of delivery is very fast and students are out of control of the knowledge-transmission process. For them, it proves impossible to 'grasp and hold on to one element before another one comes along'.

There can be a mismatch between what the lecturer thinks the students understand, and what is actually understood. This wrong impression, as one interviewee explains, can result from reluctance on the part of the students to admit that a problem exists:

'Through no real fault of their own, lecturers can leave with the impression that all is well with their teaching, when it is not. As a result, there is a failure to appreciate that problems can exist.'

In some cases, lecturers may under-estimate the difficulties students can face. What seems obvious to a highly experienced lecturer is not the case for some undergraduates:

'Things may not be so obvious. The staff aim at the middle level of knowledge; somebody like me, in certain subjects (I don't have Maths A-Level). Students need explanations of the bits that are obvious. Lecturers may not realise this. Some may have done a topic for 30 years, and it has become second nature. But it is not second nature to us.'

The student below emphasises why referring to textbooks may not be the only answer in some cases:

'It is getting the right breadth and depth... If you go to a textbook, there are assumptions, assumptions that you have already read the previous five chapters and can comfortably build on these...'

Students were convinced that an alternative approach could be adopted through the use of TLPs to address these problems. This is considered below.

The Value of TLPs

The great thing about TLPs is not just that they provide an alternative approach – helping you visualise, for example, what can be mathematically-based concepts. They also let you work through things, construct things in your own time, and you can do it step-by-step yourself.'

'Students attend lectures and listen. They take notes at a furious pace sometimes, but go away not fully grasping the concepts... The TLP is to support students by clarifying things, by helping them make sense of the concepts.'

'...The TLP does not make assumptions. It does not operate from the premise that there are already sound building blocks on which further understanding can be constructed...'

'...The TLP is quite clear in that it says what it is assuming from the beginning. It clearly introduces the problem, and defines the level from which you are working. Then, it leads you through the topic/problem, making use of interactive tools to help the reader on the way. These could be video clips, graphics, interactive stuff.'



Clearly, the students involved in the programme are assured of the value of TLPs in enhancing student learning. From their comments, TLPs:

- provide an alternative approach to lecturers
- challenge assumptions regarding students' level of understanding of a particular topic/concept
- give students control over the pace of their learning
- help clarify and make sense of concepts using a variety of mechanisms.

Students are equally convinced that they have a crucial role to play, if TLPs are to be fully effective. This is considered next.

4 Students

Students as TLP Developers

Students are strongly convinced that they have a crucial role to play, if TLPs are to be fully effective.

Student developers have already struggled with the problems associated with understanding the course content. As a result, 'they have gained a head-start on the best ways of approaching the problems'. TLP development requires finding different methods to promote understanding, and these should come from those attempting to learn the material.

'I had gone through the process of being taught certain topics, but not really understanding at all. I had gone off to read lots of books and talked with my supervisors/tutor during supervision classes. So, I had already made several attempts to understand the topic. People doing these TLPs, like me, have been struggling to come to terms with problems, trying to understand things in different ways. That makes us very suitable to do these TLPs. I feel because of my own struggle, I had gained a head-start on the best ways of approaching the problem of the TLP project.'

'TLPs mean, if you haven't understood something first time around, there will be a different way of looking at [the topic], different information which gives you an alternative take on the subject. That different way could be very valuable, if it has come from a student.'

Staff too, are convinced that if this process is facilitated effectively, learning resources will emerge which will be valued by and useful to other students.

It is fundamental to the Summer School that students get to a position where they can get their imagination and creativity to shape the content of the TLP, to determine how this should be represented.

Getting the students to do this, and to produce 'packages' to the appropriate quality, requires a considerable and varied commitment from the Department. These practices have evolved over the years as experience has been gained. It is on this that attention now falls.



5 Attracting and Selecting Students

Attracting Students

A number of factors of the Summer School have been identified by the Department, which made participation attractive to students.

The Summer School:

- offers a chance to undertake paid vacation work in Cambridge
- relates directly to undergraduate studies, and represents attendance on an industrial placement
- provides an opportunity to contribute to the process of teaching and learning within the Department
- gives opportunities for personal development
- has a valuable and visible end-product.

Much greater attention will be given to the benefits of participation towards the end of the report. The focus is now on selection of students.

Selecting Students

It is important to get the selection process right, especially with the Summer School being extended to include participants from outside Cambridge.

Continuous funding over the past few years has meant that the Department has become much more fully aware of the characteristics students must have, if they are to engage successfully in TLP development.

Students must be bright, enthusiastic and committed; people who may 'stand out from the average within their undergraduate population'. Participants must have some computer capability, but 'need not be technical whiz-kids'. Crucially, they must be reliable and able to work independently.

Certainly, selection of students at Cambridge is being taken very seriously. A number of key elements of the process can be identified:

- Selection must start early. At Cambridge, it begins in January, with each student studying Materials Science receiving an email inviting them to apply.
- Selection is based on receiving credible evidence. For example, based on the quality of references provided by the student's Director of Studies, and from a Materials Science supervisor familiar with his/her work and progress.
- To set-up the programme, dates must be clarified, to ensure that students will be available at the same time as their supervisors.
- In addition, an attempt must be made to match the student's level of experience with the requirements of the TLP being developed.

Once a student has been selected, s/he is invited to attend a briefing session held before the start of the summer. All students must attend this session, irrespective of their particular starting date.

Clearly, it will be necessary for UKCME to take on some of the responsibility for selection, as the Summer School becomes more nationally based.

6: Preparing

Preparing Students

There are two aspects of preparation:

- Orientation
- Induction

Orientation – The Briefing Session

Students cannot be thrown in at the deep end. Experience has taught that there is the need for a structured programme of preparation, compulsory for all students.



A number of elements must be included.

- An explanation of the way the Summer School must operate, with expectations made explicit relating to hours of work, remuneration, etc.
- Participant awareness must be raised of what a TLP is, and what it looks like (its scope, structure, typical content, etc). Clear messages must be given about the need to develop a high quality product (see below).
- Opportunities must be provided to meet the Webmaster and staff providing other technical services. This will promote understanding of the support and guidance to be made available during TLP development.
- Participants must be informed about on-line facilities relating to the programme – for discussion, posting of draft work, etc.
- Library and photocopying facilities must be explained.
- Information must be given about health and safety, location of workplace, etc.

The Department at Cambridge has now developed documentation relating to these elements, which is made available to participating students.

Students

The Induction Programme

Participants have a lot to learn. To become effective developers, they must acquire both the necessary conceptual understanding, and the appropriate technical expertise to develop TLPs.

In the first three years of the summer programme, such learning had been gained in an ad hoc manner, during its early weeks.

Funding for the 2007 Summer School enabled the Department to provide more effective preparation. As a result, an Induction Programme was introduced to provide a formal element of technical training for students before they began TLP development.

This programme goes beyond orientation to:

- identify what support will be available on a continuous basis (e.g. through the work of an Academic Co-ordinator), and clarify how progress will be monitored (e.g. through the Weekly Meeting)
- introduce participants to the different computer applications / programmes available, especially in relation to animation
- raise awareness of what each application could do.

The induction session provided presentations and demonstrations from both staff associated with the Summer School at Cambridge, and from outside. Students also had opportunities to gain hands-on experience.

Although some modifications may be required, there can be no doubting the success of this training. It became clear that as a consequence of attending, students in the 2007 Summer School were much quicker to engage with the computer applications than their predecessors, and several developed high quality TLPs, into which animation had been successfully incorporated.

Such training will now become a permanent feature of the students' preparatory programme, compulsory for students both from Cambridge and those participating from other institutions.

One final element of preparation remains. Before the programme can begin, students must have an opportunity to meet their supervisors. Initially, this will be an informal meeting. It is here that development begins. This meeting gives the supervisors the opportunity to clarify the aims of the TLP, and to identify resources which will give the student the necessary theoretical underpinning. A date for the next meeting will then be set.

As a result of this preparation, a context has been defined, and a framework has been developed for TLP production to take place. The foundations have been laid to enable the student developer to work alongside a particular academic to develop a specific TLP.

Having selected and inducted students to the programme, it is now time to get on with the business of developing the TLPs. This process is considered next.

7 Developing

Developing the TLP

The Challenges

'It's not worth doing a TLP unless you can do something you can't do in a book, animation or something you can interact with. Otherwise, you are not using the medium.'

'It is a challenge to make the TLP interesting, as well as having it make sense. That can be difficult. It has to be a hundred percent accurate, but sometimes it can come out a bit dry. It can be a real challenge to find something that will keep students engaged with the TLP.'

'It's tricky to simplify difficult concepts, but simplify it in a way that isn't in some subtle way misleading.'

Students can face a number of challenges. Developing TLPs will involve:

- finding alternative ways of presenting content, avoiding a heavy reliance on lecture notes and textbooks
- simplifying difficult concepts; stimulating interest, without losing the integrity of the subject matter
- ensuring development is underpinned by a clear understanding of the subject matter
- operating, for the most part, as an independent worker.



the TLP

The process of developing TLPs proceeds through three phases:

(1) Making sense of the theory – Getting to the right level of understanding

‘It was a topic I had struggled with. It was partly terminology – I don’t think I had got the basic terminology pinned down. Maybe the building blocks weren’t there.’

‘When I started, I thought I might understand it. You don’t know if you understand something fully until you have to say it, and then draw it on paper and put words to it.’

‘My original idea was wrong, based on a slight misunderstanding of the theory. So, we kept on talking about it, and eventually we converged on what was the way forward.’

To develop a TLP successfully, the student must understand fully the theory underpinning it. Sometimes the student may have struggled with the topic in the past. In other cases, misunderstandings only become apparent once the student had got started.

Although the academic has an important role in promoting understanding, students are very clear that a great deal of responsibility lies with them:

‘Your TLP is focusing on a concept, and you are not quite sure whether or not you understand correctly. The student has to address the question “Do I understand it or not?”. Only when the student starts working on this can he/she get feedback of any value.’



‘Especially the first time, when you are relatively young in degree terms – Year One or Two undergraduates – you start expecting answers. Students are expecting to be told what to do. But when developing a TLP, you have to tell yourself what to do; you have to set off answering your own questions.’

‘What you are developing in the TLP has to be absolutely correct. You have to gain enough confidence to say to the supervisor “I don’t really understand that”. That’s the whole business of a TLP – to help students understand topics better. It requires a lot of effort, and you need to talk to the academics more than you would normally do.’

Students cannot rely on supervisors for the answers, but must be honest and have the confidence to make it clear when they don't fully understand the theory. Successful development of a TLP requires a dialogue to be established to work towards clarifying understanding.

Although students note that the TLP cannot be a regurgitation of lecture notes or extracts from textbooks, these prove to be an invaluable preliminary resource. In many cases, along with some direction and guidance from academic staff, these represent the starting point.

The following are examples of how students attempt, in the early days, to make sense of it all:

- Planning and making lists
- Writing it in your own way
- A storyboard, sorting out what to include
- Keeping a log linking planning and reading
- Titles and bullet points
- Leaving blocks out



(2) Constructing the TLP – Building in the student perception

'The academics take our contribution very seriously. The TLPs are for students, so they [the academics] appreciated our take. We know what students get stuck on. We know that not everything is as easy as some academics might think.'

'I think what I am struggling with is how to explain something – explain concepts that can be very abstract. I find myself constantly thinking about how you can teach these ideas.'

Students find the process challenging. They are there to represent the learner, and must struggle to explain difficult concepts, but do so in ways that are accessible and appealing. The aim is to produce a resource which can be used independently of lectures.

However, while capturing the essence of the theory, developers must ensure that accuracy is not lost. Academics have an important role to play here, in ensuring that the integrity of the theory is retained.

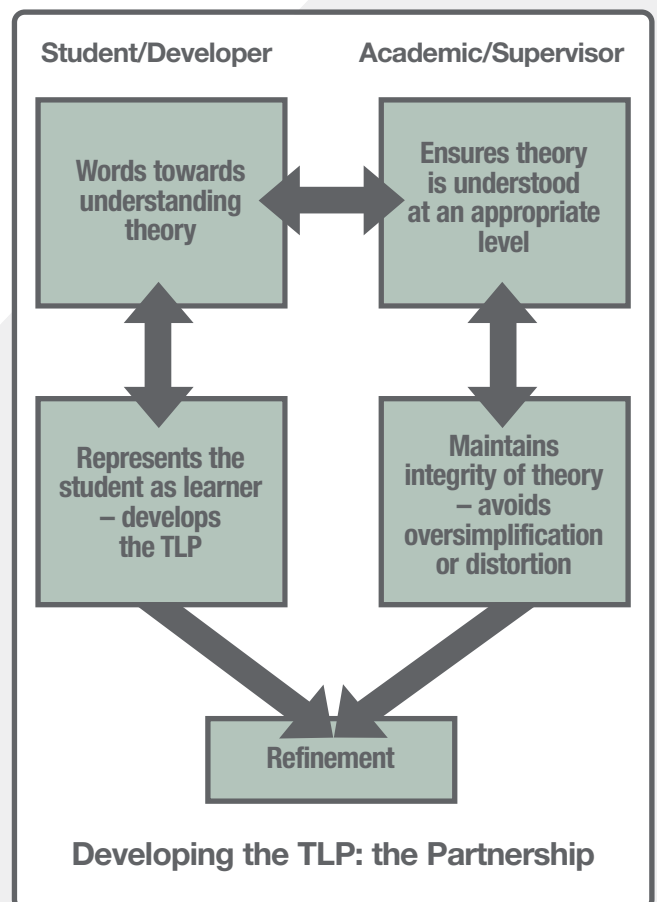
(3) Refining the TLP – Ensuring a high quality product

A number of processes operate to enable the student to work towards developing an end product.

Some of them (the role of the Webmaster, student support, the Weekly Meeting) will be considered in greater detail in following sections. Essentially, the student works in collaboration with the supervisor to modify and refine the TLP over time. A facility is available to enable the students to post the latest version of their work on the Department’s development website. This offers supervisors opportunities on an ongoing basis to make suggestions, and to highlight particular problems while development is taking place.

The Webmaster (see later) will take over responsibility for producing the final product. Although, even at very late stages, the student is able to comment and provide feedback ‘before the TLP goes live’. It will be the academic supervisor, however, who will give final approval before the TLP becomes available as a learning resource. It is this mix of student involvement coupled with departmental quality control which makes the TLPs a ‘potent’ learning resource.

Academic supervisors are by no means the only ‘resource’ available to student developers. The following sections consider other elements of support provided by the Department, with the initial focus falling on the Webmaster and on other technical support staff.



8 The Webmaster and Other Technical Support

The summer programme must have a dedicated Webmaster for the two months of 'active development', and beyond (see below).

The Webmaster:

- provides IT expertise to support and build on the work undertaken by the students
- needs subject discipline knowledge to advise on the accuracy of the scientific content (and appropriate representation)
- must be able to cope with problems resulting from changes to platforms, servers etc.

Interacting with Students

The Webmaster's role involves interacting with students throughout the development programme. This represents much more than providing technical expertise. A great deal of skill and sensitivity is also needed to enable the Webmaster to:

- overcome students' initial lack of confidence relating both to the feasibility of their ideas, and their capacity to cope with the technical demands of translating these into the TLP
- avoid 'squashing' ideas and the creative urge, when confronted with suggestions which may initially be unrealistic or inappropriate.

The evaluation identified a number of other roles:

Contributing to the Induction Programme

The Webmaster plays an active role in raising students' awareness of the 'potential for interactivity' from a range of applications; providing exemplars, and giving students hands-on experience of using these applications.

Maintaining a Quick Response Across the Whole Summer School

The Webmaster must plan effectively. There are several TLPs being developed at the same time; each at a different stage of development. It is important that the Webmaster responds quickly to determine what is feasible. Students must see their ideas being realised quickly, perhaps in a form they had not thought of.

Liaising with Other Staff

The Webmaster must interact not only with the 10 or 12 students developing TLPs, but with an equivalent number of academics, and with a range of administrative and technical staff, too.

Translating into the Final Product

As mentioned earlier, once a package has been produced, the Webmaster takes some responsibility for quality assurance and for checking accuracy. The Webmaster works beyond the summer programme, to ensure TLPs reach their 'final professional form'.

aster and

Other Technical Support

'You set everything up, and the photographic unit come to set the backdrop, lights and camera. You have already done the practical to make sure it works and checked the timings. The Unit video the practical, and get it back to you in the most suitable form. You have to think of the students. It might be better as a series of photographs, rather than playing a whole video back.'

'With the support and suggestions of technical staff, I developed a new mechanism. The coil is enclosed in a big perspex tube to keep the temperature stable. I developed a mechanism to stop it creeping until it was ready... I had to solve the problem by creating the enclosure, but then had to find a way of touching the coil to start it creeping... We worked on it together with the guys in the workshop.'

'I talked to the photographer about how best to see what is going on. We are doing time lapse; taking stills every minute or so, then feeding into the computer, and will play them back at a different speed. This will be an excellent way to illustrate what is going on.'

'I started with simple 2D drawings, and then moved to animation showing the construction drawn in stages... I couldn't find any reference for the coordinates, and ended up writing the program to calculate it, using another piece of software... With technical support, I took snapshots... different angles. At ten degree intervals it still gives you enough to appreciate the structure is in 3D, and also cuts down on file size. Which is important if you are trying to make it available on the web. It can't be inaccessible to anyone who is not on the internet.'



In addition to the Webmaster, students are given access to technical and photographic staff to support the development of TLPs. This enables them to engage in a collaborative problem-solving activity, as is illustrated by the four examples above.

Students take a leading role; considering and planning to meet the needs of the target audience, and solving technical problems. Throughout, the over-riding concern must be to meet the needs of the learner.

9: Supporting Development – Other Students

‘People required very little management. Those who signed up were very keen. They would turn up at 9am and not leave until after 6pm some nights. The problem was more about stopping them, rather than making them turn up.’

The Department does not need a formal system for managing the development process on a day-to-day basis. Students are sufficiently self-motivated that nothing further is necessary.

However, the evaluation did reveal that having other students present is highly beneficial. Experience with the Summer School has taught that:

- Although students are strongly self-motivated, having other students nearby helps sustain interest, and makes students more productive.
- Students who have gained expertise in specific areas of computer technology are highly valued. Such ‘pioneers’ will often influence others to experiment with a different approach.
- Having access to a variety of perceptions and reactions from other students proves valuable in promoting understanding, and in driving development forward.
- A strong case can be made not simply for giving students access to the perceptions and reactions of others, but also for putting together a group from different years of study. ‘Older’ students can give extra information, make suggestions about what is appropriate and realistic, and provide explanations to enhance understanding. Less experienced students also

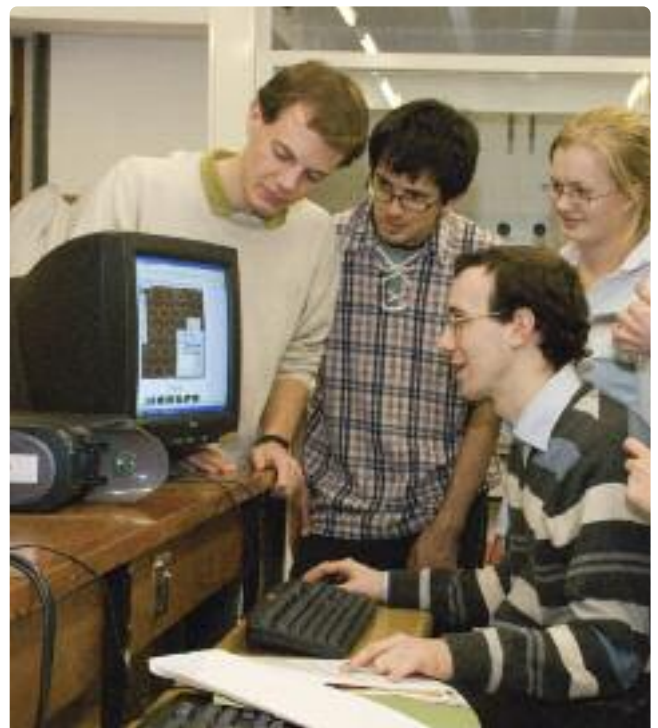
have a role to play. For them, the assumptions have not yet been ‘knocked away’. Their input is a timely reminder of what represents ‘the appropriate level’ of communication for the TLP.

- Finally, the group may come together to focus on a particular problem, pooling knowledge and exploring possible solutions.

It is clear that individual developers value the support and guidance offered to them by other students engaged in the programme; especially from those who can combine an overview of the undergraduate course, with previous experience of developing TLPs.

In summer 2007, the Department decided to build on this, and to formalise the ‘support process’ by giving a student the responsibility of Student Co-ordinator.

It is on this new role that the next section focuses.



10: The Student Co-ordinator

External evaluation by UKCME in summer 2007 revealed that the Student Co-ordinator has a role in:

- reinforcing in students the value of the work, and of the benefits to be gained by participating in the Summer School
- raising awareness of the characteristics of a TLP; of what this resource can achieve
- facilitating TLP development, by signposting students to relevant resources / facilities, and to particular expertise (including that held by other students)
- ensuring progress is being made, especially as made public in the Weekly Meetings (see later).

Crucially, the Student Co-ordinator must pay careful attention to meeting the particular needs of individual students. Much of the work is done on an informal basis; chatting over coffee.

It is clear from the evaluation that:

- The Student Co-ordinator can act as an intermediary between the student developer and the Webmaster. By working alongside the latter, the Co-ordinator ensures that the Webmaster is not brought into the development process needlessly; drawn into cases when specialist technical knowledge is not needed.



- There is a clear appreciation that sensitivity and versatility are needed, when attempting to respond to students' needs. Students may struggle, even lose heart. This needs to be spotted and attended to; but the mechanism for providing support may vary from one individual to another.
- A problem may occur as a result of inadequate academic supervision. While the Student Co-ordinator remains carefully divorced from the role of determining content, s/he can offer a temporary supportive role.

In addition to the support mechanisms provided by the Department, weekly meetings are also held, primarily to monitor progress. The value of this strategy is considered next.

11 Monitoring

Monitoring Progress – The Weekly Meeting

- The meetings are held weekly and all students are expected to attend. The message is clear – the Department is taking the programme seriously.
- The presence of the supervisors, Webmaster, Administrator/Academic Co-ordinator and other technical staff is impressive. Not only does this give a clear message to students about the importance attached to this programme, it gives TLP development credibility. It represents an invaluable resource to provide alternative perspectives, suggestions and ways forward. Academic staff are particularly useful in suggesting alternatives, and refinements, and in making links with other relevant work: ‘Have you thought of...?’, ‘You may like to consider...’ Technical staff are invaluable in explaining how particular developments can be taken on, and how this can be made to happen.
- The climate is warm, friendly and welcoming (especially so for those at a very early stage of TLP development). The tone is encouraging and supportive.
- Nevertheless, there is a clear expectation that students would have given thought to the progress they had made since the previous week, and given adequate consideration as to how this was to be presented to the group.
- Students do take trouble to prepare for the meeting. They are able to present an up-to-date appraisal of progress, along with a preview of the way forward.
- For those newly joining the programme, the meeting gives clear messages about what is required of them, defining unequivocally that high quality is expected from the development work.
- For those some way through the development programme, there is a clear reminder of the impressive work being undertaken by others. This operates to motivate students. But, the meeting also provides further guidance and support based on the input of participants who genuinely wish the TLP programme to succeed.

(Evaluation Notes, Summer 2006)

Progress



From the evaluation, these meetings give instant feedback – reactions from all those present – on the quality and suitability of their work to-date. The students gain an appreciation of alternative ways of proceeding, beyond those of their supervisor, based on the insight and experience of both academics and students. As a result, students are signposted to alternative resources available to enhance TLP development. The presence of the audio visual / photography staff enables immediate judgements to be made in relation to technical feasibility, and the way forward.

It is clear also that, although there is a strong focus during these meetings on graphical representation, great care is taken to ensure that the integrity of the scientific content is protected. Improvements are suggested to ensure that misunderstandings and misconceptions are avoided. This cannot be technology for its own sake.

Finally, students confirm that these opportunities to network serve to boost confidence. Students go back to working on their TLPs believing they have made progress, and stimulated to go further.



Benefits - Staff

'The students bring a slightly different perspective. They are consumers. They know what might be interesting and helpful. Some of the students have been very productive.'

'I am impressed by what the students are capable of producing. They are impressive in terms of putting knowledge together. They are able to repackage this information into a readable format.'

'We were really quite surprised by how creative the students can be. They bring a wide range of incidental expertise and experiences relating to IT. Most have been good, coming up with interesting suggestions to illustrate concepts.'

- gain a fuller appreciation of the teaching-learning process
- enhance their working relationships with staff
- develop capability in relation to working as a member of a team
- become enthused by Materials Science, and are more likely to choose to study the subject in subsequent years.

Visiting academic supervisors also benefit from the experience, and this is considered in the next section.

The above comments focus on the benefits gained by the Department from using students to develop TLPs. Staff have been impressed with what has been achieved. Students bring a consumer's perspective. They have been very productive, developing packages of very high quality. They have been able to draw on their experiences and on their own expertise, especially in relation to IT, to develop a creative and alternative approach to representing the curriculum content.

In addition, staff believe that, as a result of working on the programme, participating students:

- grow in confidence
- develop greater practical (and IT) competence



13 Benefits – Visiting Supervisors



Expanding the Summer School in 2007 has meant that academics from outside Cambridge have gained experience in developing TLPs.

The external evaluation (2007) reveals that visiting supervisors:

- gain a greater awareness of what a TLP is, and of what it can achieve
- have an enhanced understanding of what e-learning resources are now available
- are more likely to search for other TLPs, and to incorporate these resources into their teaching
- will share TLP developments with other colleagues at their own institutions to spread the use of the e-learning approach.

In effect, for visiting supervisors, the Summer School was ‘a growth process’; introducing participants ‘to another way’ of looking at things. As a result, an appreciation has been promoted of the potential of e-learning packages, and expertise has been gained which could be used for future development, and in relation to using TLPs to promote student learning. It is clear also that external supervisors would be pleased to become involved in future programmes of development.

Perhaps the most potent evidence relating to benefits however comes from the participating students themselves, and it is to this that we now turn.

14: Benefits – Students

The evaluation reveals that students believe they develop in a number of ways:

'It is a useful experience. It gives you an insight into working in the Department. It gets you more involved in the course, its content and its teaching. I now know more about the problems faced when you are trying to get people to understand the subject.'

- A number of students endorsed the view expressed by staff that they had benefited from working in the Department during the summer. As a result, they had gained an insight into how the Department operates, and a positive appreciation of how colleagues interact. The Summer School meant that students had become 'more involved with the course' and more appreciative of the issues relating to teaching the subject matter.



'I have been learning FLASH over the last couple of weeks, and I now believe I can do the animations myself.'

'I have learned how you can use Photoshop effectively to edit the images to bring the text up, to make the process more interactive.'

- Students acknowledged that participating on the programme had enabled them to develop skills; in some cases gaining opportunities to build on skills they already had in place; in other cases learning something new.

However, student comments do not only relate to skill development. They also give out a message of confidence in their use. Students now believe they can 'do the animations'; can 'use Photoshop effectively' to accomplish the task.

'You develop "people skills". You must learn to work with others – students, academic staff and departmental support staff. You need organisational skills – there is a lot of thinking through and planning how you can put all of this diverse material together. How to select it and sequence it in a limited, defined timescale.'

- Again, messages from the staff are reinforced. Students learn to work effectively together; to organise, plan and sequence; to deliver a final project against a pre-set deadline.

Students

'I have got a better understanding of the whole of the first year course. Having the lecture notes, and the question sheets is one thing, but when you have done the TLPs you do think about the course more; go deeper, struggle to get to the fundamentals.'

- In addition, students were convinced that by participating in the Summer School, their understanding of the theory underpinning the course had been enhanced. Working on the TLP had forced them to 'go deeper, [to] struggle to get to the fundamentals'.

'It made me more confident to do Materials in the second year. More happy to be doing it, really wanting to do it.'

- Again, students agreed with staff that the experience of working on the TLPs had made them more positive about studying Materials Science.

'The TLPs are gaining popularity fast. With the increase in numbers, people are becoming a lot more aware of them. And, working on the TLPs is becoming more popular as a way of working during the summer.'

- Finally, one of the benefits gained by the students was a conviction that they were doing something worthwhile; that they were part of a success story, with the TLPs and the Summer School becoming more popular.

The UKCME Supported Change Programme was augmented by JISC funding to widen the Summer School of 2007 to others from outside Cambridge. It is clear that this brings additional benefits for those who participate from elsewhere:

'I felt part of the group... It was a real experience to live in a College, and be a student at Cambridge.'

(Visiting Student)

- There is a cachet to being a Cambridge student, to living in a Cambridge College, and the visiting student gets to 'experience' this; albeit only for a few weeks in summer.
- There is the confidence also to be gained from coping with the unfamiliar; of becoming accepted by colleagues from another institution, and of working successfully on a common enterprise, with people who were previously strangers.

Attention now falls on how TLPs are used.

Using TLPs

'The fact that there has been student involvement and ownership...you feel that if the students who wrote the TLPs understand the content, then you as a learner should be able to understand it.'

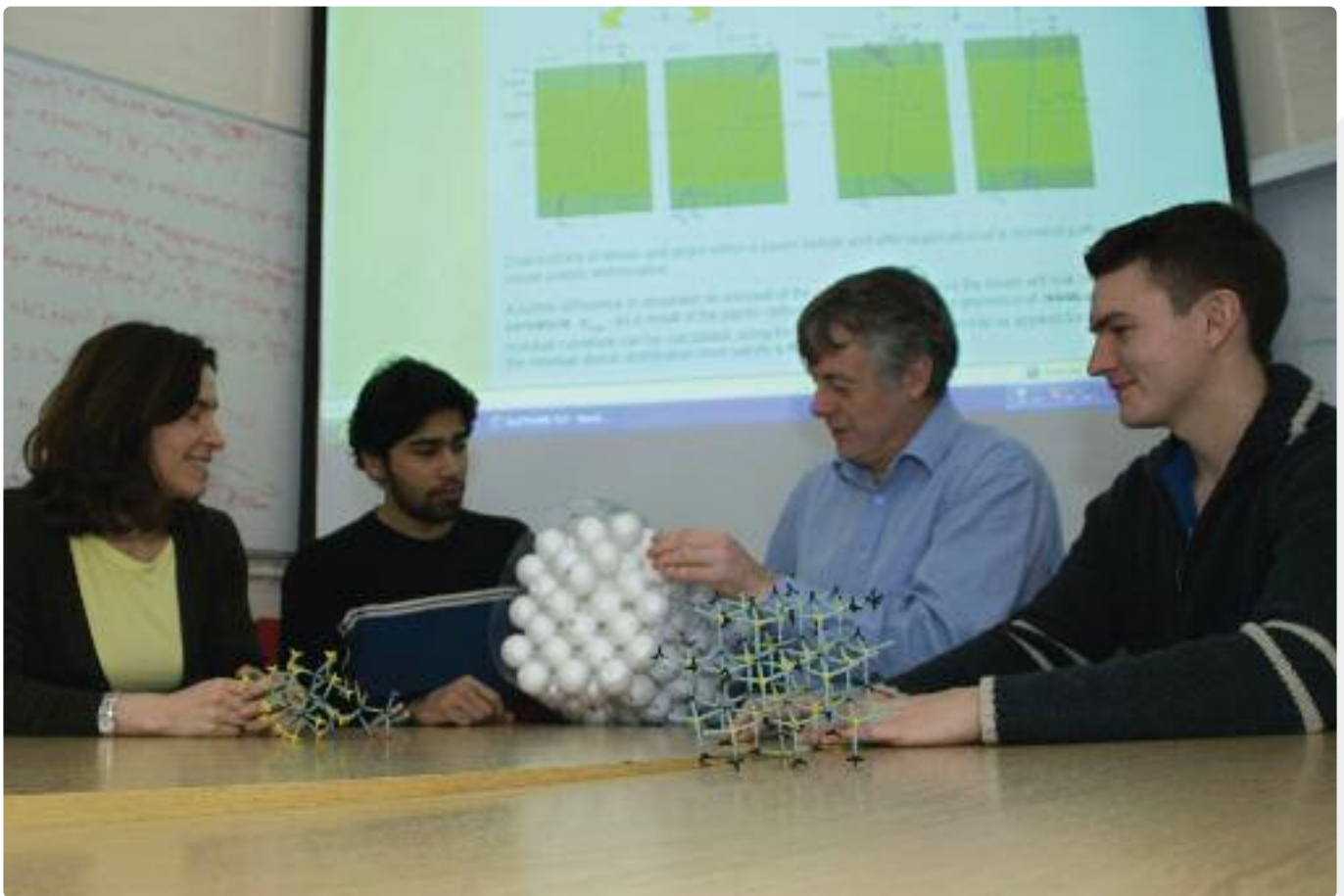
'You know the resource has been created by one of your peers. This is not like a textbook, which may be impossible to read...it is at our level.'

'You know the TLP information, that the content is right because it has come from the Department. Your lecturers and supervisors have been involved, which makes it more reliable somehow.'

The students appreciate the value of the TLPs. These resources gain 'authenticity' because they provide a student 'take' or 'slant' on the topic, and because they have been developed by students following the same courses.

They are also highly convenient. They remove the frustration of an internet search, and the need to cope with an overwhelming volume of information. They link specifically to the lecture notes. Finally, they have credibility. They are trusted because they have been subject to a recognised quality control process, having been filtered for accuracy by academics, and by other staff.





Evaluation has revealed that staff, as below, had been reinforced in their use of TLPs from the feedback they had received from students:

'The students all get pointed to the TLP resource website. A lot of students have told me that particular TLPs had been useful. They had checked some out and found things had been explained in a different way, so that they understand a bit better now.'

This confirms that the packages are a valuable resource.

How has this enthusiasm for TLPs been translated into practice within the Department?

TLPs in Practice – The ‘Global Reach’

‘It is being used worldwide. We get enquiries each week from all over the world – this clearly suggests that people are using it, but obviously in different ways. Quite a few of the enquiries are from students; others are from academics suggesting usage and highlighting possible errors or improvements. They don’t actually offer to produce TLPs, but do make suggestions and say “Have you possibly thought about a TLP in this area?”’

Enquiries from all over the world indicate that the TLPs are reaching a wide audience, and being used in a variety of ways. Such enquiries also provide suggestions for further work.

But, what of the Department itself?

Evaluation has revealed evidence of growing use of TLPs by both students and staff; the latter developing confidence and evolving expertise in incorporating these resources into the student learning experience.

The TLPs are no longer seen simply as stand-alone resources to bolt onto a practical or demonstration. Increasingly during their teaching, lecturers are making explicit links to specific TLPs or are incorporating them – or elements of them – into the lecture.

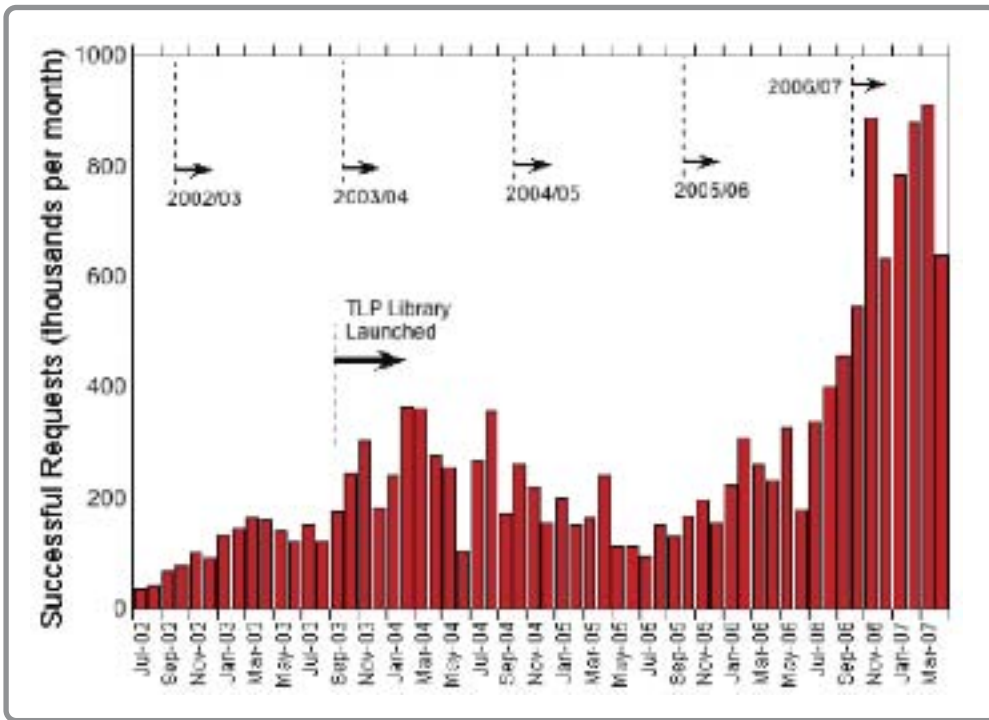
Some examples of the use of TLPs, drawn from the interviews, are presented below:

The TLPs were:

- being incorporated directly as elements in the lecture to reinforce understanding
- actively linked with the lecture to be used later by the students. Again, the aim was to reinforce understanding by providing alternative ways of looking at subject content; but also to make available additional material not incorporated in the lecture, to enrich the learning experience
- actively linked with courses to be used as a revision tool, ‘to help relieve the tedium of reading through the lecture notes’.

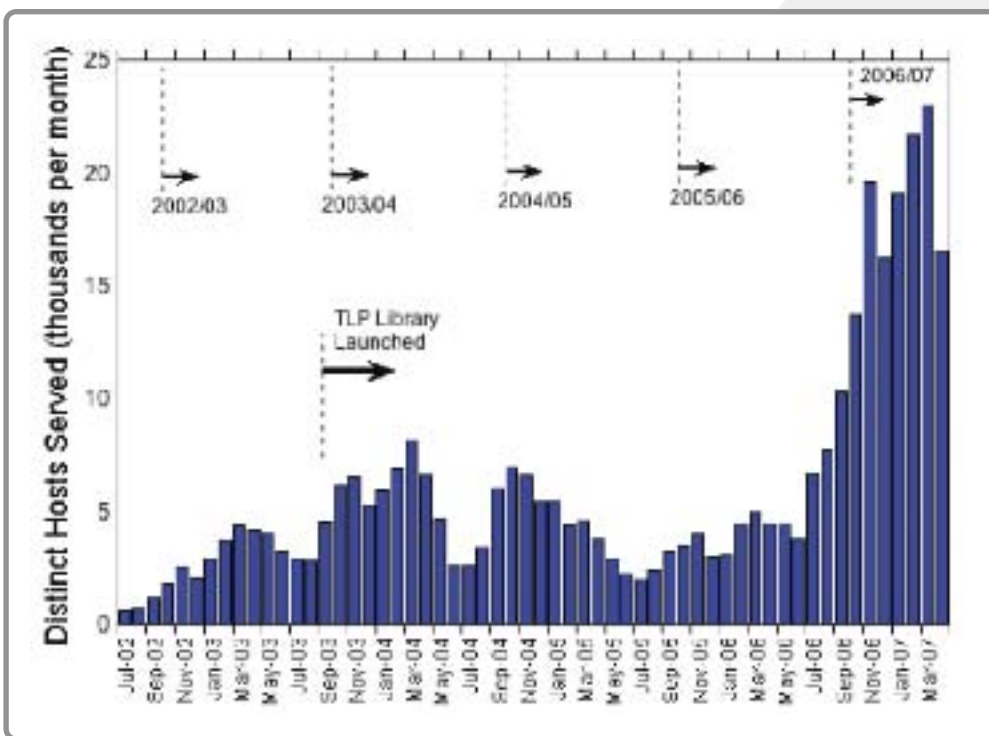


Practice – TLP



The statistics represented here clearly show the dramatic increase in user interaction since the inception of the UKCME Supported Change Programme in summer 2005.

A further analysis undertaken in September 2007, revealed that the TLPs developed at Cambridge invariably feature in the top five websites when undertaking a Google search.



17 Concluding Remarks – The Way Forward

This is clearly a success story, which is based on evaluative evidence.

Engaging actively and successfully over the years has placed e-learning developments within the Materials Department at Cambridge on very strong foundations. There is now permanence, continuity and a strong commitment from senior colleagues, with an increasing number of academic staff becoming actively involved in the production and use of e-learning resources.

What has been innovative, perhaps unique, about this initiative, has been the strong commitment to having students work in partnership with academics. Students have an invaluable role to play. They draw on their experiences as learners. They bring a fresh perspective, and are clearly capable of representing course content in a creative and alternative way.

A great deal has been learned to make this happen. Practices are now in place to select and support the students. Expertise has evolved relating to the resourcing and management of the development process. There remains a strong emphasis on ensuring a high quality end-product is delivered.

What has also emerged from this year's experience is that the support systems and practices in place are both 'robust and elastic'; capable of incorporating without difficulty both academic and student participants from other institutions. Indeed, the most recent evaluation

has identified the clear benefits to be gained by both these parties.

Although the Summer School is a major success story, the Department at Cambridge does not intend to rest on its laurels. There are now plans to develop further, by:

- Expanding the programme of TLP production, and widening the range of learning resources on offer
- Encouraging participation in the Summer School from academics and students from other institutions
- Engaging in a systematic appraisal of where and how e-learning resources are currently being used
- Promoting a more active use of e-learning resources within the Materials community.

Clearly, the Department at Cambridge cannot do all of this on its own. This must become a 'national initiative'. What is now needed is ongoing support and an active contribution from others in the community. There is also a need for forward planning, both strategically and on an annual basis. The UK Centre for Materials Education, most recently with JISC funding, has been able to play a vital role in supporting these developments at Cambridge.

Endorsement

Institutional Endorsement

The University of Cambridge is delighted to see initiatives facilitating web-based learning. The Summer School in the Department of Materials Science and Metallurgy is particularly notable for the key undergraduate engagement with the production of teaching resources, a feature providing multiple benefits. The University is very grateful to UKCME for supporting the development of this landmark, internationally relevant programme. We look forward to collaborating further with UKCME to extend this work, building on the excellent approach clearly set out in this Case Study.



Professor Melveena McKendrick
Pro Vice-Chancellor for Education

The Summer School in the Department of Materials Science and Metallurgy at the University of Cambridge produces web-based outputs for the promotion and teaching of the discipline of Materials. In addition to being used extensively by staff and students within the Department, these outputs are intended to have a global reach, and we do indeed have evidence that the teaching resources are used and appreciated across the world of Materials Science.

The outputs are produced by undergraduates in partnership with academic staff. Through the UKCME Supported Change Programme initiative, many staff from across the Department are now involved, and the Summer School has expanded to include colleagues from other Departments in the University, and from Materials Science Departments in other institutions. It has been a particular pleasure to see the positive effects on our undergraduates, developing their communication and organisational skills, increasing their technical knowledge of Materials Science, and building their confidence.

The Department's informal impression that the Summer School is an all-round success, needed validation, and so I challenged the UKCME team to provide a thorough evaluation. This they have now done, and magnificently so. I am impressed by the extent and scope of the research evaluation undertaken. UKCME's report captures all the relevant messages regarding the excellent practices that have evolved in the Department and, very importantly, it identifies strategies for further improvements.

This Case Study is very positively received by the Department, highlighting that our work with students to develop web-based teaching resources is of national and international significance, while also benefiting the individuals involved. We could not have made this progress without the continued support over the years from colleagues at UKCME. This Case Study itself is a valuable resource on which future planning and development can be built. In particular, we look forward to the evolution of the national Summer School. In that regard, continuing partnership with UKCME will be essential to shape, manage and sustain outcomes of the highest quality.



Professor A. Lindsay Greer
Head of Department of Materials Science and Metallurgy

References & Acknowledgements

DoITPoMS

- Dissemination of Information Technology for the Promotion of Materials Science
 - *based at the University of Cambridge*
- www.doitpoms.ac.uk

UK Centre for Materials Education

- the national Subject Centre (of the Higher Education Academy) for the UK Materials community
 - *based at the University of Liverpool*
- www.materials.ac.uk

MATTER

- Materials Science and Engineering educational software
 - *based at the University of Liverpool*
- www.matter.org.uk

JISC

- Joint Information Services Committee
 - *based at the University of Bristol*
- www.jisc.ac.uk

The UKCME would like to thank all the staff and students who contributed to this Case Study of the Summer School at Cambridge, and who also approved the use of the various digital images in the final publication.

A special thanks to Professor Bill Clyne, who initiated and has evolved the programme of activities in the Department that have led to the national Summer School.

We would also like to acknowledge the crucial role of the current Webmaster, David Brook, who works in partnership with UKCME to make the Summer School such a success.



Partnership with Students

Working in Partnership with Students: The Summer School at Cambridges: a Case Study from the UK Centre for Materials Education

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