

OER-based course development framework in ODL environment

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OER-based Course Development Framework in ODL Environment

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Abstract

This paper describes the framework for the development of OER-based learning materials for foundation level courses in computer programming namely TCC121/05 Programming Fundamentals with Java and TCC241/05 Database Programming in School of Science and Technology, Wawasan Open University. The development framework consist of three main development phases mainly: creation phase, evaluation phase and production phase. The contribution of this paper is the insight it provides into the OER course development in open access environment by utilizing OER in the construction of a course. The engagement of the different stakeholders in this course development even as it progresses literally in real time adds value to the development process. This approach serves as a global call for greater effort in utilization of OER in parallel to the production of the resources. Virtual workshops were conducted via WizIQ and Skype in collective feedback sessions are presented in this study. The evaluations were conducted on ODL learners in completion of the two OER courses in January 2013 semester which provide findings such as learners' interactions, assessments, examinations, learning outcomes and external assessor's recommendations. The development framework further provides validation of academic descriptors for course specialists in initiating and supporting the creation of OER-based learning materials and utilise open content more effectively in the ODL environment.

Keywords: course development, OER, quality assurance, virtual workshops

1. Introduction

The use of Open Educational Resources (OER) which exists in different format (e.g. visual, text, audio and video) is available for supporting series of lessons or courses in ODL environment. OER repositories provides openly license that resides in the public domain (Atkins, 2007) with intellectual property license for users. The development of digital materials movement has encouraged users to re-use, revise, remix and redistribute resources (Hilton, 2010) through appropriate tools and made available through Creative Commons (CC) licensing. Instructors or course specialists who wish to integrate OER as part of their lesson perform validations on OER content to be considered and fit with a particular course.

The OER course development initiative is introduced to all the academic members in Wawasan Open University (WOU) during course units write up and the revise of course materials. E-Learning course, workshops and seminars are held to develop capacity of participants for integration of OER in their own teaching and learning. The OER-Asia initiative in 2010 under the auspices of the University for promoting and transforming the existing course development process is aim to increase the quality and efficiency of developing OER-based course materials (Menon and Ali, 2012). The OER Policy for WOU with implementation strategies are given as follows:

“WOU will promote and implement the creation, reuse, remix, repurpose and redistribution of Open Educational Resources (OER) within an Open Licensing framework”

The repositories are introduced to the course team members in the development of the two OER-based courses, *TCC121/05 Programming Fundamentals with Java* and *TCC241/05 Database Programming* who comprised of Course Team Coordinator, Academic Members, Course Writers, Instructional Designers, Editor and External Course Assessor (ECA) for searching, creating and customizing learning contents including content modules, articles, books and journals.

Both *TCC121/05* and *TCC241/05* were scheduled for course development in July 2012 as an OER integrated course adopting the WOU-Open License Policy (OLP) (Menon and Ali, 2012) and first presented in January 2013 semester.

- ☐ *TCC121/05* comprises of 5 units OER integrated materials.
- ☐ *TCC241/05* comprises of 3 units of standalone write up and 2 units of OER integrated materials.

The development of *TCC121/05* is a revise of course materials which conducted based on the students' and tutors' experience that have gone through the course whereby the development of *TCC241/05* is newly developed and presented first time with new students enrolled. The course module and OER additional contents provided in *WawasanLearn*— a LMS based on the open-source system called Moodle is aimed to broaden access for students' learning.

According to Burgos Aguilar et al. (2013), sharing OER can be a valuable way to disseminate knowledge, diversify teaching activities and gain new insights into other teaching methods for a particular subject. A number of technical issues relating to improving accessibility and usefulness of OER such as the use of open source software, increasing interoperability by using open standards and emerging technologies that affect the open educational resources movement are being investigated (OECD, 2007). Motivations for learners to participate in OER development are varied, and many struggle to engage with courses and keep motivated in the context of an online learning environment (Yuan and Powell, 2010). The live interactions sessions held in WizIQ are targeted to bring in the course development team members and other course specialist to become more familiar with the OER environment and opens up new possibilities of knowledge sharing in usage of OER repositories and CC licenses.

The outline of the paper as follows: The first section overviews the course development framework and discuss the three phases (creation, evaluation and production). Quality Assurance (QA) implementation is included as a core mechanism of evaluation phase to identify errors and follow-up actions. The findings and discussions are presented in the third section. The final section describes the conclusion and features adopted in the development framework.

2. Overview of OER Course Development Framework

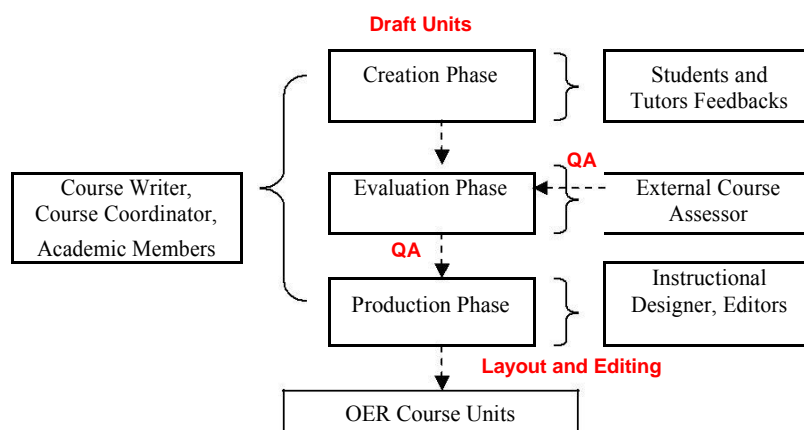


Figure 1: OER-based Course Development Framework

Figure 1 illustrates the overview framework of the course development which includes three main phases. They are creation, evaluation and production phase. Five main interim reports are produced in the development stages. The details of five main interim reports and members involved in the each stage of the course development framework are as follows:

1. Course Syllabus, Course Development Timeline

Members involved: Course Writers, Course Team Coordinator

2. Course Blue Print

Members involved: Course Team Coordinator, Course Writers, Academic Members and Instructional Designers

3. Course Guide

Members involved: Course Team Coordinator, Course Writers, Academic Members and Instructional Designers

4. Course Units

Members involved: Course Team Coordinator, Course Writers, Academic Members, Instructional Designers, Graphics Designers, Learning and Library Services Members

5. Assessments

Members involved: Course Team Coordinator, Course Writers, Academic Members and Instructional Designers

The use of CC license for the two courses is written based on the integration of OERs under a CC BY-SA 3.0 license. The courses are to be ensuring that the author's name (**attribution**) will remain while reusing it and the materials must also remain open license (**share-alike**). The course team coordinator and the publishing group (Instructional Designers) vetted the instructional status of course units in each evaluation phase. Several meetings were held among the course team members and all suggestions made by the course team were adopted to ensure sufficient amount of

contents in introducing programming concepts in Java and Database. The course units were assessed through review of ECA (SOP for Course Development, 2010) before final production.

3. Quality Assurance via Collective Feedback Sessions

The discussions in the collective feedback sessions held during the course development focused on the ‘how to develop’ and usage of OER particularly in Java programming related areas. In development of TCC121/05, tangible deliveries of virtual sessions using the virtual domain via WiziQ are held with guidance and step-by-step OER creation sessions for the OER content and intellectual property issues. The members perform productive discussion for resources that can be reuse, remix, repurpose and integrate can be accessed in the following sessions links:

- OER Creation Initiative Discussion <http://www.wiziq.com/online-class/645825-creation-assurance-repurpose-and-sharing-of-oer>

Members attended: Coordinator, Course Writers, Library members

- OER Repositories Walkthrough <http://www.wiziq.com/online-class/644140-basic-guide-of-oer-and-oer-repositories>

Members attended: Coordinator, Academic members, Instructional Designers.

- Assessment Discussion and Review of feedbacks
<http://www.wiziq.com/online-class/636868-java-programming-assessment-discussion>

Members attended: Coordinator, Course Writers

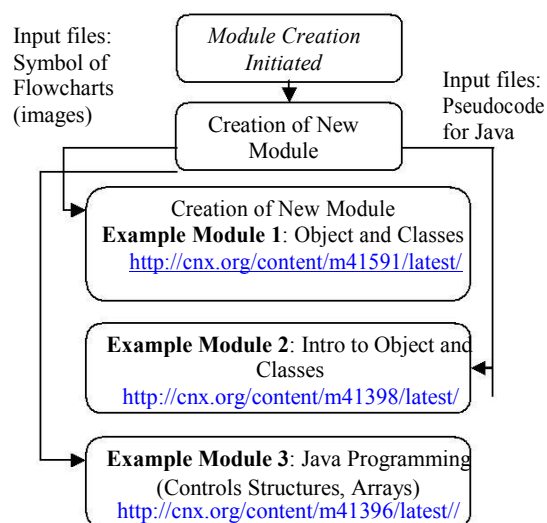


Figure 2: Showcase of modules creation in CNX OER repository

The study of adapting and remixing individual modules into courses (example illustrated using CNX) is presented in Figure 2. The creation of two modules illustrated in Figure 2 as follows:

Module 1: Object and Classes (with image containing Symbols of Flowcharts)
 Module 2: Intro to Object and Classes (Pseudocode for Java)
 Module 3: Java Programming (Control Structures, Arrays).

The three modules serve as supporting materials for the TCC121/05 in the examples sections. The examples for the modules created consist of self-contained metadata which allows the users to choose varieties of language used and the subject categories. The creation module enable users to import CNXML documents (Words files, OpenOffice files, LaTeX, multimedia assets) and select specific elements of the module to edit.

The development model for OER-based materials involves the discussion in several key components:

- ☐ **“Warp-around model” with only OER** – integration of OER resource in course development policy within an Open Licensing framework
- ☐ **“Stand-alone model” based on copyrighted books or/and OER** - identifying OER materials relevant to ODL courses for using and remixing OERs with WOU-Open License Policy (OLP).
- ☐ **“WOU-OER Repository”** - a repository holding the Wawasan Open University's collection of open educational resources (OER).

4. Findings and Discussion

Key Findings: Summary of OER Courses (TCC121/05, TCC241/05)

The assessment strategy and the summary of the information for the students enrolled in the OER courses: TCC121/05 Programming Fundamentals with Java and TCC241/05 Database Programming are presented in Table 1 and Table 2 below:

Table 1: Assessment Strategy

Type	TCC121/05 (Jan 2013)	TCC241/05 (Jan 2013)
TMA 1	25%	25%
TMA 2	-	25%
Mini Project	25%	-
Final Examination	50%	50%

Table 2: Summary of TCC121/05 and TCC241/05

	TCC121/05 (Jan 2013)	TCC241/05 (Jan 2013)
Number of learners enrolled for this course	124	6
Average age	32	33
Gender (Male/Female)	49% Male, 51% Female	100% Male
Participation rate (%) (No. of Online / No. Enrolled) *100%	98	90
Average frequency of activity over a semester (Total No. of Activity/No. of Learners Online)	7.39	5.12

Key Findings: External Course Assessors Reports

The course materials were evaluated by ECA and the ECA has no reservation in recommending that both the courses are suitable to be presented in a distance learning mode. The external course assessor for these two courses, Prof Andrew Lui was briefed with regards to the course development design and the course materials produced. The following recommendations were extracted from ECA final report for TCC121/05 Programming Fundamentals with Java and TCC241/05 Database Programming respectively:

“The course’ major topics: Basic Java Programming, Control Structure, Arrays and Array Operations are arranged in a logical and natural manner. These topics should altogether fulfil the course’s aims. The content should be able to allow students building a firm foundation for further studies in programming. Other aspects of the course such as instruction design and assessment are found to be acceptable and should be useful for teaching and learning.”

ECA: Prof Andrew Lui, Open University of Hong Kong (OUHK)

“Although it is a higher level course, the course still covers fundamental SQL which should be useful for students to revisit them before embarking on the rest of the journey. As stated before, the course is of a high technical nature and students are to study how to perform certain operations with database programming. From this perspective, the course should be able to satisfy the aim. I would expect that this course would be complemented by other courses that cover database program design issues, if otherwise students would have fewer opportunities to apply the skills.

The course development process was satisfactory and the course team was eager to improve the quality of course design, content, and writing. I am also grateful that Vincent Chung is always helpful and always willing to explain copyright and other course development issues to me. I am pleased to have been appointed the ECA of this course.”

ECA: Prof Andrew Lui, Open University of Hong Kong (OUHK)

Key Findings: Activity in LMS-WawasanLearn

The pattern of access and activity by the course participants are observed in the two courses in January 2013 semesters as depicted in Figure 3 (TCC121/05) and Figure 4 (TCC241/05).

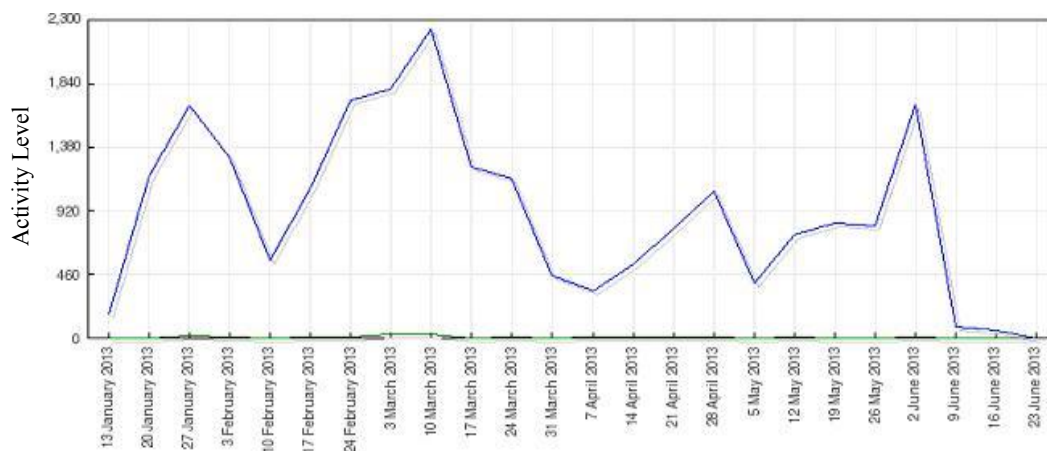


Figure 3: TCC121/05 (Views and Posts)

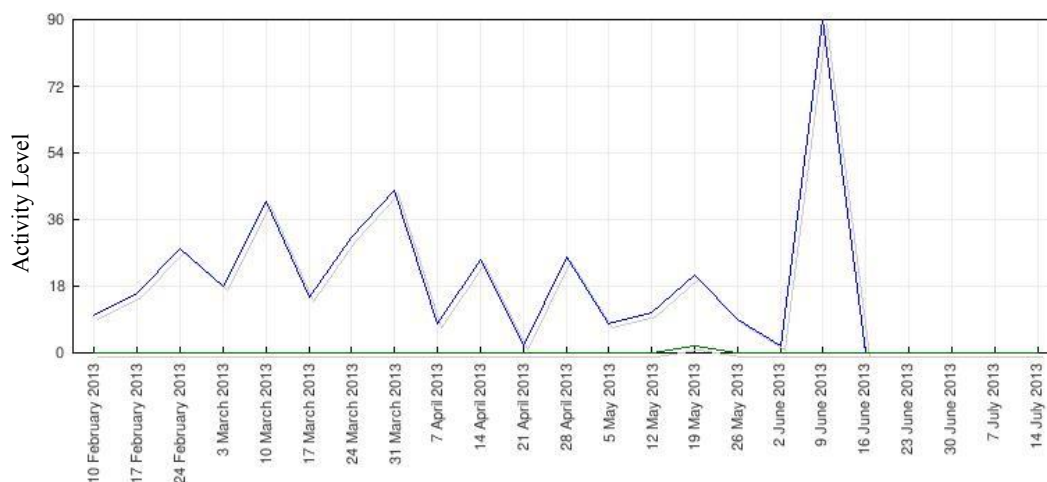


Figure 4: TCC241/05 (Views and Posts)

Key Findings: Assessments and Examination Score

Students' Performance for TCC121/05:

Candidates performed satisfactorily in the 6 questions in final examination, the students have fairly well answered the definition question, calculation and interpretation of algorithms. The *OES* (Overall Examination Score) achieved in January 2013 and July 2012 semester are as follow:

Table 3: Overall Examination Score

Overall Examination Score	January 2013 (OER)	July 2012 (Non OER)
Mean	54.18	50.98
Standard Deviation	12.56	11.17

As observed in Table 3, the Overall Examination Score (*OES*) achieved is 54.18%, with a standard deviation of 12.56. The OER-based student performance on the *OES* is considered to be above average as compared with non OER TCC121/05 with a mean score of 50.98% and standard deviation 11.17.

On the other hand, learners' scores for *OCAS* (*Overall Continuous Assessment Score*) as follow:

Table 4: Overall Continuous Assessment Score

Overall Continuous Assessment Score	January 2013 (OER)	July 2012 (Non OER)
Mean	75.14	68.84
Standard Deviation	8.82	7.10

Students' Performance for TCC241/05:

The course TCC241/05 is firstly presented in January 2013 semester with the newest batch of students enrolled. The *OES* (Overall Examination Score) achieved in January 2013 semester are as follow:

Table 5: Overall Examination Score

Overall Examination Score	January 2013 (OER)
Mean	47.00
Standard Deviation	12.56

Table 6: Overall Continuous Assessment Score

Overall Continuous Assessment Score	January 2013 (OER)
Mean	41.63
Standard Deviation	8.82

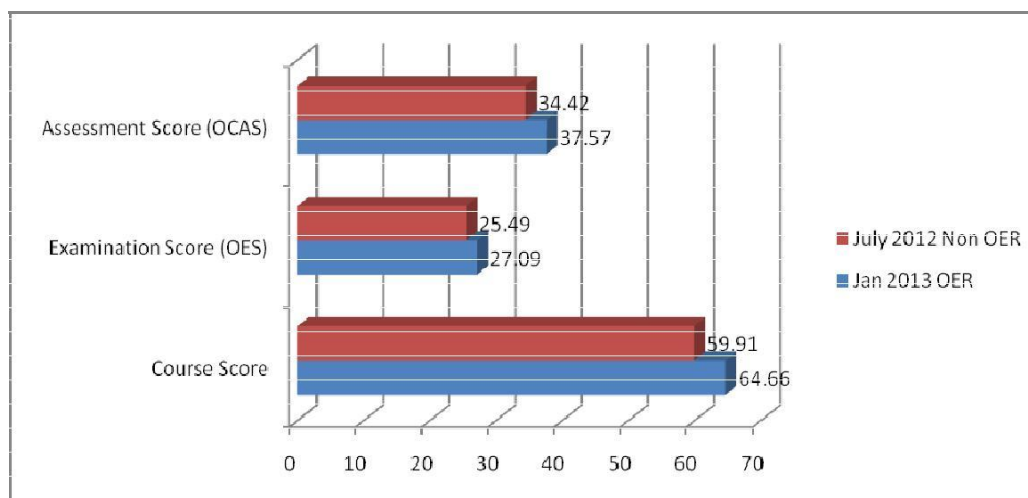


Figure 6: Students' performance for TCC121/05 (*Course Score* = *OES* + *OCAS*)

The summary of the students' overall performance is illustrated in Figure 6 above. The mastery of the TCC121/05 course is evaluated via an assessment strategy that

consists of assignments, *OCAS* weighted at 50% and a proctored final examination,

OES weighted at 50% to be computed as overall Course Score, 100%. It was found that the students who use OER course materials achieved better results in OCAS and OES. Further evaluation will be conducted for students who enrolled in TCC241/05 in the future.

Key Findings: Learning Outcome Performance Evaluation

The evaluation of the learning outcomes (LO) for the course is presented in Figure 7 and Figure 8. Upon successful completion of the course, the learners were observed to be able to master the six LOs as shown in Figure 7 and seven Los in Figure 8. The learners' performance on the course learning outcomes is considered to be above average with average score over 50%. The measure of achievement of unit learning outcome is evaluated through *Percentage of Passes* $\geq 50\%$ in examination question and assignments to determine the mastery of each *LO* by the learners. As indicated in *LO2*, The successful learners has reliably demonstrated the ability to analyse problems and producing software designs using object-oriented programming as the course has incorporated mini projects in the assignments aiming to test the students' knowledge and capabilities in solving java programming case studies. The detailed evaluation components (*examination + assignments*) of the course learning outcome are shown in Appendix A and B.

Course learning outcomes (TCC121/05):

1	Explain the fundamental concepts in hardware and software
2	Analyse problems and produce software designs to handle these problems using basic object oriented programming methodology
3	Construct objects and differentiate primitive data types and classes and perform simple data manipulation using Java
4	Apply the programming constructs like sequence, condition and iteration to develop applications using Java language
5	Use arrays and apply advance control structures in the applications to produce solution designs for problems using Java
6	Describe array based solution using searching, sorting, and multidimensional tabulation or recursion

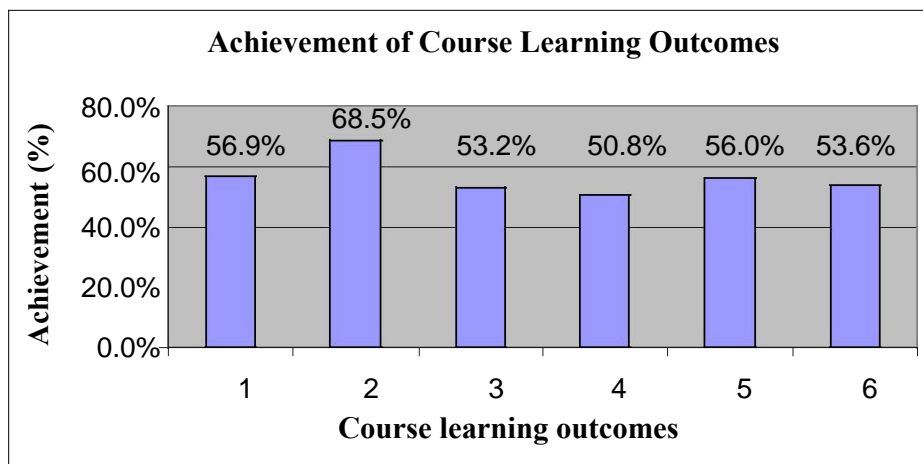


Figure 7: Evaluation of course learning outcomes (*Learning outcome 1 – 6*)

Course learning outcomes (TCC241/05):

1	Use foundation statements of T-SQL for adding data, query and update the database.
2	Use inner join, outer join, full join and cross join.
3	Create, alter and drop the table and database.
4	Apply the constraints in create table statement.
5	Create, edit and drop views with T-SQL.
6	Write basic T-SQL scripts and batches.
7	Create, alter and dropping stored procedures.

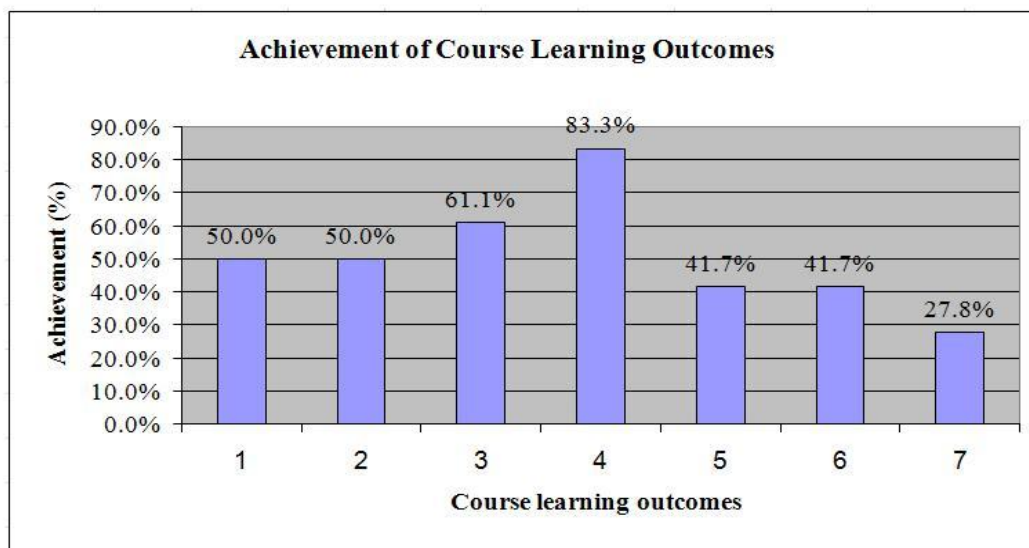


Figure 8: Evaluation of course learning outcomes (*Learning outcome 1 – 7*)

4. Conclusion

A number of discussions took place among course team members during the development and delivery of the two OER course learning materials in January 2013 semester. All the suggestions and recommendations made by the course team were incorporated in the course development cycle which includes the interaction among students and tutors with feedbacks sessions and learning experiences of courses units' content. The two OER courses developed were found to be covering all vital aspects of object-oriented programming, Java programming language and SQL programming at an appropriate level of details and good quality.

TCC121/05 and TCC241/05 have incorporated following features as recommended by the course team members:

- 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
- 6) Examples, activities, self-test questions and unit practice exercises

The course development for both TCC121/05 and TCC241/05 have been conducted smoothly within the estimated duration (6~8 months) and the course materials were provided to the students for ODL course delivery.

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Appendix A:
Course Learning Outcomes Performance Evaluation for
TCC121/05 Programming Fundamentals with Java

Course Learning Outcomes	Assessment of Course Learning Outcomes									
	Examination Questions									
	1	2	3	4	5	6	7	8	9	10
1			1				1			
2				1				1		1
3					1					
4		1		1		1			1	
5	1									
6										

Course Learning Outcomes	Other assessments of Course Learning Outcomes				Total	Achievement(%)	Achievement(Pass/Fail)	Bloom's Taxonomy Level
	(Legend: A = Assignment; P = Practical)							
	A1	A2	P1	P2				
1	1		1		2	56.9%	Pass	2
2	1		1		2	68.5%	Pass	1
3	1	1	1		3	53.2%	Pass	3
4	1	1		1	5	50.8%	Pass	2
5		1		1	2	56.0%	Pass	3
6		1		1	2	53.6%	Pass	2

Appendix B:

Course Learning Outcomes Performance Evaluation for TCC241/05 Database Programming

Course Learning Outcomes	Assessment of Course Learning Outcomes					
	Examination Questions					
	1	2	3	4	5	6
1	1					
2		1				
3				1		
4						
5			1			
6						1
7		1			1	

Course Learning Outcomes	Other assessments of Course Learning Outcomes (Legend: A = Assignment)		Total	Achievement (%)	Achievement (Pass/Fail)	Bloom's Taxonomy Level*
	A1	A2				
1	1		2	50.0%	Pass	1
2	1		2	50.0%	Pass	2
3	1	1	3	61.1%	Pass	2
4		1	1	83.3%	Pass	2
5		1	2	51.7%	Pass	2
6		1	2	51.7%	Pass	3
7		1	3	57.8%	Pass	2