

Collaborative OER Course Development – Remix and Reuse Approach

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ABSTRACT

This paper presents the initiative of OER course development for the undergraduate course, Software Scalability and Reengineering using Wikibooks which was recently completed in Semester II, July 2014 in Wawasan Open University (WOU), Malaysia. The initiative presents the phases involved for the development of OER-based course materials namely the OER course integration using Wikibooks, evaluation of Quality Assurance (QA) in OER learning content and the design of OER course material. The learning design for the computing courses with engagement of learning experiences and feedbacks from different stakeholders in Open Distance Learning (ODL) environment are taken into consideration as one of the major components in the OER-based course development phases. The OER-based course comprises of course units, self-tests, unit practice exercises and activities focused on supporting distance learners to fulfill self-directed learning. Evaluations and studies are being carried out at end of the semester by the course team members on the primary aspects focusing on assessments and course learning outcomes. The OER course development has successfully carried out with the integration of four Wikibooks as major resources mainly “Introduction to Software Engineering”, “A-Level Computing”, “Embedded Systems” and “Embedded Control Systems Design” to promote the use and understanding of Wikibooks and building a learning community in ODL environment.

Categories and Subject Descriptors

K.3.1 [Computers and Education]: Computer Uses in Education – distance learning

General Terms

Design, Experimentation, Performance.

Keywords

OER, Course Development, WikiBooks, Learning Navigation, Learning Outcomes.

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1. INTRODUCTION

The term Open Educational Resource (OER) defines technology-enabled, open provision of educational resources for consultation, use and adaptation by a community of users for non commercial purposes (Wiley, 2007). Wikibooks have been increasingly adopted by higher education institutions in assisting knowledge management for academic setting and development of collaborative online textbook (Ravid et al., 2008). The collaborative OER course development initiative was initiated by the OER course team members in School of Science and Technology, Wawasan Open University (WOU) during course units write up of the undergraduate course *Software Scalability and Reengineering*. The OER course development framework consist of three main development phases mainly: creation phase, evaluation phase and production phase as illustrated in **Figure 1**. The objective of the OER course development and required tasks are introduced to the course team members during the development of the OER-based course including (locating appropriate Wikibooks resources, understanding licensing policies, integration and customizing learning content). The OER course development team includes the Course Team Coordinator, Academic Members, Course Writers, Instructional Designers, Editor and External Course Assessor (ECA). The initiative carried out in this study provides new insight into the OER course development in open access environment by utilizing Wikibooks as the main resources in the development of course material, lecture notes and assessments used in the undergraduate study. The engagement of the different team members in this course development even as it progresses literally in real time adds value to the development and integration processes.

2. IDENTIFICATION OF RELEVANT OER FOR REMIX AND REUSE

In the identification of suitable OER resources, a number of relevant OER were selected for peer-review during the course development process. As highlighted by Hatakka (2009), writing new course content is time consuming and open content can help educational organizations to deal with these problems by offering free-to-use educational resources. In order to overcome the difficulties of locating suitable OER for course integration, virtual workshops were conducted via Skype for discussion sessions and Wikibooks resources are shared among team members using sharing platform service, Dropbox which supports cloud storage and file synchronization in this study.

During the development of the course material based on the Wikibooks resources, the following benefits of using Wikibooks

are identified in **Table 1** during the demonstrations and showcase of Wikibooks repositories (<https://en.wikibooks.org>). The benefits are derived while orientating the Wikibooks repositories towards the subject course – *Software Scalability and Reengineering*. The emphasis on the use of Wikibooks for this approach is due to the benefits and the content suitability of the Wikibooks to be used in collaborative environment. The four respective Wikibooks resources materials namely “*Introduction to Software Engineering*”, “*A-Level Computing*”, “*Embedded Systems*” and “*Embedded Control Systems Design*” are found to be suitable to be used as distance educational courses.

Table 1. Benefits of Using Wikibooks

Benefits	Descriptions
1. Save costs for students	-Wikibooks is an affordable option for students taking the course
2. Open Licenses – more clarity or certainty	-Wikibooks resources are licensed to allow sharing of content which provide more clarity and certainty regarding the reuse of its materials
3. Allows for peer review	-Students get to be involved in producing materials
4. Comprehensive curriculum of textbook	-Wikibooks resources provide accurate and relevant of textbook with wide range of topics
5. Editing Wikitext	-Wikibooks are written using Wikitext with several combinations of Wikitext, HTML and CSS -Easily to manipulate, read and edit.
6. Language	-Wikibooks support different language interpretations
7. Readership	-Wikibooks provide good structural and stylish structure including Main page, Table of contents, Navigations, Bibliography, Glossary, Appendices, Examples

3. OER INTEGRATION USING WIKIBOOKS

The **Figure 1** below illustrates the development model of the OER course development which includes three main phases mainly creation, evaluation and production phase.

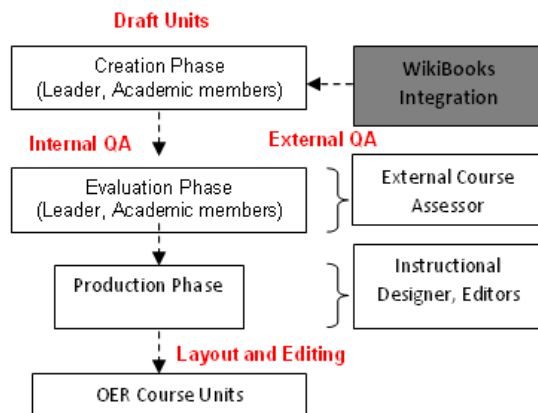


Figure 1. OER Course Development Framework

The three phases were undertaken by the OER course development team to produce approximately 50-60 pages per unit write up which consist of Unit 1: *Introduction to Scalability*, Unit 2: *Software Reuse*, Unit 3: *Dependability Reengineering*, Unit 4: *Software Reengineering* and Unit 5: *Evolving Software Paradigm*. The following **Table 2** describes the course learning outcomes for each of the course units to explain what a student is expected to learn during the course delivery and assessment. Establishing course learning outcomes is important to articulate knowledge, skills and help students to better understand their own learning and assist the course development in instructional design strategies.

Table 2. Learning Outcomes

Course Units	Learning Outcomes
1. Introduction to Scalability	-State the concept of software performances and scalability testing.
2. Software reuse	-Identify the key factors for reuse planning. -Explain the COTS system reuse.
3. Dependability Reengineering	-Perform dependability testing
4. Software Reengineering	Explore different paradigm of software reengineering.
5. Evolving Software Paradigm	Apply evolving software paradigm in software development.

Internal Quality Assurance (QA) such as interim reports and unit evaluations are produced in the course units’ development period. The internal QA is conducted by the peer-review performed by course team leader, academic member and instructional designers whereby external QA is conducted by External Course Assessor after the course units’ internal evaluations are completely undertaken. External Course Assessor is selected based on strong background in the subject matter with prime experience in distance learning environment.

4. DESIGN OF OER COURSE MATERIAL

4.1 Learning Navigation

As observed in **Table 3**, the five units’ materials are allocated to 200 hours with combinations of self-study, tutorials, assessments, library research, consultation and LMS learning activities which span over 20-24 weeks (approximately 6 months).











Table 3. Time Required Completing a Course

	Self-Study	Tutorial	Assessment	Library and Consultation	LMS	
Course Guide	2	0	0	0	0	2
Unit 1	10	2	0	2	8	22
Unit 2	20	2	10	3	14	49
Unit 3	20	2	0	3	14	39
Unit 4	20	2	12	3	14	51
Unit 5	20	2	0	3	12	37
Total Hours	92	10	22	14	62	200

The completed course units were distributed to six regional centres in each semester (Semester duration: 6 months) in Learning Management Systems (LMS). The course materials for *Software Reengineering and Scalability* created contain five sub-units for each course and are made available as CC-BY SA licence.

Table 4 shows the icons that are incorporated into the course units to facilitate self-directed learning. The icons are designed to inform the learners of the activities that are required to do before proceeding to the next section. The icons navigation is used to serve the purpose of richer reading and learning experiences.


Table 4. Interactive Icons Used for Learning Navigation

			
Activity	Assignment	Audio	Case Study
			
Reading	Reminder	Self-test	Summary
			
Tutorial	Web Reference		

4.2 Example of WikiBooks Integration

The following **Figure 2** is an example of *A-level Computing Wikibooks* incorporated in the unit write up “*Web Reference*” section of Unit 1 *Software Scalability*. The diagram of **Black box testing** is use in the inclusion of the learning pathway to demonstrate a search algorithm. The Web Reference icon is used to assist learner’s navigation.

The following provides an example of black box testing on a search algorithm.



In this search algorithm, the code segment which is being run in the background is not made aware to the tester during black box testing. The user will only know what results should come about from particular data inputs. This is useful for complex subroutines that have multiple possible inputs.

Web Reference

You can refer to the following online resources about the Black box testing:

https://en.wikibooks.org/wiki/A-level_Computing/AQA/The_Computing_Practical_Project/Design#Black-box_testing

Figure 2. Example of Reusing “Black Box Testing” concept from A-Level Computing Wikibooks
http://en.wikibooks.org/wiki/A-level_Computing

The following **Figure 3** depicts the creation of “*Self-test*” with the support of *Embedded Control Systems Design Wikibooks*.

Self-test 5.2

- Referring to the Wikibooks https://en.wikibooks.org/wiki/Embedded_Control_Systems_Design/Design_criteria
 Explain the design criteria for an embedded system in the following aspects:
 - Robustness
 - Human Resources
- Discuss the following technical design for the following embedded control system:
 - Aviation: Flight control
https://en.wikibooks.org/wiki/Embedded_Control_Systems_Design/Aviation#Flight_Control_System
 - Robotics: Robocup
https://en.wikibooks.org/wiki/Embedded_Control_Systems_Design/Robotics/A_team_of_RoboCup_robots

Figure 3. Example of “Self-test” reused at the end of the unit to test the learner’s background understanding of the course content.

http://en.wikibooks.org/wiki/Embedded_Control_Systems_Design

4.3 Assessment Strategy

Multiple qualitative and quantitative evaluations were conducted on ODL learners in completion of the OER courses at the end of the semester which provide findings such as assessments, examinations, learning outcomes and reviewers recommendations. According to Neumann and Hood (2009), course evaluations and assessments of learning outcomes are important for examining a particular learning and teaching context.

Table 5. Scheme of Assessment

	Assessment Methods	Weightage	Area of Assessment
Formative Assessment	Assignment 1	25%	-Application of Knowledge -Clarity of Concepts -Thinking Skills
	Assignment 2 (Mini Project)	25%	
Summative Assessment	Final Examination	50%	-Attentiveness -Comprehension -Application of Knowledge -Thinking Skills

The assessment strategy in the OER course is presented in **Table 5**. The weightage of **Formative Assessment (FA)** comprises of *Assignment 1* (25%) and *Assignment 2* (25%) which helps to evaluate the students understanding and provide ongoing feedbacks to improve their learning. **Summative Assessment (SA)** consists of a formal examination at the end of the semester to evaluate and measure learning achievement and skill acquisition as the end-of-course evaluation. The learners are required to apply the concepts introduced by this course and show

their ability to attempt the tasks outlined in the assessment methods as shown in the **Table 5**.

The process of aligning course learning outcomes takes in considerations the following three aspects (i) *Course content* (ii) *Learning Activities* and (iii) *Assessment*

The following learning outcomes evaluation is presented in **Figure 4** below. The assessments and the learning activities are aligned with the intended learning outcomes in order to lead the students to achieve and master specific outcome with teaching goal.

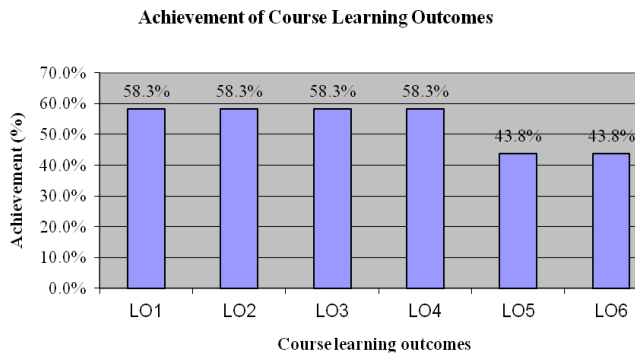


Figure 4. Achievement of Course Learning Outcomes.

In the final phase, the OER course has incorporated the following features as recommended reviewers, such as

1. Useful and practical programming simulation exercises
2. Illustrative pictorial diagram and flowcharts
3. Self-explanatory introductory programming concept for beginner
4. Improved flow of content
5. Examples, activities, self-test questions and unit practice exercises

The OER course development has been conducted smoothly within the estimated duration (6-8 months) and the course materials were provided to the students for ODL course delivery.

5. CONCLUSION

The presented study demonstrated the use of Wikibooks in course development for *Software Scalability and Reengineering* context and successfully completed with integration of four Wikibooks. The *Formative Assessment* and *Summative Assessment* are presented to evaluate the learners' achievement towards the course learning outcomes and to gain insight of how effective the students are achieving the course-specific goal (Simon & Taylor, 2009) upon completion of the course. The presented study and processes involved in course development are useful for future implementation of creation, reuse, remix, repurpose and redistribution of OER (Hilton et al., 2010) for open licensing framework in the future and aiming to broaden the accessibility of OER usage for student's learning. The OER course development aims to achieve the "increase of openness" as highlighted by Four R's approach includes Reuse, Revise, Remix and Redistribute (Hilton et al., 2010) and promoting awareness and the use of OER by integration of numerous resources such as Wikibooks (Chung and Khor, 2014).

6. ACKNOWLEDGMENTS

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