DEVELOPMENT OF A WEB-BASED PLANT SCIENCE TEACHING RESOURCE FOR USE BY UNIVERSITY LECTURERS

The Gatsby Plants Teaching Resource

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Abstract: Undergraduate interest in plant science has reached a new critical low; with so few students taking plant-based options that some Universities no longer do a separate Plant Science degree. This raises the question "where is the next generation of British plant science researchers going to come from?". The Gatsby Plants Teaching Resource http://www.gatsbyplants.leeds.ac.uk/tr aims to support research academics to provide stimulating and inspiring plant science teaching to reverse this downwards trend. The on-line resource will supply a mix of novel teaching ideas, images and practical protocols, as well as holding a database of plant science lecturer contacts so the lecturing community can work together to spread good teaching practice.

1 INTRODUCTION

Plants hold the key to many of the world's problems, such as food production; managing the environment and climate; providing alternative renewable energy sources and materials. But solutions need graduates with a solid understanding of plant function, diversity and potential. However, recent years have seen a rapid decline in undergraduate student uptake of plant based options, with a knock on effect of reduced numbers choosing plant science for post graduate studies and as a career. It is often the case that students arrive at University with a perception that 'plants are boring' and with a poor understanding of the subject.

The Gatsby Charitable Foundation supports plant research and, recognising this problem, has funded Gatsby Plants – a 4 year National Teaching Facility for Plant Sciences, coordinated by Dr. Celia Knight at the University of Leeds.

Gatsby Plants aims to support academics to provide stimulating and inspiring plant science teaching to reverse this downwards trend and enthuse students. One part of this initiative is the Gatsby Plants Teaching Resource (http://www.gatsbyplants.leeds.ac.uk/tr), which is currently running as a pilot resource. It aims to provide University lecturers with access to novel and inspiring plant science teaching material developed by experienced lecturers in the field.

In this paper we describe the approach we have taken in the development of this teaching resource. The link between research and teaching is core to our approach, as is the support of a network of University lecturers from 20 UK Universities who have been key in identifying teaching requirements, defining the user interface, providing direction and will continue to be central to the development of the teaching material. This resource has been developed with the lecturer as the user, so that they may download and use material from this resource for their University teaching. As such it is described as a Teaching Resource and the emphasis is to develop inspiring teaching material rather than informative material alone.

2 IDENTIFYING USER REQUIREMENTS

2.1 Method

In order to establish the design and direction of the resource we sought the views of the Plant Science lecturing community through a user survey

consisting of a focus group meeting and a questionnaire which was sent out to an established network of university lecturers from 20 UK Universities. The focus group meeting and questionnaire were constructed to examine the following key areas:

1. Lecturer use of on-line teaching material.
2. Priority content for the proposed resource
3. Priority features for the proposed resource

Questions took two forms: multiple choice or open ended questions. The multiple choice questions asked lecturers to rate resources/features as either very useful, useful, fairly useful or not useful. Other questions required lecturers to input their answers or comments into text boxes.

2.2 Results

18 lectures from 12 UK Universities and research institutions responded to the user survey, either through the focus group or on-line questionnaire. A scoring system was then applied to the ratings (very useful=3; useful=2; fairly useful=1; not useful=0) for analysis. The results are summarised below.

2.2.1 Lecturer Use of On-line Teaching Material

67% of plant science lecturers use on-line material to support their lectures. The most used types are images, movies and on-line databases (e.g. DNA sequence databases, protein interaction databases, DNA analysis programmes).
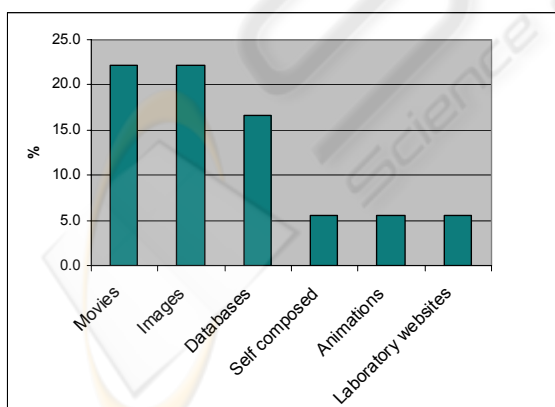

Figure 1: Types of on-line teaching material used by plant science lecturers (n=18). On-line databases refers to DNA sequence databases, protein interaction databases, DNA analysis programmes; Self composed refers to learning and revision packages created by the lecturer.

2.2.2 Establishing Priority Content for the Proposed Resource

Lecturers were asked to suggest and rate the types of resource which would best support their teaching. The resources that were ranked highest were: high quality images; animations to explain a concept, short video clips (3 minutes or less) and practicals.
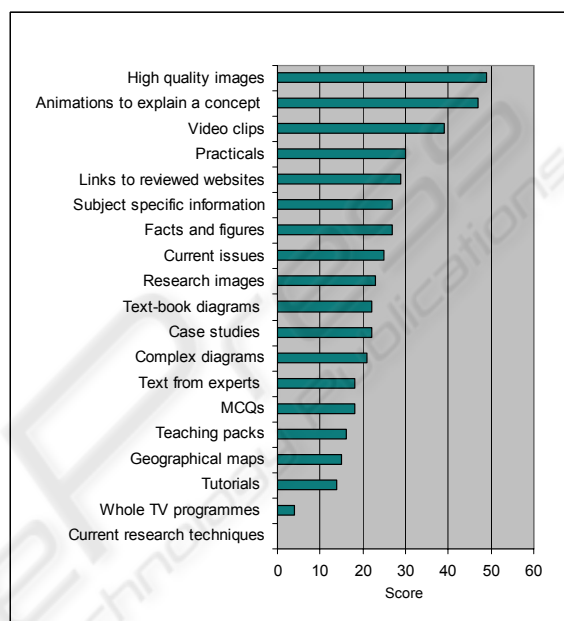

Figure 2: Lecturer resource preference. A high score indicates a resource that was assessed as most useful in supporting lecturer teaching.

Other favoured resources included:
- Links to reviewed quality web sites,
- subject specific information e.g. plant physiology,
- facts and figures,
- current issues,
- research and text book images and
- case studies.

Resources which did not rank highly included tutorials, Multiple Choice Questions, whole TV programmes and materials which are pre-packaged into 'teaching packs' for a particular key concept or topic.

Analysis seems to show that lectures would prefer to be given raw materials from which they build their own custom made learning resources rather than pre-packaged learning materials. This is perhaps not surprising given that raw materials may be incorporated into a module which may change and evolve from year to year with relative ease.

Further consultations with the plants science community has highlighted the importance of having all teaching material peer-reviewed for accuracy, relevance and quality. This could be done through a resource-review panel or subject consultants who could comment on materials submitted to them and identify priority content for a specific subject.

2.2.3 Establishing Priority Features for the Proposed Resource

Lecturers were asked to rate potentially useful web site features. The features that were rated highest (with a majority of lecturers rating them as very useful) were:

- that all teaching material should be free for educational use,
- that the web site should facilitate browsing as well as searching;
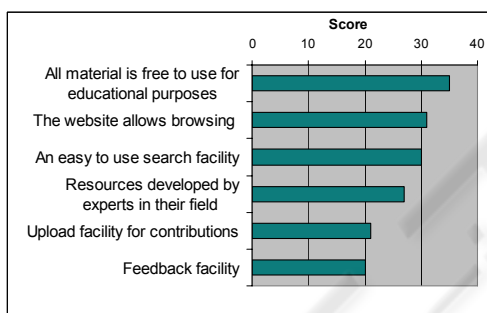- and that the teaching material should be developed by experts in the field.

Figure 3: Lecturer preference for web site features and functions.

Given the high rating attributed to browsing for teaching material, lecturers were asked to state how they prefer to browse for teaching material. Lecturers rated browsing by subject and by resource type as their preferred browsing categories.
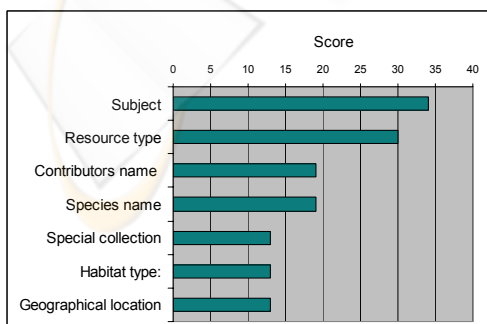

Figure 4: Lecturer preference for browse categories.

3 EVALUATION OF DIGITAL OBJECT REPOSITORY MANAGEMENT SYSTEMS

Several options were available to us in developing the digital object repository management system (software system) required to facilitate delivery and management of the Gatsby Plants Teaching Material:

1. A bespoke 'in-house' system
2. Commercially available system
3. Freely available, open source system

A brief evaluation of commercially available and open source software systems was carried out. The evaluation was based on testing the 'user side' and where possible accessing and testing the 'admin side'. A technical evaluation of most of the evaluated open source software was assessed through a report published by the Open Society Institute: A Guide to Institutional Repository Software,
http://www.soros.org/openaccess/pdf/OSI_Guide_to_IR_Software_v3.pdf

Commercially available digital asset management systems:

- Contentdm
- Digitool
- Symposia
- Endevour: encompass

Open Source digital asset management systems

- DSpace
- Fedora
- CDSware
- i-Tor
- MyCoRe
- OPUS
- Greenstore

While many of the software systems evaluated mostly met our requirements, developing an in house bespoke resource was the best option available to us. Although open source software would mostly meet our needs, considerable in-house technical expertise would be required to install onto a server and adapt to our requirements. No technical support is offered other than that available through discussion fora and BLOGS. Furthermore, many of the additional features found in open access and commercial systems were found to be unnecessary for our purposes, as defined by our user requirements. A bespoke system developed in-house would have the added advantage of being adaptable so that we would be at liberty to respond rapidly to user requirements.

4 THE GATSBY PLANTS TEACHING RESOURCE

4.1 The System

The development of a bespoke digital object repository management system was required to facilitate delivery of the Gatsby Plants Teaching Resource. Institutional support was a major contribution to the decision to adopt PHP and MySQL database for the necessary dynamic

database driven web site.

The system uses a MySQL 3.23 database with PHP 4.3.1 web pages on a SUSE Linux v.8.2 operating system on an Apache 1.3 server. The system consists of a user end and an administrator side. The administrator side has been designed to accommodate content upload, editing of content metadata and deleting. The system accommodates deliver of a variety of teaching media (jpegs, gif, ppt, MPEG, streamed video (AVI), word documents, url links) as well as a database of lecturer contact details. The system is scalable and may be modified to respond to user requirements.

4.2 The User Interface

The user survey informed the user interface design. The ability to browse by subject, resource type and contributor as well as to search the teaching material was implemented.
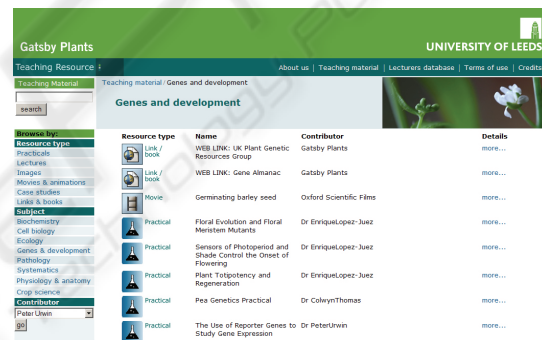
Figure 6: Resource type specific icons are used to facilitate navigation.

4.3 Teaching Materials Development

The user survey was essential in establishing priority content to be delivered through the Gatsby Plants Teaching Resource. The following have been prioritised:

- High quality images
- Video clips and animations
- Practical class exercises
- Links to quality web sites
- Development of subject specific content (Plant Physiology in the first instance)

4.3.1 High Quality Images

Targeted publishers and organisations have been approached for high quality images. Research images will be sought from the research community
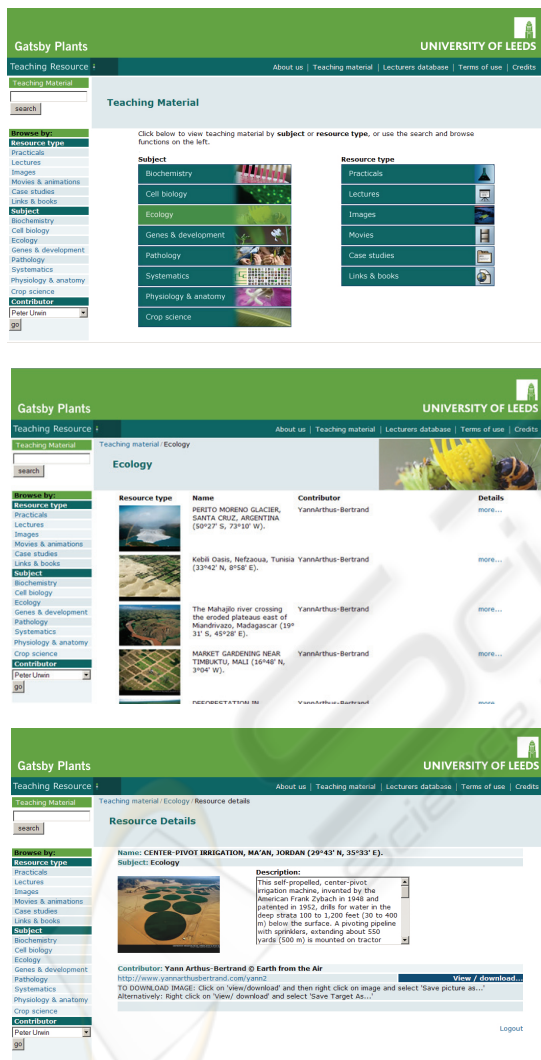

Figure 5: Three screen shots of the Gatsby Plants Teaching Resource. The user is able to search or browse the teaching material by subject, by resource type or by contributor. Selecting a category takes the user to a resource list page. Selecting a resource takes the user to a detail page, from where viewing and downloading the full resource is possible.

and targeted research journals. The plant science community will be consulted to identify key images.

4.3.2 Video Clips and Animations

In response to the user survey, which identified time lapse photography of plants as useful content, we have initially acquired 5 such clips and if further need is established, will acquire more.

Further consultation with the plant science lecturer community identified the use of short films highlighting key research breakthroughs as potential lecture hooks. We intend to trial the production of such short films. The aim of this novel resource is to produce a film of about 5 minutes for lecturers to use in a number of different ways. The emphasis of the film will be to inspire students rather than informing them through the film alone.

4.3.3 Practical Class Exercises

A focus group of plant science lecturers was created to look into the issues surrounding practical classes. Tried and tested practical class exercises that illustrate key concepts in contemporary plant science were identified as a much needed resource. Gathering such practicals has subsequently been identified as key to the initial stages of developing more subject-specific content.

4.3.4 Links to Quality Websites

An extensive, although not exhaustive, survey of over 60 plant science related web sites has been carried out. The best web sites have been included as links from the Gatsby Plants Teaching Resource. Additional evaluated links are included as necessary, most come from recommendations by the plant science community. Links will be reviewed on a regular basis to ensure their continued relevance.

4.3.5 Development of Subject Specific Content

The development of content within a specific subject area will be piloted. A strategy has been put into place where by an established and recognised member of the plant science community will champion a subject area, identify content and encourage contributions from the plant science community.

4.4 Copyright

Copyright is governed primarily by statute and the Act now in force is the Copyright, Designs and Patents Act 1988 (CDPA 1988). Often copyright is transferred to publishers when an academic publishes his or her research in a journal. Furthermore, although the legal position is inevitably complex, the law is such that, unless there are specific agreements to the contrary, an academic's employer would normally be regarded as owning all intellectual property generated by them during the course of their employment, with some exceptions (Leeds University Library, Copyright and Licences http://www.leeds.ac.uk/library/rights/). These two factors broadly mean that much of the material we receive from academics requires rights clearance not just from them as authors (since they hold the moral rights on their materials) but often from publishers or/and their employing institution before it can be made freely available, through the Gatsby Plants Teaching Resource, for educational use. We have worked with the University of Leeds lawyer to develop the appropriate procedures and licenses to copyright clear all materials for educational use.

4.5 Additional Features

4.5.1 Lecturers Database

A database of plant science lecturer contacts has been established so that the lecturing community can work together to spread good teaching practice. The database includes over 150 plant science lecturers who have agreed to be contactable to discuss teaching and possibly share resources. The database covers contact details, research interests and, where provided, teaching interests. This database has already been essential in providing feedback and disseminating information on important learning and teaching issues. An associated discussion forum will be piloted and evaluated to assess whether it is an effective means of facilitating discussions amongst the plant science lecturing community and so help spread good teaching practice.

4.5.2 Password Protection

The question of whether the website should be open access or password protected was discussed as part of the practical focus group. The decision was made to password protect the site for three reasons: to reassure contributors of resources that their material

was only going to be accessible by legitimate members of the plant science community, to protect lecturers in the lecturers database (see section 4.5.1) from unsolicited contacts and to allow the Teaching Resource users to keep one step ahead of the students they are teaching. New users are required to register and usernames and passwords are only supplied to genuine plant scientists working at research institutes or Universities.

The issue of password protection will be reviewed at the end of the pilot year to see if it has had any affect on the user experience or facilitating clearing copyright for access to novel teaching resources.

4.5.3 Plant News and RSS

The user survey highlighted the importance of providing information on plant science current issues. In response to this we are developing a 'Plant News' area to inform users on current developments and breakthroughs in plant science as well as any plants science being reported in the news. Furthermore, as highlighted in by JISC the profile of a resource may be raised by using RSS for newsfeeds and alerting (JISC, 2005). RSS will be used to disseminate 'Plant news' and also to inform users about new content and so draw interested users to the Gatsby Plants Teaching Resource web site and maintain user interest.

4.5.4 Resource of the Week

Furthermore we will implement a 'Resource of the week' area to highlight teaching material within the Gatsby Plants Teaching Resource.

4.6 Evaluation

The Gatsby Plants Teaching Resource was launched in September 2006 and is currently at the pilot stage. The resource will undergo development and evaluation over the next year.
User statistics will be used to gather access information such as,

- visitor characteristics, e.g. regional distributions and institutional affiliations,
- visitor technical profiles,
- visit characteristics, such as visit referral, visitor browsing and searching preferences, materials downloads.

Feedback will be generated both passively through the website and actively through targeted questionnaires and interviews with individual users.

This feedback will generate information on content use by subject, visitor materials type preferences, visitor scenarios of use, visitor satisfaction and suggestions for improvement, visitor perceptions of materials and visitor perceptions of impact.

5 CONCLUSIONS

A system to accommodate deliver of a variety of teaching materials (jpeg, PowerPoint slides, streamed video, downloadable video clips, word documents, links) and a database of University lecturers has been developed and will be undergoing evaluation during this its pilot year. The system uses a MySQL database with PHP web pages and consists of a user end and an administrator side. The administrator side has been designed to accommodate content upload, editing of content metadata and deleting. The system is scalable and may be modified to respond to user requirements. The user survey defined the design and user interface of the Teaching Resource. Preliminary feedback suggests the resource has been well received. The continued feedback from the plant science community will be essential in fine tuning the technical requirements of the Teaching Resource.

However, the technical side of the resource is not the major challenge to the development of the Gatsby Plants Teaching Resource. The greatest challenge has proved to be delivering quality and relevant content, which can only be achieved by close collaboration with the plant science community. Engaging the plant science community and developing its sense of ownership of the Teaching Resource will be key to the Resource's future.

The laborious nature of clearing copyright has, unfortunately, resulted in a slow population of the Teaching Resource by contributions. To overcome this we are targeting collecting subject specific content via a 'Subject Champion' and are trialling having the website password protected as a way of alleviating the worries of some contributors.

Once the Gatsby Plants Teaching Resource has become established, there may be the potential to expand the user base by extending the plant science teaching content to schools level and maybe providing learning resources directly to undergraduate students.

We anticipate that through engagement with the established network of plant science lecturers and researchers, the Gatsby Plants Teaching Resource

will grow to become a valuable teaching tool and will assist plant science lecturers in their task of inspiring future generations of plant scientists.

ACKNOWLEDGEMENTS

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