



Academy/JISC Final Report

Project Acronym: [None Adopted]
 Version: 3
 Contact: Dr Stephen Hagan
 Date: 29 April 2010



Project Document Cover Sheet

Project Information			
Project Acronym	*None Selected*		
Project Title	Open Educational Repository in Support of Computer Science		
Start Date	1 April 2009	End Date	30 April 2010
Lead Institution	Higher Education Academy Subject Centre for Information and Computer Sciences, University of Ulster		
Project Director	Dr Stephen Hagan		
Project Manager & contact details	Mrs Hazel White Higher Education Academy Subject Centre for Information and Computer Sciences Room 16G28 Faculty of Computing and Engineering University of Ulster at Jordanstown Newtownabbey Co. Antrim N Ireland BT37 0QB Tel: (028) 90 366109: Email: h.white1@ulster.ac.uk		
Partner Institutions	London Metropolitan University Sheffield Hallam University Teesside University University of Portsmouth University of the West of England, Bristol		
Project Web URL	http://www.heacademy.ac.uk/ourwork/teachingandlearning/oer http://www.ics.heacademy.ac.uk/projects/oer/		
Programme Name (and number)	HEFCE/JISC/Academy Open Educational Resources Grant Funding 14/08		
Programme	Sharon Waller, Higher Education Academy		

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

Manager	
----------------	--

Project Acronym: [None Adopted]
 Version: 3
 Contact: Dr Stephen Hagan
 Date: 29 April 2010

Document Name		
Document Title	Final Report	
Reporting Period	1 April 2009 – 28 April 2010	
Author(s) & project role	<p>Dr Stephen Hagan Project Director</p> <p>and</p> <p>Miss Sharon McCaffrey Project Support Officer Higher Education Academy Subject Centre for Information and Computer Sciences Room 16G28 University of Ulster Shore Road NEWTOWNABBEY Co Antrim Northern Ireland BT37 0QB</p> <p>Tel: +44 (0)28 90 368920 Fax: +44 (0)28 90 368206 Email: SJ.Hagan@ulster.ac.uk</p> <p>Tel: +44 (0)28 90 368122 Fax: +44 (0)28 90 368206 Email: SN.McCaffrey@ulster.ac.uk</p>	
Date	28 April 2010	Filename
URL	http://www.ics.heacademy.ac.uk/projects/oe/	
Access	<input type="checkbox"/> Project and JISC internal	<input type="checkbox"/> General dissemination

Document History		
Version	Date	Comments
1	1 March 2010	Final submission (Draft)
2	27 April 2010	Final submission
3	29 April 2010	Final submission

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

1. Title Page

PROJECT NAME: Open Educational Repository in Support of Computer Science

FINAL REPORT

AUTHORS: Dr Stephen Hagan - Project Director
Miss Sharon McCaffrey - Project Support Officer

CONTACT PERSON: Dr Stephen Hagan - Project Director
Higher Education Academy Subject Centre for
Information and Computer Sciences
Room 16G28
University of Ulster
Shore Road
NEWTOWNABBEY
Co Antrim
Northern Ireland BT37 0QB

Tel: +44 (0)28 90 368920
Fax: +44 (0)28 90 368206
Email: SJ.Hagan@ulster.ac.uk

DATE: 29 April 2010

2. Table of Contents

Contents

JISC Final Report.....	1
Project Document Cover Sheet.....	2
1. Title Page.....	5
2. Table of Contents.....	6
3. Acknowledgements.....	7
5. Background.....	8
6. Aims and Objectives.....	9
7. General approach.....	10
7.1 Engagement with contributors.....	11
7.2 Engagement with potential adopters.....	12
7.3 Evaluation of resources.....	13
8. Implementation.....	14
8.1 Consortium Agreement.....	14
8.2 Quality Committee.....	14
8.3 Repurposing and Validation Committee.....	14
8.4 Metadata tagging.....	14
8.5 Awareness Building and Dissemination.....	15
9. Outputs and Results.....	15
10. Outcomes and Impact.....	17
11. Conclusions and Recommendations.....	18
12. Implications for the future.....	19
13. References.....	19
14. Appendices.....	20

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

3. Acknowledgements

This project was funded under HEFCE/JISC/Academy Open Educational Resources Grant Funding 14/08 from 1 April 2009 to 30 April 2010.

The Project was founded upon the provision of teaching materials by:

Professor Dominic Palmer-Brown,
London Metropolitan University

Dr Gary Griffiths and Professor Mike Lockyer,
Teesside University

Dr Jim Smith and Dr Rong Yang,
University of the West of England, Bristol

Dr Elizabeth Uruchurtu,
Sheffield Hallam University

Dr Rinat Khusainov,
University of Portsmouth

The Project Team wish to acknowledge the advice and guidance received from Professor Tom Boyle, Director of the Centre for Excellence in Teaching and Learning (CETL) in Reusable Learning Objects, London Metropolitan University and representatives from JISC Legal Information Service, JorumOpen and the Higher Education Academy/JISC OER Project Management Team.

4 Executive Summary

This project made available Open Educational course resources kernel to Computer Science which can be deployed across the spectrum of computer-related programmes, including new and emerging disciplines.

4.1 Overall approach

Following a subject community-wide call for expressions of interest, modules of study were selected from within those Schools of Computing/Computer Science and Electronic and Computer Engineering which had demonstrated a significant strategic investment in supporting the development and deployment of on-line materials, as evidenced by the associated academic credit value and deployment across multiple programmes of study in-house. Acceptance of materials was further governed by tests of academic level, pedagogic quality, autonomy and ease of repurposing.

The title, academic level, credit value and originating institution of the modules of study offered by the Project Consortium are presented in Appendix 1. The selected modules were systematically parsed into topics and further into individual learning

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

units, defined here as autonomous lectures, tutorials, practical assignments, assessments or reading lists. Although each learning unit is independently discoverable, hierarchical metadata tagging groups learning units into overarching topical and thematic families and links to a detailed module descriptor which suggests a pedagogical context for their potential deployment.

4.2 Findings

The Project Consortium made available 665 independent learning units, each pedagogically effective and maximally reusable. All learning units were extracted from currently validated programmes of study offered within the UK and in total represent approximately 2,100 hours of learning.

5. Background

Globally, computing has influenced science, engineering, business and society. The subject presents challenging career and entrepreneurial opportunities demanding competent and responsible professionals. The seeding of these traits lie within an informed and up-to-date computing curriculum.

The dramatic and on-going penetration of computing systems into all aspects of daily life and work brought with it increased specialisation supported by a growing family of Computer Science related undergraduate curricula. The principle disciplines among these remain Information Systems, Information Technology, Computer Systems Engineering and Software Engineering. Each of the major disciplines has their own character and differ in emphasis, goals and expected capabilities of their respective graduates. Yet they also have much in common, drawing from a kernel of the traditional 'Computer Science' curricula viz. an essential and foundational underpinning of the discipline, a foundation in the concepts and skills of computer programming, an understanding of the computer related systems lifecycle and an exploration of the major application areas of databases and computer networks.

5.1 Where programme fits with the OER Project

This Subject Area Strand project made core educational course content for Computer Science freely available and easily discoverable. The learning units can be deployed across the spectrum of computer-related programmes, including new and emerging disciplines, and is available to both educators and learners for adaption and reuse.

The Project is a subject-specific extension of previous investments in the establishment of digital repositories and is a further test of the willingness of academics and their host institutions to position themselves as both contributors and adopters of quality Open Educational course content.

The Higher Education Academy's Subject Centre for Information and Computer Science first established a repository for Reusable Learning Objects (in conjunction with London Metropolitan University) in 2004. Funding secured under the JISC distributed e-learning programme in 2005 and again in 2007 supported specific tranches of development funded projects dedicated to increasing constituency

involvement in the development, use and embedding of Reusable Learning Objects and Question Banks. The outputs from these projects featured in a number of workshops and presentations and at the 2006 and 2008 ICS Annual Conferences (see http://www.ics.heacademy.ac.uk/resources/rlos/rlo_repository.php).

Subsequent adoption of these resources outside of the originating institutions however appears to have been low.

5.2 Benefits of this project.

While useful to articulate the perceived benefits to be derived from the release of OER materials brought forward by this Project, it is acknowledged that further evidence is required to support some of these assertions. Overall efficiency gains and gross institutional impact in particular cannot be confirmed within the timeframe of the Project. However, the Project:

1. Enhanced opportunities for student learning from the open sharing of quality teaching materials;
2. Promoted the establishment of a quality brand based on the robustness and scholarly integrity of the OER materials made available;
3. Increased dissemination of OER materials mediated through deposition within a single repository and ease of discovery therein;
4. Promoted sustainability by supporting and encouraging initial adopters to convert to contributors; and
5. Offered efficiency gains in course development.

6. Aims and Objectives

In the Project Plan, the aims and objectives were outlined as follows:

“To provide open access to materials with direct relevance to the teaching and assessment of:

- *Systems Analysis and Design;*
- *Computer Programming;*
- *Data and Computer Networks;*
- *Databases; and*
- *The Development of Problem solving Skills.”*

The distillation and presentation of learning units within specific thematic areas kernel to Computer Science was intentional and intended to maximise their potential for adoption.

The primary objective was to raise the profile of open access module content within the subject discipline and offer guidance on the design, deposition and access to such materials. In one part, this was achieved through a schedule of presentations and workshops, key publications and offers of support to interested parties. Another significant contribution came from extensive metadata tagging and associated efforts to reflect the pedagogic context within which individual learning units could be delivered. This approach permitted the discovery of resources at various levels of

granularity ranging from a single autonomous learning unit (such as a specific lecture) up to and including an entire module of study. It also facilitates the recombination of learning units to afford different/novel learning experiences. These aims and objectives remained constant throughout the Project.

Feedback from the subject community sourced prior to the full release of the project deliverables (see section 7.2) contained representative commentary from both proponents and opponents to the release and adoption of OERs. Proponents tended to compliment the opportunity to share quality materials and appreciated the broad spectrum of benefits this offers. Opponents challenged the academic quality, pedagogic contribution and general 'usefulness' of some OERs. There are also various opinions on the general 'ownership' of materials and with whom IPR resided.

This Project offers simple guidance on the design and presentation of reusable learning objects based on Boyle's (2003) 'Guidelines in Creating Reusable Learning Objects (RLOs)'¹.

The Project also acknowledged the spectrum of existing views concerning the academic quality of open resources. In the absence of consensus on this issue, the learning units offered here are restricted to existing validated programmes of study, open to the scrutiny of an External Examiner. In addition, each contributor was tasked with resolving IPR issues with their employer and with ensuring all materials submitted were available for release under a Creative Commons licence.

7. General approach

At conception, it was envisaged that the initial contributors would come from our UK based subject community and that the potential adopters would come from the global subject community of academics and students capable of accessing JorumOpen and to whom materials scripted in English could be of use.

Following a UK subject community-wide call for expressions of interest, modules of study were selected from within those Schools of Computing/Computer Science and Electronic and Computer Engineering who had demonstrated a significant strategic investment in supporting the development and deployment of on-line materials, evidenced by the associated academic credit value and utilisation across multiple programmes of study in-house. This initial pass brought to our attention materials which had already undergone some measure of refinement and within which the content was stable.

Acceptance of materials was further governed by a small number of Guidelines on Quality and Repurposing (see Appendices 3 and 5). In essence, the materials submitted had to have been used for more than one year as part of an approved and validated undergraduate or postgraduate programme of study and have had assessment considered by an External Examiner at least once (following the existing practice for the external assessment governing the host programme of study). In

¹ Boyle, T. (2003) Design principles for authoring dynamic, reusable learning objects. Australian Journal of Educational Technology, 19, 1, 46-58.

addition, each contributor was asked to evidence added pedagogic value derived from the use of the materials offered. This was subjectively assessed by a range of appropriate metrics which included increased student engagement (attendance records), increased student satisfaction (module evaluation) or an improvement of the over student mark profile (module mark profile). This commentary is contained within each module description for consideration by potential adopters.

The Project identified seven contributors across five institutions willing to participate and to become signatories to the Consortium agreement governing the Project. The Project also secured the support of the British Computer Society. Having selected contributors, each module offered was as far as possible decoupled and restructured to yield autonomous learning units according to Repurposing Guidelines offered up to the contributors as suggested by Boyle (2003)¹ (see Table 9.1, p15).

Satisfactory implementation of the Quality and Repurposing guidance was verified by the Consortium before the learning units were made available for localised release and upload into JorumOpen (see Appendix 6).

7.1 Engagement with contributors.

The initial Project Bid Document was accompanied by Letters of Intent countersigned by the Heads of School/Department or Deans of Faculty as well as by the contributors themselves. The Consortium Agreement was in all cases overseen by the appropriate officers within each of the contributor's institutions and explicitly dealt with issues relating to IPR and the release of materials under a Creative Commons licence.

The Consortium Agreement established the terms, the rights and obligations of the contributors. These obligations included their respective contributions and remuneration, the management structure and all other terms of collaboration to be complied with in connection with this Project.

A Project Management Team coordinated the activities of the Project Steering Group and its two sub-committees: the Quality Committee and the Repurposing and Validation Committee. Email and telephone exchanges were complemented by a schedule of formal meetings over the duration of the Project.

Project Steering Group meetings	10 September 2009 2 December 2009 10 February 2010
Quality Committee meetings	30 September 2009 6 November 2009 3 December 2009
Repurposing and Validation Committee meetings	28 September 2009 5 November 2009 18 January 2010

Table 7.1 Schedule of Project committee meetings

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

The initial framing of the Project and the careful selection of contributors avoided particular technical, legal or organisational issues interfering with the initial project objectives.

7.2 Engagement with potential adopters

The assembled materials were first trialled by a limited access release (password protected) in December 2009 open to ICS Departmental Representatives. From December 2009 to February 2010, we recorded 273 visits to the trial site. As to be expected, the majority of these visits (90.8%) originated from within the UK but we also logged visits from countries including USA, Sweden, UAE, Malaysia, France, Italy and India. Feedback obtained over this phase related to metadata tagging issues and server access which the Project Team moved to resolve.

The Project Team undertook a baseline survey of our subject community's attitudes to the sharing and adoption of learning and teaching materials (as formulated by the Higher Education Academy's UK Centre for Bioscience). A summary of the results obtained are available at <http://www.ics.heacademy.ac.uk/projects/oer/surveyanalysis.doc>. Further analysis and formal reporting on the results of this survey is planned. Among the commentary captured by the survey was evidence of a level of concern relating to the perceived quality of some OER offerings and the time requirement demanded for the effective repurposing of the same. Similar concerns were debated by the Project Steering Group. In mitigation, the Project Team developed two sets of broad Guidelines (Quality Guidelines and Repurposing and Validation Guidelines) which were applied to the learning units brought forward by the consortium.

The Quality Guidelines were established to govern the academic content of the materials to be placed in the public domain under the terms of the Project (see Appendix 3).

The Repurposing and Validation Guidelines were established to govern the portability and accessibility of the resources to be placed in the public domain under the terms of the Project (see Appendix 5)

The Project also delivered two formal dissemination workshops where contributor presentations preceded guided hands-on exploration of the learning units deposited in JorumOpen. These events also provided additional opportunities to harvest feedback on the resources made available under the terms of the Project and to explore the sustainability and expansion of the current offering.

Teesside University	10 February 2010
University of Portsmouth	19 March 2010

Table 7.2: Schedule of Dissemination Events

Potential adopters have available to them 665 learning units on JorumOpen, each independently discoverable and maximally reusable. Each learning unit represents an autonomous lecture, tutorial, practical assignment, assessment, or reading list. The supportive metadata tagging permits discovery of additional supportive learning

units at the topic level and links to an overarching module descriptor which details, among other things, Author, Host Institution, Module Title, Programme of Study, Credit value, and Aims. It also has links to a complete module download (Zip file) and to the individual topics and learning units available (see Appendix 7 for an exemplar module descriptor file supplied in support of the learning units).

7.3 Evaluation of resources

The initial limited access release and subsequent dissemination activities were accompanied by invitations for potential adopters to contact the Project Support Officer or the Technical Support Officer directly by either email or telephone. All such contacts were logged and responded to. Additionally, electronic forums were established to facilitate cross-adopter discussions on the discovery, adaptability and suitability of the learning units. These discussion threads were monitored by the Technical Support Officer with suitable interjections offered where appropriate.

When the materials were originally hosted on a local server, server logs monitored access, origin and dwell time.

At the time of writing the JourmOpen Technical Team are investigating ways to harvest statistics on traffic sources and on-site activity. The most popular traffic sources for April 2010 were reported (in rank order) as:

- | | |
|-------------------|----------------------------------|
| 1 www.jorum.ac.uk | 6 www.c-change.org.uk |
| 2 Google | 7 www.ics.heacademy.ac.uk |
| 3 www.Merlot.org | 8 Bing |
| 4 Yahoo | 9 www.bioscience.heacademy.ac.uk |
| 5 Twitter | |

with the visitor demographics for the same period noted as (again in rank order)

- | | | |
|-------------|-----------|----------------|
| 1 UK | 5 Germany | 9 South Africa |
| 2 USA | 6 Canada | 10 Pakistan |
| 3 India | 7 Ireland | |
| 4 Australia | 8 China | |

(posted 23 April 2010 at <http://community.jorum.ac.uk/mod/forum/discuss.php?d=99>)

The JorumOpen environment also logs the number of times a Learning Unit has been viewed. Monitoring this activity for the period 18/3/10 to 22/4/10 across the Module Descriptor, associated module zip file and one randomly selected Learning Unit from within each of the five thematic areas supported by this Project indicated a growing an upward trend in the number of views recorded in all cases.

As of yet, the JorumOpen environment cannot report on the search strings entry/efficiency or download activity. It would be advantageous to analyse search efficiency and so refine the number of metadata tags being employed (down from the current 1,743 unique tags assigned across the learning units presented here) and to offer further guidance to future contributors. Similarly, the ability to track what has

been downloaded and by whom would provide an initial point of contact to which an invitation to provide feedback could be addressed and future impact assessed.

We will continue to work with the JorumOpen Technical Team in moving to identify potentially useful metrics to record access and downloads.

8. Implementation

At all stages the Project was informed and guided by the supportive framework of briefings and information sessions put in place by the Academy's Project Management Team.

Having identified suitable contributors and detailed the modules each would bring forward, the Project advanced on a number of fronts:

8.1 Consortium Agreement.

A Consortium Agreement was drafted and offered to the Project Partners. The correspondence which ensued reflected each institution's particular approach/concerns to agreeing contracts and their various sensitivities to the potential implications of surrendering IPR. However, a short, workable agreement was produced which was accepted and provided the foundation for all subsequent work.

8.2 Quality Committee.

A Quality Committee was established to provide appropriate Quality Guidelines governing the academic content of the OER materials to be placed in the public domain under the terms of the project. Terms of Reference and Quality Guidelines are presented in Appendices 2 and 3.

8.3 Repurposing and Validation Committee.

A Repurposing and Validation Committee was established to provide appropriate guidelines governing the portability and accessibility of the resources to be placed in the public domain under the terms of the Project and to agree appropriate metadata tags to be assigned to the spectrum of resources to be made available. Terms of Reference and Repurposing and Validation Guidelines are presented in Appendices 4 and 5.

A compliance check with both Quality and Repurposing Guidelines was undertaken for each learning unit offered with the necessary repurposing completed by the contributors prior to upload (see Appendix 6).

8.4 Metadata tagging

As we had hoped to make the materials discoverable by the global subject community of both academics and students, significant effort was invested in attaching appropriate metadata tags to each of the learning units which reflected the vocabulary of terms, pseudonyms and abbreviations in current usage. The 665 learning units are described by multiple tags from a lexicon of 1,743 unique terms assembled by the contributors and the Project's Technical Support Officer. The lexicon itself is available on JorumOpen and also on the ICS OER website at

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

<http://www.ics.heacademy.ac.uk/projects/oer/sandbox/search/>. Future work distilling the lexicon would be worthwhile and the resulting subset of tags offered to future contributors as a reference.

8.5 Awareness Building and Dissemination

The Project and Technical Support Officers interacted with other OER project institutions through email, telephone conversations and participation in workshops and presentations at conferences including the JISC CETIS Conference, Aston University, November 2009; the Open Learning Conference and OER Africa/UK Commission for UNESCO meeting, University of Nottingham, 25-26 November 2009.

Community briefings on the Subject Centre's involvement in the project, its aims and objectives began in January 2009 and continued for the Project's duration using the Centre's Newsletter publications, a web presence, events postings and mail shots.

A Project Workplan scheduled two dedicated events which were successfully completed in Teesside University, February 2010 and University of Portsmouth, March 2010.

The Project Outline was presented at the second meeting of the eLearning and Student Experience Special Interest Group on 23 March 2010 and at the OER10 Conference, Cambridge, 23-25 March 2010.

The availability of Project deliverables were announced via the BCS eLearning Specialist Group and outlined to the Council of Professors and Heads of Computing.

At the time of writing, the project is scheduled to be represented at the Higher Education Academy's Annual Conference 2010, (University of Hertfordshire) and at the Information and Computer Sciences Subject Centre's 11th Annual Conference 2010, (Durham University).

A collaborative OER dissemination event with the STEM group of Subject Centres is also in planning.

9. Outputs and Results

The Project adopted 11 complete modules of study offered by seven contributors across five institutions. Decoupling and restructuring yielded 665 learning units. Each learning unit represents an autonomous lecture, tutorial, practical assignment, assessment, or reading list supported by metadata tagging which links units at the topic level and presents an overarching module descriptor which details, among other things, Author, Host Institution, Module Title, Programme of Study, Credit value, and Aims. It also has links to a complete module download (Zip file) and the individual topics and learning units available within the host module. Table 9.1 overleaf summarises the thematic area, academic level, number and granularity of the learning units made available by this Project.

Thematic Area	Academic Level	Credit Value	Learning Units available
Computer Science Concepts	4	20	11 lectures, 21 class tests, 1 laboratory-based practical exercise, 5 assignment pieces.
Database Concepts	5	40	20 lectures, 1 workbook, 6 screencasts.
Distributed Web Systems	6	20	14 lectures, 13 practical exercises and solutions, 12 quizzes and answers, 6 tutorials, 1 reading material piece.
Introduction to Artificial Intelligence	4	20	21 lectures, 10 tutorials, 14 reading material pieces, 17 tests, 17 practical exercises and solutions, 3 notes, 1 video lecture.
Introduction to OO programming in Java	4	15	12 lectures, 19 visual aids, 5 assignment pieces, 13 task guides, 46 reading material pieces.
Object Oriented Software Development	5	20	9 lectures, 8 laboratory-based practical exercises, 11 reading material pieces.
Rapid Application Development	5	15	11 lectures, 31 laboratory-based practical exercises, 22 task guides, 9 reading material pieces.
Real-Time Embedded Systems	6	20	17 lectures, 7 quizzes and answers, 7 laboratory-based practical and solutions.
Structured Systems Analysis	3/4	20	2 lectures, 12 video lectures, 22 reading material pieces, 4 classroom-based practicals and solutions, 14 non-assessed written exercises, 13 examples, 9 teaching guides.
Web Analysis and Design	4	10	4 classroom-based practicals and solutions, 3 task guides, 70 reading material pieces.
Web Design and Objects	6/7	10	8 lectures, 1 classroom-based practical, 24 reading material pieces, 4 task guides.

Entry point	Academic level
Pre-university	3
First year	4
Second year	5
Final year	6
Masters	7

Table 9.1: Quantity and nature of learning units available per module of study

Each learning unit is independently discoverable and maximally reusable.

The source modules represented 210 credits in total. Collectively, therefore, the 665 learning units available can be equated to a minimum of 2,100 hours of learning.

All learning units have been deposited into, and are directly accessible from, JorumOpen.

The materials submitted by the Project Contributors had been developed over a number of years and are backward compatible with current versions of the original development software. No propriety software or non-standard formats are offered. Typical formats and the material encoded are summarised in Table 9.2 below:

Name of standard or specification	Version	Notes
DOC/PDF/PPT	Most recent/defacto Microsoft offering/PDF/UA	Binary Text Documents
HTML/CSS	Most recent/defacto	Web Standard
Flash(SWF)/GIF/JPEG	Most recent/defacto	Web image presentations
AVI (WMF)/WAV/MPEG	Defacto	Multimedia containers/audio and video

Table 9.2: Software standards and formats across the learning units

The resources are in the main openly accessible and available for format conversions. The module descriptors embedded with the learning units direct potential adopters to the suite of accessibility tools collated by TechDis.

10. Outcomes and Impact

The Project has achieved the original aims and objectives. Table 10.1 overleaf suggests how the outcomes of the Project have addressed the interests of our major stakeholders (as identified in the original Bid Document):

Stakeholder	Interest/stake	Project Outcome
Project contributors	Recognition/Reputation	Due attribution embedded within the learning units affords appropriate recognition to each contributor. All concurred with the Project guidelines issued and approved of the materials deposited into JorumOpen.
Project advisors	Project Success/Dissemination of informed good practices	The envisaged project outputs have been achieved. Planned dissemination activities have been achieved, supplemented and well-received.
Professional body	Leadership / promotion of best practice	Have been appraised of progress. Chair of the BCS e-Learning Specialist Interest Group has viewed the resource.
Teaching staff	Adopters/Users	Initial feedback is positive.
Subject Centre Network	Shared experience/future collaboration/future promotion of resources	Lessons have been learned and experiences shared. Collaboration with the STEM group has been strengthened.
Technical Support staff	Interoperability/Access	There have been numerous productive exchanges between the Project's Technical Support Officer and the JorumOpen Development Team. All learning units have been uploaded successfully and are accessible.

Table 10.1 How Interests of Stakeholders have been addressed

The Project provided an opportunity for the Subject Centre to lead in a major new initiative and to raise the awareness of our work both nationally and internationally. Further and fuller analysis of impact will continue beyond the current time-frame.

11. Conclusions and Recommendations

Below is offered an initial list of conclusions presented at this time:

1. Institutional concerns arising from the surrender of IPR would appear to go beyond the concerns of the individual contributors and members of the subject community. (Standardisation and simplification of Consortia Agreements as they relate to open source materials would greatly help here).
2. Authors need to be aware of copyright issues governing third party materials and of the formal processes required in securing all appropriate permissions to include such materials within OERs.
3. Contributors were concerned that future inappropriate or factually incorrect modifications to their initial offerings may be attributed to them.
4. Decoupling materials within pre-existing modules can be difficult.
5. Attaching appropriate metadata tagging is crucial to ease discovery.

Recommendations:

1. Standardisation and simplification of Consortium Agreements as they relate specifically to open source materials would be of assistance.
2. Offerings embedding a significant amount of third-party material are best avoided, or if possible re-written.
3. Misrepresentation is not unique to OER materials and can be addressed in the normal manner (through withdrawals or appropriate take-down policies)
4. Adequate decoupling of existing materials is possible, if time-consuming. Tools exist to support authors setting out to write course content as a series of independent learning units (eg GLO Maker which was developed by Professor Tom Boyle, Learning Technology Research Institute, London Metropolitan University <http://www.glomaker.org/>)
5. The Project should be guided by the ongoing research findings of various tagging schemas and efficiency of search algorithms.

12. Implications for the future

The Subject Centre would wish to promote a cultural change in attitudes to the release, adoption and reuse of micro-sized, open source learning units. Where possible, we would wish to supply case-study materials and publications in support of this approach and will continue to provide a forum for the debate and dissemination of the same.

We would hope to further engage with our Special Interest Groups and through them add to the five thematic computing areas within this pilot and begin to support additional themes reflective of the spectrum of computing based programmes.

The Centre is already funding a project to identify sites containing 'open' learning materials which are provided in the form of reusable learning objects (RLOs) across the English speaking world. The intention is to construct a web resource which provides:

- links to all such resources which meet certain quality standards;
- a search mechanism for users to find relevant materials; and
- a mechanism for the resource to be updated regularly with minimal effort.

This Project will be completed in July 2010. It is hoped that making such a resource available will further familiarise our subject community with the nature of OER materials in existence globally, to simultaneously offer some examples of good practice and to support and to support and encourage the UK subject community to script and release more of their own materials.

13. References

Boyle, T. (2003) Design principles for authoring dynamic, reusable learning objects. Australian Journal of Educational Technology, 19, 1, 46-58.

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

14. Appendices

14.1 Appendix 1

Title of resource, academic level, credit value and nature of materials made available by the Project

Resource Index	Partner	Title of resource	Academic level	Credit value	Nature of materials
1.1	Teesside University	Structured Systems Analysis	3/4	20	Lecture notes/slides, video based support materials and assessment materials.
1.2	Teesside University	Web Analysis and Design	4	10	Lecture notes/slides and assessment materials.
1.3	Teesside University	Web Design and Objects	6/7	10	Lecture notes/slides and assessment materials.
2.1	London Metropolitan University	Object Oriented Software Development		20	Lecture notes/slides and assessment materials.
2.2	London Metropolitan University	Rapid Application Development	5	15	Lecture notes/slides and assessment materials.
2.3	London Metropolitan University	Introduction to OO Programming in Java	4	15	Lecture notes/slides and assessment materials.
3.1	University of Portsmouth	Distributed Web Systems	6	20	Lecture notes/slides and assessment materials.
3.2	University of Portsmouth	Real-Time Embedded Systems	6	20	Lecture notes/slides and assessment materials.
4.1	Sheffield Hallam University	Database Concepts	5	40	Lecture notes/slides, video based support materials and assessment materials.
5.1	University of the West of England	Introduction to Artificial Intelligence	4	20	Lecture notes/slides, video based support materials and assessment materials.
5.2	University of the West of England	Computer Science Concepts	4	20	Lecture notes/slides and assessment materials.

Entry point	Academic level
Pre-university	3
First year	4
Second year	5
Final year	6
Masters	7

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

14.2 Appendix 2

UNIVERSITY OF ULSTER

HIGHER EDUCATION ACADEMY SUBJECT CENTRE FOR INFORMATION AND
COMPUTER SCIENCES

OPEN EDUCATIONAL REPOSITORY IN SUPPORT OF COMPUTER SCIENCE

QUALITY COMMITTEE

MEMBERSHIP

Chair: Miss Sharon McCaffrey, Project Support Officer, Higher Education Academy Subject Centre for Information and Computer Sciences, University of Ulster

Core members: Mr Simon Fraser, Technical Support Officer, Higher Education Academy Subject Centre for Information and Computer Sciences, University of Ulster

Dr Gary Griffiths, Teesside University

Dr Stephen Hagan, Project Director, Higher Education Academy Subject Centre for Information and Computer Sciences Centre Manager, University of Ulster

Dr Rinat Khusainov, University of Portsmouth

Professor Dominic Palmer-Brown, London Metropolitan University

Mrs Hazel White, Project Manager, Higher Education Academy Subject Centre for Information and Computer Sciences, University of Ulster

Dr Rong Yang, University of the West of England, Bristol

In addition to the above membership, other staff may be invited to attend meetings of the Quality Committee as appropriate for other agenda items.

TERMS OF REFERENCE

This Project aims to make available core educational materials which can be deployed across the spectrum of computer-related programmes, including new and emerging disciplines. The distillation and presentation of a sub-set of materials kernel to Computer Science is intentional to maximise the potential for uptake.

The Quality Committee will:

- 1 Establish appropriate communication and reporting mechanisms.
- 2 In reaching decisions, have due regard for democratic decision-making, whilst recognising that the decision of the Project Director is final.
- 3 Agree a schedule of at least three Quality Committee meetings which will be held by teleconference.
- 4 Report to each meeting of the Repository's Steering Group.
- 5 Develop appropriate Quality Guidelines on materials to be made available online.
- 6 It will validate the quality, academic level and associated credit value of materials submitted to the Repository.
- 7 Adhere to a deliverable schedule and report deadlines as detailed in the Bid Document.
- 8 Receive collated copies of materials offered under the Project terms from the Project Team.
- 9 Prepare and circulate project reports as appropriate.
- 10 Liaise with the Steering Group and the Project Team, including the Project Support Officer and the Technical Support Officer, to prepare and submit formative reports in a timely fashion.
- 11 Liaise with the Steering Group and the Project Team, including the Project Support Officer and the Technical Support Officer, to prepare and submit a final summative report in a timely fashion.

In reaching decisions, the Consortium will have due regard to their impact on, and implications for, widely accepted commitments to ensuring equality of opportunity and good relations where possible and practicable. The Consortium will ensure that its actions are proactive in this respect.

14.3 Appendix 3

UNIVERSITY OF ULSTER

HIGHER EDUCATION ACADEMY SUBJECT CENTRE FOR INFORMATION AND
COMPUTER SCIENCES

OPEN EDUCATIONAL REPOSITORY IN SUPPORT OF COMPUTER SCIENCES

OER QUALITY GUIDELINES

The Quality Committee of the Open Educational Repository in Support of Computer Science Education (known as 'the OER Project') have agreed the following guidelines on the academic quality governing materials to be deposited:

1. That materials accepted to the Repository must:

Have been used for more than one year as part of an approved and validated undergraduate/postgraduate programme;

and

Have had their assessments considered by an External Examiner at least once. (Only previously agreed assessment materials, eg past papers, will be included and remains dependent upon both institutional and author viewpoints.)

2. Evidence of added pedagogic value will be subjectively assessed by a range of appropriate metrics which may include increased student engagement (Attendance records), increased student satisfaction (Module evaluation) or an improvement of the over student mark profile (Module mark profile).

It is acknowledged that the materials offered under the terms of the Project represent a snapshot of the current offering and that the future currency of the materials is a separate issue falling outside of the terms of the Project.

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

14.4 Appendix 4

UNIVERSITY OF ULSTER

HIGHER EDUCATION ACADEMY SUBJECT CENTRE FOR INFORMATION AND
COMPUTER SCIENCES

OPEN EDUCATIONAL REPOSITORY IN SUPPORT OF COMPUTER SCIENCE

REPURPOSING AND VALIDATION COMMITTEE

MEMBERSHIP

Chair: Professor Tom Boyle, London Metropolitan University

Core members: Mr Simon Fraser, Technical Support Officer, Higher Education
Academy Subject Centre for Information and Computer
Sciences, University of Ulster

Dr Stephen Hagan, Project Director, Higher Education Academy
Subject Centre for Information and Computer Sciences Centre
Manager, University of Ulster

Dr Mike Lockyer, Teesside University

Miss Sharon McCaffrey, Project Support Officer, Higher
Education Academy Subject Centre for Information and
Computer Sciences, University of Ulster

Professor Dominic Palmer-Brown, London Metropolitan
University

Dr Jim Smith, University of the West of England, Bristol

Dr Elizabeth Uruchurtu, Sheffield Hallam University

Mrs Hazel White, Project Manager, Higher Education Academy
Subject Centre for Information and Computer Sciences,
University of Ulster

In addition to the above membership, other staff may be invited to attend meetings of the Quality Committee as appropriate for other agenda items.

TERMS OF REFERENCE

This Project aims to make available core educational materials which can be deployed across the spectrum of computer-related programmes including new and emerging disciplines. The distillation and presentation of a sub-set of materials kernel to Computer Science is intentional to maximise the potential for uptake.

The Repurposing and Validation Committee will:

- 1 Establish appropriate communication and reporting mechanisms.
- 2 In reaching decisions, have due regard for democratic decision-making, whilst recognising that the decision of the Project Director is final.
- 3 Agree a schedule of at least three Repurposing and Validation Committee meetings which will be held by teleconference.
- 4 Report to each meeting of the Repository's Steering Group.
- 5 Develop appropriate Quality Guidelines on materials to be made available online.
- 6 It will validate the quality, academic level and associated credit value of materials submitted to the Repository.
- 7 Adhere to a deliverable schedule, report deadlines and payment schedule as detailed in the Bid Document.
- 8 Collate copies of materials offered under the Project terms.
- 9 Prepare and circulate project reports as appropriate.
- 10 Liaise with the Steering Group, the Project Support Officer and the Technical Support Officer, to prepare and submit formative reports in a timely fashion.
- 11 Liaise with Steering Group, the Project Support Officer and the Technical Support Officer, to prepare and submit a final summative report in a timely fashion.

In reaching decisions, the Consortium will have due regard to their impact on, and implications for, widely accepted commitments to ensuring equality of opportunity and good relations where possible and practicable. The Consortium will ensure that its actions are proactive in this respect.

Project Acronym: [None Adopted]
Version: 3
Contact: Dr Stephen Hagan
Date: 29 April 2010

14.5 Appendix 5

UNIVERSITY OF ULSTER

HIGHER EDUCATION ACADEMY SUBJECT CENTRE FOR INFORMATION AND
COMPUTER SCIENCES

OPEN EDUCATIONAL REPOSITORY IN SUPPORT OF COMPUTER SCIENCE

OER REPURPOSING AND VALIDATION GUIDELINES

The Repurposing and Validation Committee of the Open Educational Repository in Support of Computer Science Education (known as 'the OER Project') have agreed the following guidelines on the materials to be deposited:

- 1) All institutional references and branding will be removed and links between modules not provided as part of the Project be decoupled by the contributing authors.
- 2) With regard to additional reading materials, such recommendations should be added as a PDF, as they constitute a paper which did not originate with the author and any repurposing is not within their remit, which will remove the need to identify/maintain URLs which may breakdown.

It is acknowledged that the materials offered under the terms of the Project represent a snapshot of the current offering and that the future currency of the materials is a separate issue falling outside of the terms of the Project.

14.6 Appendix 6 - Compliance Matrix

		QUESTION				
CONTRIBUTOR NAME	<i>Material Contributed</i>	<i>Repurposing & Validation</i>		<i>Quality</i>		
		Have all institutional references and branding been removed and links between modules not provided as part of the Project been decoupled?	Where references are made to supportive materials, such as published works, copyrighted to individuals or organisations not signatories to the Consortium Agreement governing this Project, have such materials been appropriately attributed?	Have materials offered been used for more than one year as part of an approved and validated undergraduate/postgraduate programme?	Have these materials had their assessments considered by an External Examiner at least once (the exception being Level 1 materials which normally would not have been presented for consideration by an External Examiner)? Formal assessment materials, eg past papers, may be included if both the contributing author and their institution have signalled their approval to do so.	Has a commentary on the added pedagogic value derived from the development/adoption of the materials in the form offered been supplied by the contributor? This will be subjectively assessed by a range of appropriate metrics which may include increased student engagement (attendance records), increased student satisfaction (through module evaluation) or an improvement of the overall student mark profile (module mark profile).
Yang, Rong						
	Computer Science Concepts http://193.61.149.85/csc-readme.html					
Smith, Jim						
	Introduction to Artificial Intelligence http://193.61.149.85/ai-readme.html					
Uruchurtu, Elizabeth						
Authors: Curtis, S., Houldcroft, A., Beer, M. and Rimmington, M.	Database Systems http://193.61.149.85/database-readme.html					

Project Acronym: [None Adopted]
 Version: 3
 Contact: Dr Stephen Hagan
 Date: 29 April 2010

Khusainov, Rinat						
Author: Khusainov, R.	Distributed Web Systems http://193.61.149.85/dws-readme.html					
Authors: Khusainov, R., Cripps, M. and Magee, J.	Real-time Embedded Systems http://193.61.149.85/rtes-readme.html					
Lockyer, Mike						
Griffiths, Gary						
Authors: Griffiths, G. and Lockyer, M.	Web Design and Projects http://193.61.149.85/wdo-readme.html					
Authors: Griffiths, G. and Lockyer, M.	Structured Systems Analysis http://193.61.149.85/ssa-readme.html					
Authors: Griffiths, G. and Lockyer, M.	Web Analysis and Design http://193.61.149.85/wsd-readme.html					
Palmer-Brown, Dominic						
Author: Chalk, P	Introduction to OO Programming in JAVA http://193.61.149.85/OOP-readme.html					
Author: Chalk, P	Object-oriented Software Design http://193.61.149.85/oosd-readme.html					
Authors: Mumford, M. and Palmer-Brown, D.	Rapid Application Development http://193.61.149.85/rad-readme.html					

14.7 Appendix 7 - Exemplar Readme file

Author	Rong Yang
Institution	University of West England, Bristol
Module Title	Computer Science Concepts
Module Homepage	n/a
Original Resource	http://www.cems.uwe.ac.uk/~ryang/csc/csc.html (as found on 2/2/10)
Programme of study	BSc Computer Science
Academic Level	1st year
Credit Value	20
Rationale	Students will learn what computer science is.
Aims	<p>Taking the module the students will typically be able to:</p> <ul style="list-style-type: none"> • Describe simple models of computation and formulate small problems in terms of those models • Be able to express the syntax of formal languages in terms of productions • Describe algorithmic behaviour in appropriate formal terms • Be aware of the possibility of proving the correctness of algorithms • Be able to perform worst-case analysis on simple algorithms and describe performance using Big-O notation • Design and simulate three abstract computation models: Finite Automata, Push Down Automata, and Turing Machines • Define context-free languages formally by using various tools.
Benefits	<ul style="list-style-type: none"> • On completion of this module students have been able to show transferable skills in self-management skills, IT skills, and problem formulation and decision making. • The student engagement has been increased due to weekly class test and interactive teaching material. (See the lecture attendance table (as found on 2/2/10)). • The module pass rate has been improved over last a few years. Last year, the first time pass rate was 75.71%, and the resit pass rate was 85.71%.
Date of use	2001-2009
Download module	The module can be downloaded as a zip file at the following URL: http://open.jorum.ac.uk:80/xmlui/handle/123456789/1477
Accessibility	If you wish to view the material in alternative formats, then you may wish to access the software tools collated by TechDis and available at http://www.techdis.ac.uk/getaccessapps (as found on 2/2/10)
Module Level Elements	<p>Assignment: Assignment 1 -Design, Implement, and Test a FA and a PDA to Recognise Arithmetic Expressions</p> <p>Assignment: Assignment 2 - Turing Machine, Inductive Definitions and Minimum Java</p> <p>Reading Material: Insert Sort in C</p> <p>Reading Material: Quick Sort in C</p>
Topic	Introduction
Elements	Lecture: Introduction Class test: Introduction
Topic	Strings and languages
Elements	Lecture: Strings and languages Class test: Strings and languages Class test: Strings and languages Assignment: Worksheet 1 for Assignment 1

Topic	Finite Automata
Elements	Lecture: Finite Automata Class test: Finite Automata Class test: Finite Automata Assignment: Worksheet 2 for Assignment 1
Topic	Push Down Automata
Elements	Lecture: Push Down Automata Class test: Push Down Automata Class test: Regular Expressions Assignment: Worksheet 3 for Assignment 1
Topic	Prolog
Elements	Lecture: Prolog Class test: Logic Programming
Topic	Data structures and algorithms
Elements	Lecture: Data structures and algorithms Class test: Stacks and Queues Class test: Algorithms Practical: Lab Session - Comparing Two Sorting Programs
Topic	Revision Exercises
Elements	Lecture: Revision Exercises Class test: Mid-revision
Topic	Induction and recursion
Elements	Lecture: Induction and recursion Class test: Induction Class test: Recursion Assignment: Work sheet 1 term 2 for Assignment 2
Topic	Turing Machines
Elements	Lecture: Turing Machines Class test: Turing Machine Class test: Turing Machine Class test: Turing Machine Assignment: Work sheet 2 term 2 for Assignment 2
Topic	Complexity
Elements	Lecture: Complexity Class test: Space and Time Complexity Class test: Space and Time Complexity Class test: Space and Time Complexity
Topic	Languages and grammar
Elements	Lecture: Languages and grammar Class test: Languages and grammar Class test: Languages and grammar