Departmental Teaching Enhancement Scheme
Final Report

Project Leader: Tina Smith

Project Title: Physical principles for bioscience students: A problem based learning tool

Report Due Date: 31 July 2011

Abstract
Please revise and insert your abstract to ensure it accurately reflects the outcomes of your project (as we will use this text for the Centre website and in our dissemination)

The aim of this project is to improve the ability and confidence of students to deal with physical science concepts when addressing problems in biosciences. This project will create an online resource aimed at developing physical science skills of bioscience students. The outcome will be an interactive web based template that allows problem-based learning materials to be embedded within courses in the wider biosciences community. Resources will be underpinned by research, and incorporated into the template to provide solutions to real life scenarios using physical science principles.

Tangible outcomes
Please reflect on the aims, process and outcomes of the project and tell us: What has been achieved? Was it necessary to make any changes to your original plan – what were they and what was the rationale behind them? Is there anything you would do differently another time or any advice you would give to individuals embarking on similar projects? Please attach or give details of how to access the outputs and resources produced (e.g. URL).

The main aim of this project was to develop physical science skills in bioscience students by:

- developing a pilot web-based template that allows interactive problem-based learning materials to be embedded within the delivery of biosciences courses

- using social networking / communities to engage students in learning and obtain feedback on the materials developed

- assessing the potential of disseminating the interactive template to the wider bioscience community to create a web-based repository of interactive problem-based learning materials

The first objective has been achieved with two learning problems having been generated based on an interactive online template built using the Moodle platform and the Moodle lesson tool. These learning problems adopted a real life scenario to teach and apply the physical science principles which were based on the concept of an implicit and explicit syllabus. The student and staff evaluation indicated that the resources had contributed to the learning of physical science skills by students. Based on student and staff evaluation, in the final modifications of these learning problems the first problem was broken down into two smaller problems and an additional lab skills tutorial was embedded within the second problem. These resources currently sit on the Roehampton University internal Moodle site (access to this will be granted to a nominated member of the UK Centre for Bioscience contact HEA, currently awaiting confirmation on who this will be).

To achieve the second objective an online forum and feedback facility were incorporated into the resources using the HTML blocks facility within Moodle. Their use received a mixed reaction from students; some expressed how useful these aspects were whilst the majority chose not to use them.

The potential to disseminate the interactive problem-based learning materials developed during this project to the wider bioscience community has been explored. Currently there are plans for the online resources to be hosted on Roehampton University's external Moodle site. Due to upgrades of the Moodle platform for the 2011-2012 academic year, and ongoing University initiatives to create public access to selected resources, public access will not be achieved until after the project completion date. When this occurs it is hoped that the UK Centre for Bioscience website will provide a link to the resources from their website.

Modifications to the project: As notified in the interim reports the project plan was modified so that the second learning problem was developed for MSc biomechanics students rather than 1st year biomechanics students. This tested the resource across a broader range of levels within HE and allowed investigation into using the resource to enhance learning for more complex concepts.

The original plan was to upload a revised / improved version of Problem 1 onto the University intranet by March 2011. However, as specified in the second interim report the finalisation of the template was ongoing until the end of the project. This allowed feedback from staff and students relevant to both Problems 1 and 2 to be implemented within the template and where relevant ensured consistency across both the developed Problems (e.g. formatting). It also allowed input from the external consultant responsible for web design to be incorporated into both resources. In addition, the student group for whom Problem 1 was developed continued to access the resource to aid their learning and therefore it was not appropriate to make significant changes until the module was complete.

The identification of appropriate web 2.0 technologies, development of an implicit and explicit syllabus and production of a guide to how we created the resource continued to be ongoing aspects of the project. This was due to the development of ideas through experience, input from critical friends, outcomes of evaluations etc throughout the project.

Outputs: The template and physical science based learning problems can be accessed through the Roehampton University Moodle site and when located on the external Moodle site will be accessible to the UK Centre for Bioscience and made available to the wider bioscience community. In order for similar problems to be generated by other individuals a copy of the implicit and explicit syllabus is attached, which demonstrates the approach to developing the problem based scenarios, along with a guide to using the Moodle lesson tool so that others may develop similar problems. A poster about the project is currently being finalised and reviewed by the project team.

An article for Bioscience Bulletin will be prepared when details concerning the submission guidelines are received. A journal article will be developed post project and a suitable journal identified to which the article might be submitted and a presentation about the project will be given at a suitable UK Centre for Bioscience event as advised by the centre.

Dissemination

a) How have you disseminated the outcomes from your project? (For example, a project website, presentation at a Centre or event or conference, journal article etc). Please include details of any future plans you have.

The project has been disseminated to staff within Roehampton University through two internal presentations. Firstly a seminar presentation entitled 'A Problem Based Approach to Learning and making use of Technology' which was given as part of the Roehampton University, Department of Life Science Learning & Teaching Seminar Series (March 2011). Secondly through a presentation entitled 'Using the Lesson Tool in Moodle to Facilitate Independent Learning' which was presented at the Roehampton University Learning & Teaching Conference (May 2011).

The learning Problems are currently hosted on an internal Moodle site and sit within the specific modules that they were aimed at. Teaching staff and students enrolled on these modules currently have access to the resources. The resources will also shortly be hosted on the Universities external Moodle site, which will allow public access to the resource. The 'How to use Moodle lesson tool' guide will also sit on the external Moodle site and electronic version of the guide will be disseminated to University staff during the upcoming academic year to encourage further use of the lesson tool.

Further plans for dissemination include the following:

- A poster about the project will be made available through the UK Centre for Bioscience website
- A brief article will be submitted to Bioscience Bulletin outlining the key outcomes of the project
- A journal article about the project will be submitted to a relevant education and / or bioscience journal
- A presentation about the project at a UK Centre for Bioscience event

b) How might the UK Centre for Bioscience help with further dissemination?

Identify upcoming UK Centre for Bioscience events at which this work can be presented. Provide details on how to submit an article to Bioscience Bulletin. Identify other key conferences or events to target where there will be a relevant audience for this project.

Once the electronic resources are available for public access and after liaison with the project leader, provide links to them from the UK Centre for Bioscience website.

Evaluation

a) What impact has the project had on your professional practice? For example, have you gained any new skills? Have you received any recognition within your own institution or externally?

The thorough student evaluation of the online resources has highlighted the value of such insight. Further feedback opportunities, beyond the standard module evaluation forms, have therefore been incorporated into modules, for example feedback links provided on modules pages on the University VLE, evaluative discussion etc.

Also actively incorporated into practice is greater provision of resources on the VLE that students can use in their own time. The student evaluation raised this as a positive aspect of the resource developed for this project, since, providing the opportunity to work independently removed the stigma associated with asking questions during lectures and allowed them to work at their own pace. Therefore further expansion of the resources developed during this project is planned, as well as more actively seeking out existing resources which would complement other taught modules and provide additional opportunities for students' to learn independently.

Completing this project has led to improved competence in using IT and audio visual resources for learning and teaching purposes and developed my ability to use more complex features of the University VLE (Moodle platform). It has also greatly increased my knowledge of e-learning and the use of web 2.0 technologies to aid learning. Also it has heightened my awareness of how to make e-learning resources more accessible to people with disabilities and the importance of this in widening participation initiatives.

b) How do you think the project has enhanced your students' learning experience? Please share with us any evidence you have to support your comments.

The first resource was piloted with Undergraduate biomechanics students, 38% of whom volunteered to participate in the formal evaluation of the resource. Figure 1 shows the mean scores of Likert scale questions designed to elicit an understanding of students perceptions of the effect the resource had on: changes to behaviour / study habits, learning gained, resource content and using the resource (a score of >3 indicates positive agreement). The scores relating to learning gained were all positive, as were two of the three questions related to change in study habits. The lowest scoring items for both categories related to the effectiveness of the resource in developing problem solving skills in students, which was noted and addressed in the upgrade of the first resource and the design and development of the second resource.

Qualitative data obtained from student questionnaires and interviews also indicated that the resource developed an improved understanding of the physical science principles covered for 66% of the students responding. Responses from students about this issue included:

"(It)…has made some of the topic I found uneasy to comprehend in (the) lecture much easier to understand"
"(I)…feel more confident in the subject area"
"It encouraged me to read up extra material to inform my answers"
"Made me research relevant concepts"

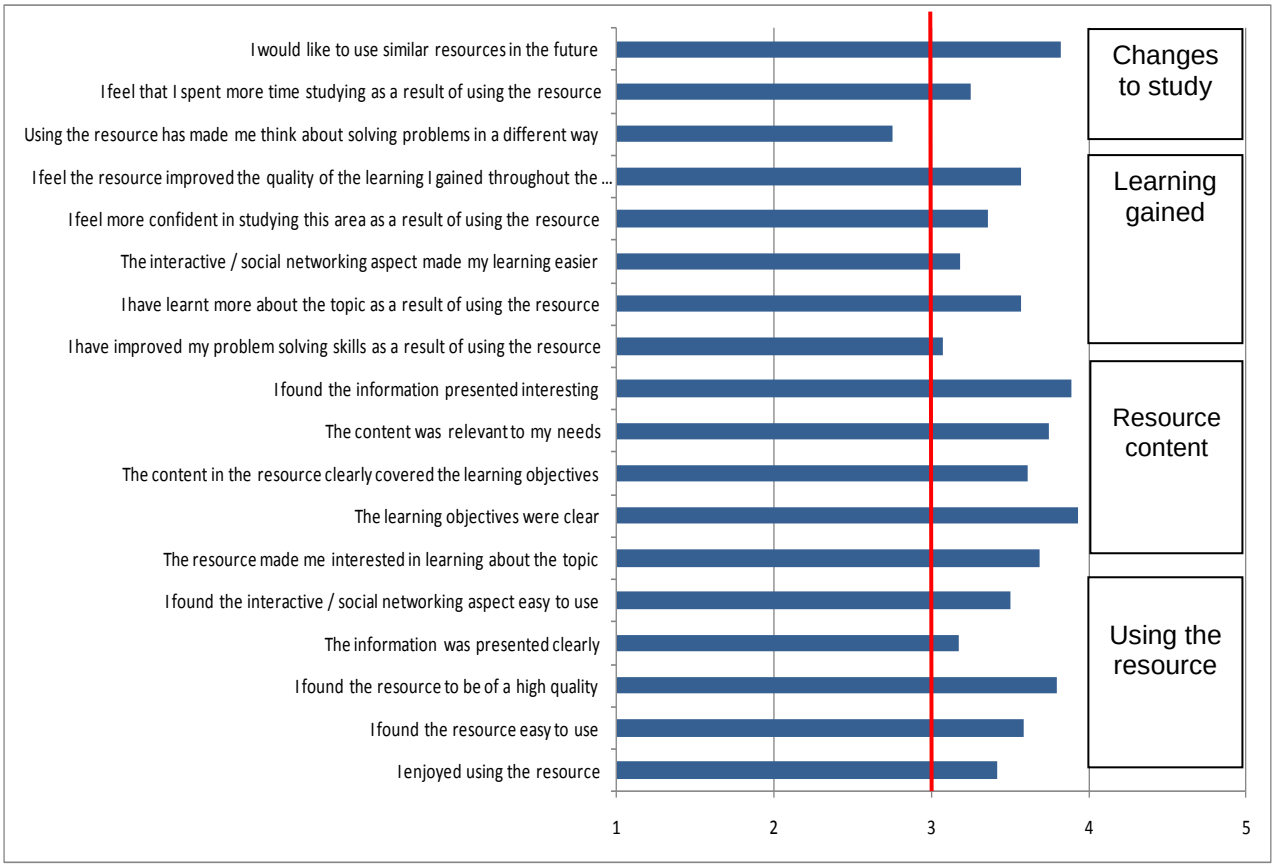

Figure 1: Mean scores of student responses to questions during final evaluation of problem 1 (Where: 1 = strongly disagree, 5 = strongly agree).

The majority of students also provided positive comments when asked to identify which elements of the resource were most effective in increasing their learning about the topics covered. The responses indicated that a number of students found the following aspects of the resource particularly useful in aiding learning: the inclusion of questions throughout, the use of 'hints' pages to help answer the questions, and inclusion of a glossary and forum.

Further analysis of the first Problem regarding content and usability were also favourable. Figure 1 illustrates the positive mean scores obtained for questions in both these categories. Student comments about the resource regarding content and usability indicated that they liked a range of features. The following quotes illustrate just some of the aspects that multiple students found useful:

"The variety of questions"
"The immediate testing and feedback"
"…if you got an answer wrong it would explain why"
"Interactive pictures"
"It was easy to navigate around"
"Very clear and understandable"
"The social networking and the glossary"

The second resource was piloted with MSc biomechanics students, 35% of whom volunteered to participate in the formal evaluation of the resource. Figure 2 shows that positive scores were obtained for all questions within the four categories: changes to behaviour / study habits, learning gained, resource content and using the resource. The highest scoring question related to ease of use, closely followed by wanting to use similar resources in the future, clarity of the learning objectives of the resource and the content meeting these objectives.

Again the majority of responses (83%) indicated that the resource developed an improved understanding of the physical science principles covered. Comments from students that illustrate how this aspect of their learning was improved were:

"(The resource)…relates to my study and clearly explained the area for me to understand."
"It improved analytical skills with relevant and applicable questions"
"A great revision resource. To use in line with study would definitely aid my learning experience."
"Because of the interactive nature."

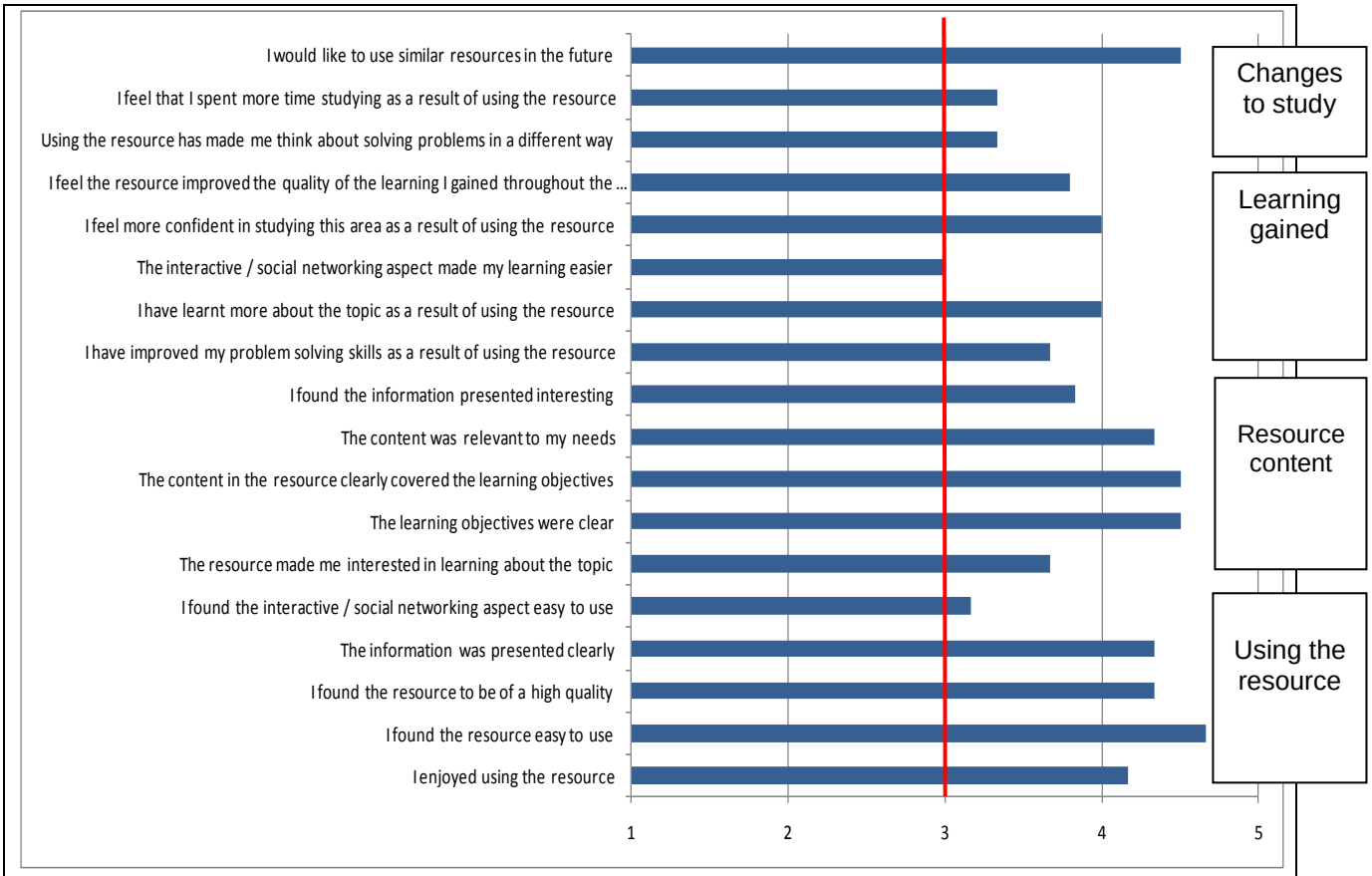

Figure 2: Mean scores of student responses to questions during final evaluation of problem 2 (Where: 1 = strongly disagree, 5 = strongly agree).

The elements of the resource which were highlighted as being most effective in increasing learning were specific elements of theoretical content as well as the way the content was delivered. The following quotes illustrate some of the aspects of the resource the students found most effective in increasing learning:

"Questions and examples and working through problems improved my understanding"
"The hints if you get the question wrong"
"Initial definitions leading on to practical examples"

The lowest scoring items for this group related to the social networking aspect of the resource. This could be related to the small number of students within this cohort and also that the resource was embedded into their course further towards the end than for the previous group. Therefore they would have had less time to orchestrate meaningful discussion. Students were questioned about this issue during the focus group which also revealed that they had their own Facebook group and would be more likely to discuss issues through that medium without the staff input.

As shown in Figures 1 and 2 both student groups indicated that they would like to use similar resources in the future (Undergraduate students' mean score: 3.82; MSc students' mean score: 4.50).

c) To what extent have the outcomes from the project become embedded within your department? Please describe any benefits there have been for staff and outline the evidence you have to support your comments.

The online resources developed for this module have been embedded into two modules that require students to learn and apply physical science principles to solving 'real life' problems. One is an Undergraduate biomechanics module and one a MSc biomechanics module. The resources were embedded within the teaching of these modules during the past academic year and data obtained through the University VLE indicates that 58% of Undergraduate students and 53% of MSc students engaged with the resources developed for their particular level. This figure is expected to rise next year as lecturing staff will be more familiar with the nature of the resource and the resource will be tuned in the light of evaluation to make it more appropriate and appealing to students.

The module convenor for the MSc biomechanics module, for which the resource was developed, indicated that the structure of the module is going to change and will become based around the resource. The staff member was quoted as follows:

"It's so useful and I am so impressed with it and it's capacity that I'm going to completely change the module next year off the back of it to try to make sure they use it for their theoretical learning"

Internal funding through the Roehampton University teaching fellowship has been awarded to the member of staff quoted above to enable further development of the resources to continue improving its capacity for developing physical science principles in bioscience students.

d) Please tell us about any interest you have received in the project from other institutions or disciplines.

Colleagues within the Department of Life Sciences have received internal funding through a Roehampton University teaching fellowship to develop the resource so that the concept can be applied to teaching research methods and sport psychology.

Critical Friends/External Advice

Please comment on the contribution from your critical friends to this project. You may wish to include direct comments or quotes from project partners and critical friends.

The contribution from critical friends has been forthcoming throughout the project.

Professor Lee has been the academic supervisor of this project, and overseen its management. He has made important contribution to the conceptualisation of the projects, and has provided advice on the choice of materials and the academic quality of the content. He meets regularly with the team to ensure that the project is satisfactorily completed.

Dr Strike has actively led the integration of the resources within her teaching during the past academic year. She has also assisted in the development of the problem scenarios used within the resources to ensure they match with the needs of the students in relation to the module content. She has been so impressed with the project and has described the quality and appropriateness of the support resources as, "... stunning, fantastic … I just thought it was fantastic I just loved it … at both levels" and as a result actively sought and was awarded an internal teaching fellowship to ensure the continued use and development of the resource during the next academic year.

Technical support with respect to the development of resources, such as videos and images integrated within the template was instrumental to the success of the project. Alison Carlisle, the biomechanics laboratory technician responsible for this aspect has expressed the following, "I enjoyed utilising my video and video editing skills in the production of high quality video resources to use in the project. I am also passionate about creating videos of lab skills to help the students' learning and welcomed the academic involvement to make this happen."

Bridget Middlemas has actively contributed to pedagogical aspect of the project, specifically the exploration of student learning through the use of the online resource and highlighted issues regarding accessibility to develop. Her input has been particularly valuable with regards to breaking down the physical science content and appreciating the differing levels of student understanding. Also the importance of realising the many differing approaches to teaching that are often required to ensure the majority of students are provided with the tools to enable them to understand theoretical concepts and be able to apply them.

Phil Cheeseman identified the initial platform (Moodle) and tool (Lesson tool) to be used to create the template. He or one of his team of e-learning advisors have always been available to provide assistance in problem-solving the development of the online resources. His team will be instrumental in uploading the final version of the resource on the external Moodle site upon completion of the project.

External consultancy provided throughout the project from Martin Robson has allowed a critical overview of the presentation of the online content from a learning and problem-solving perspective. Following the first student evaluation we worked together to address the issue of improving the capacity for the resource to develop problem solving skills in students. His input was instrumental in identifying the application of Borromeo Ferri's (2006) version of the Blum and Leiss 7-step model of maths modelling to the structure of questions and content within the final version of the online resources.

Further expertise from an external consultant to develop the user interface in order to improve the ease of use and accessibility, suitable for an educational context improved the design of the resource. They also fed into further improving the integration of external applications / technologies and teaching resources as well as demonstrate key areas to target in the continued development of the resource.

Reference
Borromeo Ferri, R. (2006) Theoretical and empirical differentiations of phases in the modelling process. Zentralblatt fur Didaktik der Mathematik, 38, (2), pp 86-95. Available at: http://www.mathematik.ph-weingarten.de/~ludwig/Vorlesungen/ws0708/fachdidaktikforschung/modelling/a2BorromeoFerri.pdf [Accessed 14.06.2011].

The future
What is next for the project? How do you plan to continue to develop and enhance your teaching? Can the Centre provide assistance with this? Have you or will you undertake additional activities as a result of the project?

The resources from the current project will be embedded within curriculum next academic year and have the opportunity to be developed due to Dr Strike being awarded an internal teaching fellowship that Dr Smith will consult on.

Dr Smith and Bridget Middlemas will also seek opportunities to obtain additional small project funding to further evaluate students' perceptions of the resource and explore the weaker and more able students' perceptions of learning and applying physical science principles.

There is also the potential to develop ideas for further external funding that will enable the resource to sit within a more generic and user friendly platform, make it more disability accessible and develop the contents for more gifted students. Another idea that will be explored, so that future funding may be sought, is a way of hosting publicly a series of similar problems and associated resources to widen access across the bioscience community. This may eventually allow others to contribute their own online learning problems to the repository, to develop confidence in handling physical science principles in bioscience students.

Feedback
We value your feedback and would like to hear your comments on the management and operation of the Departmental Teaching Enhancement Scheme and your experience with this project (or anything else you feel is relevant). Are there any changes we could make to improve the scheme and its impact?

It has been a pleasure to work with the UK Centre for Bioscience. Staff have always been friendly and available to offer advice and support.

Completed by: Tina Smith

Date: 31.7.2011
