Repurposing with a purpose: A story with a happy ending

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Abstract: The work reported here forms part of a UK Joint Information Systems Committee (JISC) funded project (BL4ACE) (http://bl4ace.tvu.ac.uk/). This project built on previous work that evaluated the effectiveness of a learning design to underpin academic competence in a Business Studies degree. A significant concern of the blended learning design was to scaffold independent learning activities by incorporating and reusing interactive Reusable Learning Objects (RLOs) within a Virtual Learning Environment (VLE). This paper reports on improvements in learner experience and performance following the transfer of the established Business Studies learning design across subject domains to a Science module. It reports on the enhancement of both modules by reusing and repurposing existing RLOs from other Institutions, and evaluates the experiences of both Business and Science students using the support provided through the interactive learning materials.

Keywords: learning objects, reusable learning objects, RLOs, situated learning, scaffolding, repurpose, re-use, e-materials development, blended and flexible learning, action research, learning designs, digital learning literacies.

Interactive Demonstration: To view some of the learning objects you will need the Adobe Flash Player installed in your browser.

1 Introduction

This paper shows how a learning design for a Business Studies module that was enhanced by the incorporation of Reusable Learning Objects (RLOs) has been successfully transferred to a different subject domain (a Science module). The paper outlines the evolution of the learning design of the Business module to put the work into context. It then shows how this was extended through the JISC funded Blended Learning for Academic Competence and Critical Enquiry (BL4ACE) project, and in the process transferred to the Science module to help solve a number of emergent problems. One of the main aims of the BL4ACE project was to reuse and repurpose existing RLOs from other Institutions. Section 2 outlines the blended learning design of the modules, looking at the RLOs that were integrated into the VLE, and how some of them were repurposed using the Generative Learning Object (GLO Maker) authoring tool. In Section 3 the results gained from the Science module are presented, along with evaluation data from students about their perceptions towards the RLOs and their usefulness, and from tutors about their views on the effectiveness of the blended learning approach. We conclude by considering the impact that RLOs or Open Educational Resources (OERs) have had in this context, and can have in helping to improve the student learning experience and improve student success rates.

1.1 Background – the Business module

The student body at Thames Valley University (TVU) in West London, UK, presents a common sector profile of challenge in terms of academic competence at entry. The Business Studies module we are focusing on here is an enquiry-based, 20 credits Higher Education (HE) module. At the point of entry the students were placed in a Learning Development Pathway (LDP) designed to ensure effective engagement and deep learning of skills required to underpin critical thinking and effective academic writing. Students were introduced to a critical skill that they were required to deploy independently within a subject-based activity.

This module had been the subject of much scrutiny in recent years, in an attempt to improve student performance (Greaves, 2007). In evaluating the learning design of the module, we made an assumption that students should be taught the required 'learning how to learn' skills through a structured approach (Harvey & Knight, 1996). We sought to find a mechanism to make explicit the academic competency structure that the students would work within. Recognising that our academic world is in fact a complex and connected activity system (Cole, 2005) which we should make visible for our students at the point of entry, also informed our learning design. Using the notion of Vygotsky's 'zone of proximal development' as our approach, we deconstructed critical academic activity for underpinning the communication of critical enquiry in essay form, into its component parts such as literature searching, information retrieval, evaluation, citation and referencing.

The component parts were designed as a series of linked activities to be introduced over a number of weeks. Each of the activities places the student in an individual experiential learning situation which allows them to bring back their discoveries at the next session. Using a series of dialogues or Conversational Frameworks (Laurillard, 1993) during the contact sessions to examine the methods that the students have each chosen to tackle the task, flawed and superficial learning strategies are challenged. The sessions also make explicit the links between the activities and the importance of these skills in communicating the outputs of critical enquiry in the written form (essay writing) to meet university standards for written academic work.

This learning design is delivered through a transparent and shared Learning Development Pathway (LDP). The aim of the LDP is that all students on completion of the taught component should be able to answer a given question and produce a 1500 word written essay which conforms to all the requirements of our definition of academic competence for essay writing. The written work of the student should demonstrate ability to:

- identify and select appropriate resources
- correctly use Harvard referencing and demonstrate an appropriate use of resources
- organise, structure and present information in a logical and coherent manner
- develop an argument through a process of critical enquiry

The LDP assumes that knowledge of the links between technical skills underpins an ability to identify the relationship between procedural and declarative knowledge, and to undertake the cognitive shift to conditional and functioning knowledge (Biggs, 2003), and fosters the ability to undertake critical enquiry. The acquisition of academic competence does not necessarily guarantee an ability to critically enquire at a high level of thinking. However, the lack of certain technical and process skills and an understanding of the links between them will seriously impede progress and ability. The learning design ensured that the situated literacies (Barton et al, 2000) activities were linked and developmental. Students were supported to a level of deep understanding through timely and appropriate educational interventions given as formative feedback. They were challenged on superficial and weak learning habits and required to re-deploy the critical skills in a new activity. Previous findings indicated that while students understood these critical skills at the time of explanation, they faced challenges in subsequent applications. In 2007, based on research findings and in response to student feedback, tutors elected to extend support for students' activity by strengthening the scaffolding for learning

through the introduction of a number of Reusable Learning Objects (RLOs) (Greaves, 2007). In the first year of introducing the RLOs, students demonstrated impressive learning gains, and combined with the results of the students' subjective evaluation, the approach was deemed to be a success (Greaves et al, 2008).

1.2 The Science module

Similarities existed between the Business Studies module and a module validated in 2002 as part of a three-year BSc (Hons) degree in Human Sciences, a general science programme with a health focus. As with the Business module, the main aim of the science module was to develop the critical thinking skills required to study science. The module also introduced students to the scientific method, the history and philosophy of science, and some of the great scientific thinkers ranging from Aristotle and Galileo, through to Einstein and Darwin. It was delivered in 3-hour weekly blocks over 14 weeks and consisted of formal lectures and several class-based exercises involving group work. The module was taught entirely face-to-face, supported by a repository of learning materials on the institutional VLE *Blackboard*. The 20-credit module was assessed by coursework and a two-hour examination at the end of the semester.

At the start of the Human Sciences programme, fewer than 15 students were enrolled in the module. However, within three years, other science students enrolled on courses such as the one-year intensive pre-medical Certificate, a two-year Foundation degree and a three-year BSc (Hons) degree in the forensic and sports sciences joined the module. Class size grew and, on one occasion, reached well over 70 students. The diversity of the student body also expanded with entry qualifications ranging from the very basic (for the general science programmes) to the advanced (for the pre-medical programme). Against this backdrop, student learning and progression deteriorated, especially amongst the general science students with lower entry qualifications. Based on the results achieved with the Business module, it was considered that the same approach could help to tackle some of the problems being faced. This module was thus selected for the transfer of the learning design as part of the BL4ACE project, to be delivered to students in the Academic Year 2008-2009.

2 The blended learning design

During 2008 both the Business Studies module and the Science module were reviewed. We knew from previous research work that the learning design had demonstrated learning gains for the Business students (Greaves et al, 2008), so in addition to improving progression, the aim was to create a more flexible, interactive and engaging experience for all our students. From the module level down to the session level (i.e. lectures, seminars, and online sessions) we wanted to improve the scaffolding of the design of the module and the learner experience. Both modules would introduce the students to key academic skills and competencies through engagement in enquiry-based, formative learning activities. Students have to identify learning needs in each of the key academic competencies and remedy false or flawed conceptions. The repeated developmental activities build links between key academic competencies, and thus encourage deep learning. Key to improving the scaffolding of these skills was identifying where RLOs could most effectively support individual concepts of the module and sessions. We developed a 'concept framework' to aid the identification of where scaffolded support would be most useful. From this, we identified existing learning objects developed by other Institutions to reuse, building on the set of RLOs already used in the Business module (reusing existing materials was the primary concern of the BL4ACE project). Other learning objects were selected for adapting to our specific needs using the Generative Learning Object (GLO Maker) authoring tool (subject to copyright negotiations with the creators). We believed that providing access to quality interactive materials through a VLE to support learning outside of the contact sessions, was fundamental to improve learner engagement and success. With this aim in mind we turned our attention to populating the learning design with exciting materials.

2.1   2.1 The reusable learning objects (RLOs)

A core of six learning objects were selected to support the learning activities, supplemented with additional objects in each module to provide subject-specific focus. All of the learning objects were reused from other institutions or learning contexts, and they were all web-based, so that students could access them through the VLE and work through the objects in their own time and at their own pace, outside of the taught classes. Table 1 shows the learning objects that were selected and integrated into each of the modules and their originating institutions.

Table 1: The learning objects reused and their originating institution
(CETL = Centre of Excellence for Teaching and Learning)

Business module	Science module
Referencing Books (from RLO-CETL)	
Referencing Websites (from RLO-CETL)	
Referencing Journals (from RLO-CETL)	
Reflective Writing (from RLO-CETL)	
The Internet Detective (from Intute)	
Help with Essay Writing (part of Academic Phrasebank from Manchester University)	
Using English for Academic Purposes (University of Hertfordshire)	How to undertake research in the Biosciences (from the Engage CETL)
	Helping you plan your career: writing your CV and everything else you need to know (TVU in-house resource)

Four of the learning objects were developed by the RLO-CETL led by London Metropolitan University, and had been successfully used with students at TVU in the previous academic year on the Business Studies module. The CETL in Reusable Learning Objects was one of 74 Centres for Teaching and Learning (CETLs) being funded by the UK's Higher Education Funding Council for England http://www.rlo-cetl.ac.uk. The RLOs are designed with pedagogy as a central concern, along with the requirement that they should be able to be reused by other tutors and institutions, and in different contexts (Boyle & Cook, 2001) and accommodate different types of users (students and tutors).

The RLO-CETL RLOs have been developed in Adobe Flash, and incorporate rich multimedia and interactive techniques to both engage students and put them in control of their learning. They include interactive simulations, 3D graphics, animations, and in the case of Reflective Writing, audio clips and videos to bring the subject matter to life. From initial introductions to the subject matter, animations are used to step through processes that need breaking down for easier understanding, such as how to build up a reference to text that is quoted in a report. In this way, scaffolding is provided to help the students understand the topics that are being covered. Reflective Writing includes a self-diagnostic questionnaire that enables students to identify their preferred learning style. They are all web-based, so that students can work through the objects in their own time and at their own pace, and they are designed so that they can revisit any part of the object at any time. Figure 1 provides screen shots of examples of two of these RLOs. All RLOs produced by the RLO-CETL are freely available for educational use at http://www.rlo-cetl.ac.uk.

The individual RLOs can be accessed from these URLs:

Referencing Books: http://www.rlo-cetl.ac.uk:8080/open_virtual_file_path/i1967n5604t/index.html

Referencing Journals: http://www.rlo-cetl.ac.uk:8080/open_virtual_file_path/i562n6162t/index.html

Referencing Websites: http://www.rlo-cetl.ac.uk:8080/open_virtual_file_path/i1405n10233t/referencing_websites_rlo.html

Reflective writing: http://intralibrary.rlo-cetl.ac.uk:8080/intralibrary/open_virtual_file_path/i1026n24186t/reflective_writing/reflective_writing.html
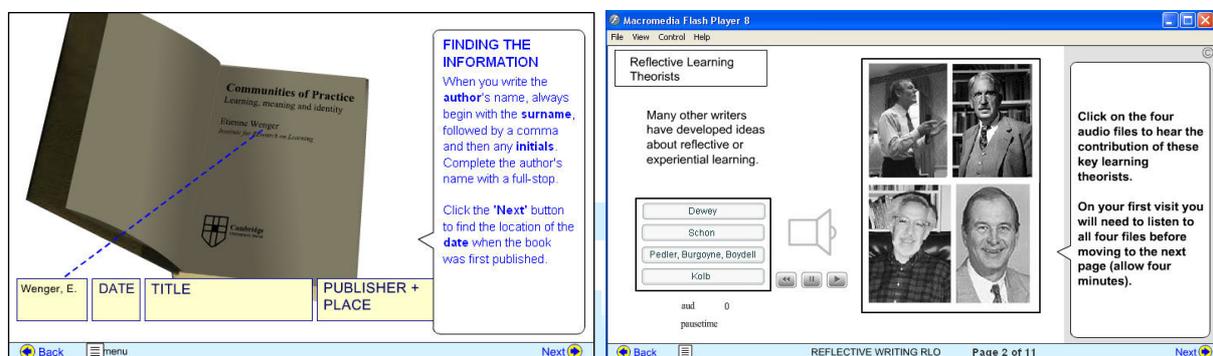
Figure 1: Screens from the Referencing Books and Reflective Writing RLOs

2.2 Adapting RLOs using the GLO Maker authoring tool

The Generative Learning Object authoring tool (GLO Maker) was used to tailor some of the learning objects to specific local requirements http://www.glomaker.org. Produced by the RLO-CETL at London Metropolitan University, it enables media rich learning objects to be created, without the need for specialist programming skills. RLOs created with the GLO tool can then be easily adapted to specific needs, for example to change a list of book references for another subject area, or to change the content or language of textual material. Figure 2 shows the GLO Maker authoring tool in use. It shows the Referencing Books learning object being edited in the 'Designer' mode of the tool.
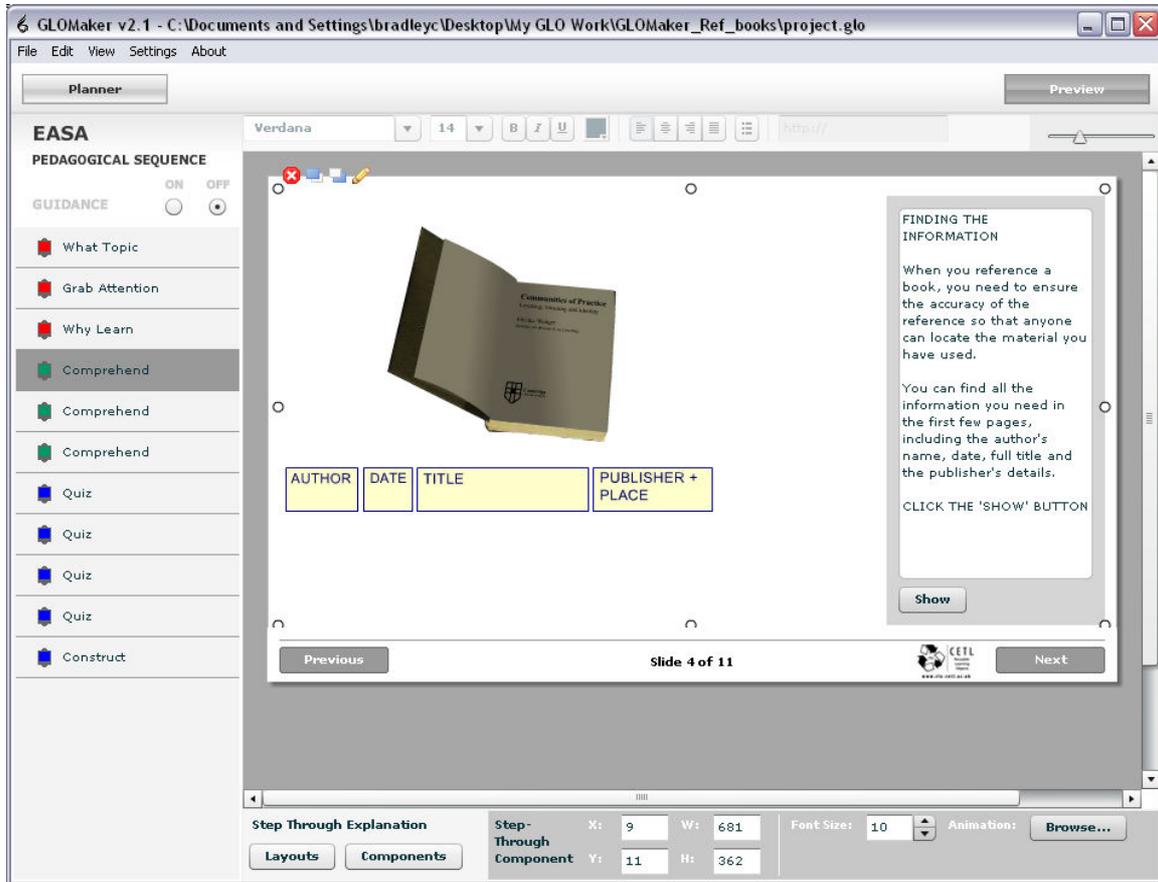
Figure 2: The GLO Maker tool in 'Designer' mode

The GLO Maker tool is open source, and is free to download and use within the educational community. It can be downloaded from the GLO Maker website: http://www.glomaker.org. There is also a GLO Maker community wiki, designed to provide a forum and additional support and advice for the user community: http://glomaker.wetpaint.com.

Figure 3: The GLO Maker website http://www.glomaker.org

The website contains a number of guides and tutorials that explain how to use the tool and develop GLOs. A short introduction to the GLO Maker tool can be found at: http://www.glomaker.org/GLO200.html and an interactive tutorial to the 'Planner' part of the GLO Maker tool is available at: http://www.glomaker.org/guides/tutorial1/tutorial1.html

We used the GLO Maker to repurpose materials from Academic Phrasebank. This is a resource for academic writers produced by Manchester University to support their students (http://www.phrasebank.manchester.ac.uk/). Lists of phrases to assist the student in thinking about their writing are arranged under headings that describe the various functions of academic writing: introducing work, referring to the literature, being critical etc. Most of the phrases are subject and content neutral, so using them does not constitute plagiarism. Students can incorporate them into their own writing, or use them as a starting point to assist them in the writing process.

The Phrasebank had been used with students during the previous year, by giving them a direct link to it. Feedback from the students indicated that whilst the site was very helpful, they found it difficult to identify the 'implicit' concepts. It was evident that smaller 'learning chunks' would be even more useful to students. Each concept was thus designed into a separate learning object, with a simplified list of the selected phrases that would be most useful or relevant to the learner. Thus implicit concepts in terms of functions of academic writing were made explicit. Introducing multiple choice quizzes and interactive exercises helped students to check that they had understood the different functions of the phrases used. The GLO Maker tool was ideal for adapting these materials, once a license to adapt them had been purchased. Work is ongoing and developmental in that we are learning with each new LO we create.

To date, five new LOs have been adapted and repurposed specifically for the needs of our students (these may be viewed at http://bl4ace.tvu.ac.uk). It is important to note that the focus in the GLO approach is on the reusable pedagogic design rather than the content. This concentrates the attention in the right place: the quality of the design for learning. This approach is very powerful in ensuring the learning need is met in a focused and precise manner.

2.3   The Virtual Learning Environment

For each module the learning objects have been made available to students through a virtual learning environment (VLE) in Blackboard. The Blackboard VLE has been designed to essentially act as a repository of information and materials to support the module and students' individual learning. The RLOs are embedded within the VLE, and are integrated into the linked activities at the point in which they can help the students complete their weekly tasks. They thus directly support the linked activities that the students are required to do. They have to access the objects in their own time, outside of the contact sessions. In effect, everything that the students need outside of their contact sessions is provided within the VLE, supporting their independent learning and the development of their academic competence. The aim was to erode the time and place barriers to formal study inside the classroom with more personalised access to materials outside the classroom, thus moving to an 'anytime anyplace anywhere' model of access (Goodyear, 2006). The notion of a 'virtual' learning experience as part of the blend was seen as critical to the success of the redesign of the modules, and to engage the students with the curriculum and scaffold their learning.

3   Results and discussion

3.1   Implementation of the revised module - student learning and achievement

Having monitored the progression and achievement of the Business students in the previous year (Greaves et al, 2008) our particular interest in this project was to see if the significant learning gains achieved with these students could be replicated across another subject domain. We thus focused our attention on the science cohorts' achievement.

Student achievement was monitored and compared across three cohorts: Academic Year (AY) 07/08 (before the module was reviewed) and AYs 08/09 and 09/10 (after module review). The results are summarised in Figures 4 and 5. As shown in Figure 4, the failure rate in AY 07/08 was reduced from about 40% of the class to 10% in AY 08/09 and 5% in AY 09/10. Furthermore, in AYs 08/09 and 09/10, the proportion of students gaining marks above 60% increased to 61 and 73% respectively, compared to 39% in AY 07/08. The results demonstrate substantial improvement in achievement, not only in terms of reducing the failure rate but also in raising the overall marks gained, with increasing numbers of students attracting marks in the 80-89% range.
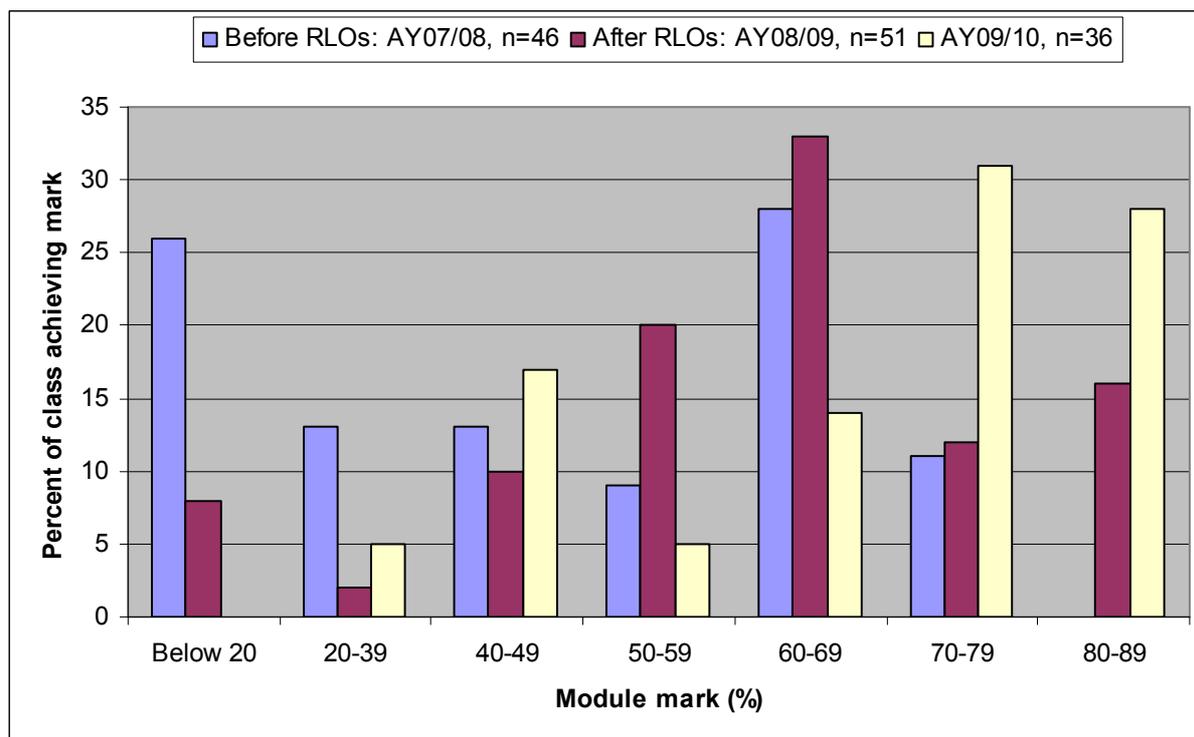
Figure 4: Student achievement in a first-year science module showing figures before (AY07/08) and after (AYs 08/09 and 09/10) the module was revised to include Reusable Learning Objects (the pass mark for the module was 40%)

Figures 5A and 5B show the disaggregated marks for the pre-medical and non-medical science students across the three academic years. The pre-medical students differed from the non-medical science students in that all applicants to the programme were required to have passed an AS Level in Chemistry prior to admission. In addition, pre-medical students were required to achieve average marks of 60% or higher in all their modules in order to qualify for an admissions interview to medical school. Figure 5A shows that the pre-medical students performed well in both old and new module but the overall marks were substantially higher in AYs 08/09 and 09/10 than in AY 07/08. For example, no pre-medical students achieved marks above 80% in AY07/08 but in AYs 08/09 and 09/10, about 40% of the pre-medical cohort did so.
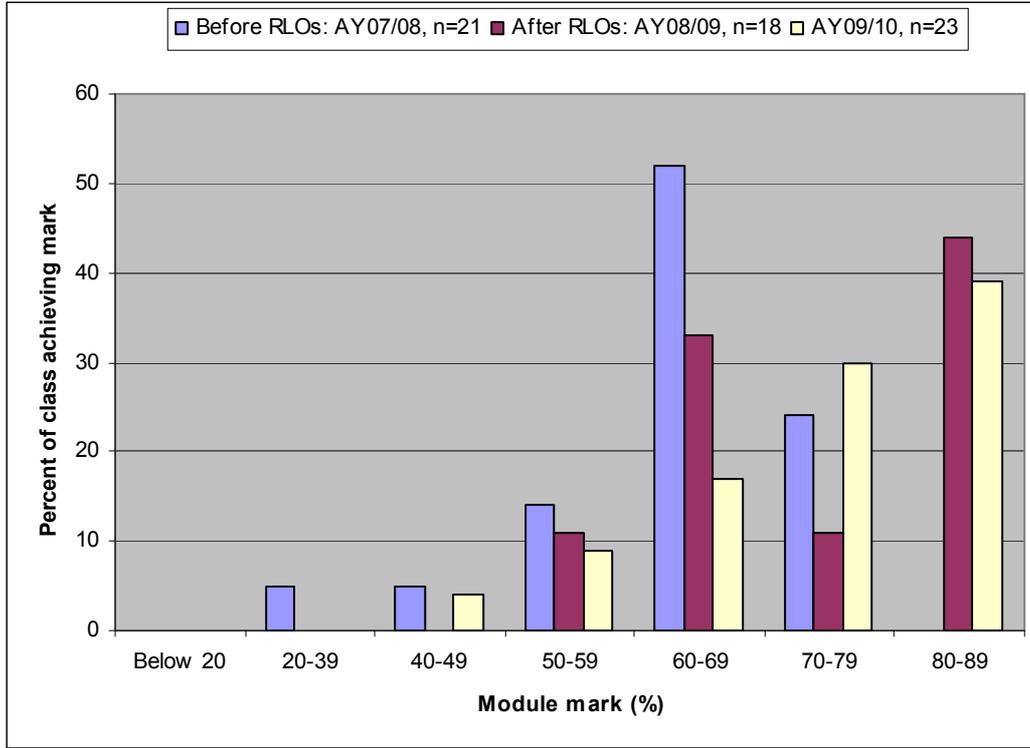
Figure5A: Student achievement (pre-medical cohort) in a first-year science module showing figures before (AY07/08) and after (AYs 08/09 and 09/10) the module was revised to include Reusable Learning Objects (the pass mark for the module was 40%)
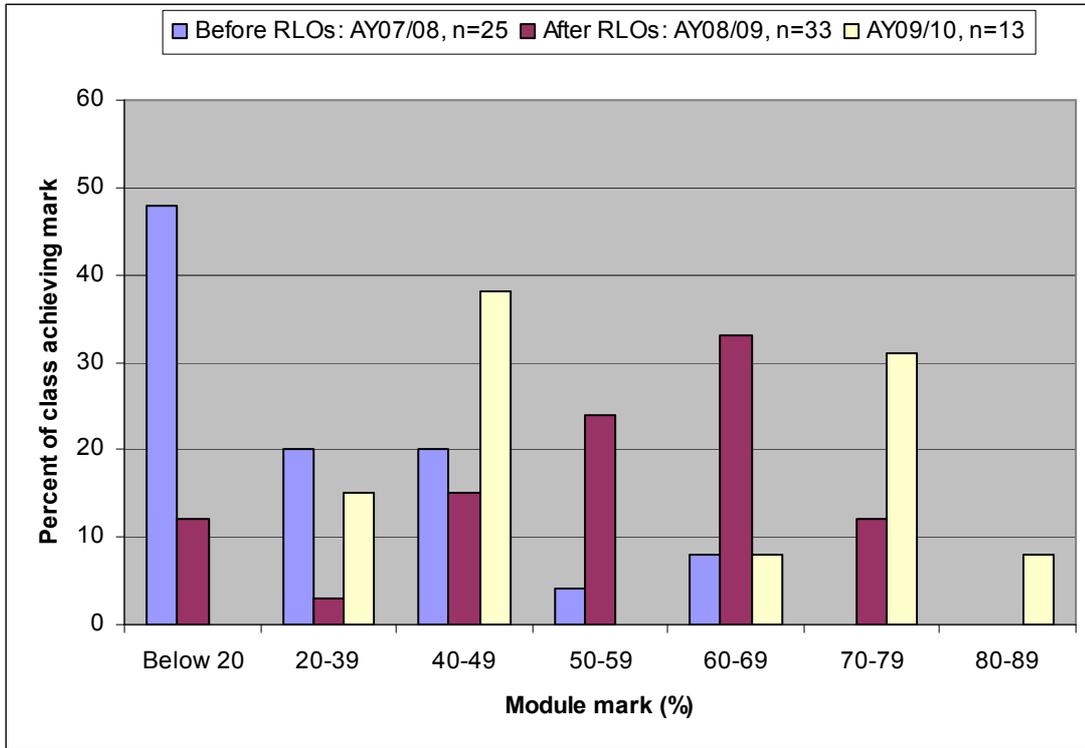
Figure 5B: Student achievement (non-medical cohort) in a first-year science module showing figures before (AY07/08) and after (AYs 08/09 and 09/10) the module was revised to include Reusable Learning Objects (the pass mark for the module was 40%)

As shown in Figure 5B, the gains achieved by the non-medical science students were even more remarkable than those of the pre-medical cohort. In AY07/08, 32% of the students passed the module and just 8% achieved marks over 60%. By contrast, in the subsequent two academic years, 85% of the class passed and 45-47% of the students achieved marks over 60%.

The results demonstrate a clear upward trend in achievement. The design of the module was changed in several ways and so it is not possible to conclude that the introduction of the RLOs alone was the sole cause of improved student learning. However, it is likely that they contributed to the upward trend in achievement. Further work is needed to confirm these results with larger numbers of students. In addition, longitudinal data on the same cohort of students would show to what extent the critical enquiry skills acquired in the first year of study persist into the second and final years of a degree course. We are in the process of collating data for the 08/09 cohort as the students' progress through their studies and will report on these in the future.

Student perceptions of the RLOs in AY08/09 were also sought and these are described in the section which follows. We were interested in both the Business and Science students' experiences so we now return our focus to both subject groups.

3.2   Evaluation of the impact of the learning objects and VLE

3.2.1   Methodology

Evaluation was built into the use of the modules in AY 08/09. The aim was to elicit student perceptions of the effectiveness of the RLOs in supporting their independent learning, and also to elicit

tutor perceptions of the effectiveness of incorporating the RLOs into the modules. The evaluation methodology consisted of gathering quantitative and qualitative feedback in the following ways:

- student questionnaire on the effectiveness of the RLOs, together with online feedback forms from the RLOs reused from the RLO-CETL which provide feedback on that RLO at the time when it was used

- interviews with the module tutors at the end of the module

A summary of the main results from the evaluation follows. The results in full are in the linked Evaluation Report, along with the forms and questions used to get the evaluation feedback.
See BL4ACE Evaluation Report 171-1668-2-SP.PDF

3.2.2   Main conclusions from the student evaluation

A total of 41 students completed the questionnaire: 8 Business students and 33 Science students. The evaluation has sought to look at the two student cohorts separately and identify any major differences between them, even though the Business cohort was smaller, representing only 20% of the students involved in the study. The data reveal some differences between the subject cohorts. A higher proportion of the Business students said that they used all of the 7 RLOs for their module (87.5%) whereas only 23.3% of the Science students used all of the 8 RLOs in their module. The Business students also used the RLOs on average more times than the Science students: 37.5% of Business students used the RLOs 5 times or more, 50% between 2 and 4 times and 12.5% (1 student) once, whereas in the Science cohort 3.3% (1 student) used them more than 5 times, 56.7% used them between 2 and 4 times and 40% used them once. Business students also agreed more strongly that the RLOs were really useful, and they all agreed that they would like more of these RLOs in other modules (in the Science cohort 21% would not). The Business students were also more positive towards the *Blackboard* VLE. Science students however have a more positive view towards being able to access the learning objects at any time, any where.

The qualitative comments from students about the RLOs show how they were helpful and useful. The RLOs helped them to:

- learn about the subject in question and develop specific skills
- complete their assignments
- gain understanding
- gain confidence in those areas
- develop their independent learning

Some of the qualities that they liked about the RLOs were:

- the subject matter was closely related to what they had to do
- the content was presented in a way that was understandable: it was clear, easy to follow, easy to absorb, took you through step by step
- easy access
- easy to use
- illustrated
- available when needed
- the questions

Only a few negative comments were made, with the most common complaint being that some were too long and/or time consuming.

Feedback on specific RLOs shows that some objects are more highly rated and helpful than others, and this was probably down to individual student preference according to what they needed to learn and

what was helpful for them. Some students commented about the use of audio and video material in the Reflective Writing RLO, that it was nice to listen and not have to read a load of writing, illustrating that multimedia resources can provide a variety of learning methods that can therefore appeal to a wider range of learning styles.

Combining the feedback from all the students shows that a very high proportion of them found the RLOs to be valuable: 92% agreed that the RLOs were useful and 83% agreed they would like to have them in other modules. The RLOs and VLE enable more flexible learning opportunities, and this is illustrated by the fact that 95% agreed that they liked being able to access LOs any time, any where, and 89% found the VLE very useful.

Overall, the students have responded positively to the learning objects and there is evidence that they have seen them as helpful in developing their independent learning and academic skills. The Business students have responded to them more positively than the Science students, but the precise reasons for this need to be explored further.

3.2.3   Tutor feedback

Some of the key comments made by tutors in the post-module interviews follow. There is also an audio file containing some of the comments made by each tutor.

Comments from the Business tutor *See Business Tutor interview 171-1656-2-SP.mp3*

The following changes and benefits have been noticed since RLOs were incorporated into the module:

- Because the RLOs address the lower level skills at the beginning of the module, six weeks of the module can be spent at higher level skills, and in effect, more content can be covered in the contact time over the duration of the module. "It has actually meant we can put things back into the module which we had to strip out because we didn't have more contact time. So more is happening."
- The tutor does not have to keep repeating the same material if it is available in RLO form, "the students can go and look at it as many times as they like".
- In the lecture "It's less telling and more showing and doing. The students are showing and telling me what they've been doing, which is an improvement on me telling them what to do and them going away and not doing it. It's just much better scaffolding of the whole independent learning and contact time."
- The RLOs suit the type of students taking the module: "they often do not read the handouts, and they understand it differently because it's 'doing' ".

The Business tutor also talked about how she thought the students reacted to the RLOs, "I know they really, really like them. They like the fact that they can go back and use them over and over, and I know they find them supportive. They said in class that they find them supportive."

The outcomes for the students are seen as follows:

- The students have all passed the module on their first attempt, which is an improvement on previous years
- They gain an understanding more quickly
- The students produce more artefact output and output that is better quality e.g. 2 more essays, which are of a higher quality.

Comments from the Science tutor *See Science Tutor interview 171-1651-1-SP.mp3*

Observations about the experience and the benefits to the module:

- Because three module cohorts were taught together, the tutor noticed that the Forensic Science students needed more help and repetition, which was available through the RLOs.

- There weren't any time savings in introducing the RLOs, but the benefits may become more evident in the following year when the same students enrol for Research Methods, for which they'll be better prepared. So time may be saved ultimately in teaching the student cohort.

- Unlike in previous years, all the students accessed *Blackboard* and they accessed it more frequently because there was a real purpose for them to use it.

- An observation from the questionnaire responses was that one student in particular expressed concern about not having the required computer skills to access and use the RLOs, and that this could present a barrier to learning for some students. However, the student in question was able to find a solution to this problem (by asking her children to help) and commented that in doing so, she improved her computer skills as a result. So whilst using computer-based resources imposed an additional learning curve, it also resulted in further skill development, which will undoubtedly be a useful life skill. Another implication from this, is that "you can't just assume that all students will be able to access it easily and you still need to tackle it in class; it's not a time saver in that sense".

- The tutor intends to reuse some of the RLOs again with students, because she thinks they are a useful reminder, and because they have to actually 'do' things within them that help them to understand and remember, for example assembling a reference in the correct order.

On the student experience, the Science module tutor felt that the students with higher entry qualifications, exemplified by the Pre-medical students, only needed to use an RLO once, as they were able to understand the subject matter more readily. For weaker students, RLOs provided the opportunity for them to use them as many times as they wished, until they understood the subject matter, or to check their understanding as necessary (e.g. when completing an assignment, for revision etc.). The tutor also thought that the students who were very computer savvy liked them.

4   Conclusions - lessons learnt for improving student learning

This paper has reported on an exploration of looking at the link between learning design and learning outcomes. Following the transfer of an established and effective learning design across subject domains, improved learner experience and performance were identified. The improvements were achieved as part of a blended learning innovation that resulted in changes both to the module design and the introduction of OERs (the learning objects). It is not possible to disaggregate the impact of the different changes made to the module. However, it is clear that without the OERs being available, it would not have been possible to introduce the rich changes made to the module. We would argue that they were a necessary condition to achieve the module transformation.

This flexible approach to scaffolding and supporting learning fits well within the emerging work/life patterns of study of our students, and is particularly important at the point of entry to the academic community where learners need support in understanding what is required and expected of them. We know that all the learners accessed the RLOs in multiple location contexts outside of the university between the taught sessions, and many students often repeated an exercise to gain deep understanding. The interactive nature and sound pedagogic design of the RLOs, effectively ensures access to a 'tutor' whenever and how often a learner feels the need to reinforce their learning or check their understanding. It is the equivalent of having a 'tutor in their pocket', a very patient tutor who explains the concept as many times as requested. It is however the learning design which ensures that the learner returns to the 'real tutor' for timely and appropriate interventions to move the learning forward.

The engagement of the learner between the contact sessions in developing their understanding of key concepts through the interactive activities is critical for successful learning. The multimedia

components within the RLOs were also liked by the learners, with several commenting that they are attracted to and learn more effectively from certain media types (graphics, animations, video, audio), according to their individual preferences. Thus the RLOs contribute to increased engagement in the learning activities. Key to this is that although the students are able to support their individual learning with the RLOs, it is within a carefully scaffolded experience that is designed, supported and monitored by the tutor.

A key message from both discipline groups was that the students liked being guided further in their learning 'out of hours'. If RLOs are effectively designed into the curriculum to scaffold particular concepts, they do the work for the tutor in supporting the development, understanding and application of them. In an emerging contact-constrained Higher Education landscape it releases the tutor to concentrate on checking the quality of learning that is occurring. The ease with which the RLOs can be utilised by tutors means that this high quality curriculum enhancement is readily available for embedding into existing curriculums. The generic skill RLOs are particularly well-designed for easy transferability across disciplines, and with the GLO Maker tool, can be adapted to suit specific local needs.

The improved performance and learning gains of the students in this study coupled with their evident enjoyment of using the materials has demonstrated the effectiveness and power of a well-designed scaffolded curriculum to support skills development, and it has shown that the approach can be transferred across subject domains. The ease of use of the GLO Maker tool to re-purpose materials coupled with the release of materials through the Open Educational Resources initiative is enabling the reuse of materials across the sector and changing the process of learning design and delivery. The recent JISC-funded project 'Any time Literacies Learning Environment' (http://alle.tvu.ac.uk) takes this work further, and is an example of a curriculum design approach that is capitalising on the emerging technological synergies.

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