

A STUDY ON COST-EFFICIENCY AND QUALITY OF OER INTEGRATED COURSE MATERIALS

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A Study on Cost-Efficiency and Quality of OER Integrated Course Materials

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Abstract

Reuse can be adopting or adapting with minimal changes, one or two existing OERs or identifying and integrating number of OER multimedia materials from various sources to suit the curricular needs of a new course. This paper reports a study which probes into the processes involved in finding, reusing and integrating a variety of OER materials to produce a new course and also the cost-efficiency of the OER integration process and quality of the resultant OER integrated course. Within the exploratory case study design adopted for the investigation, a mixed methods approach involving collection of both qualitative and quantitative data was employed. In addition to reporting the findings of the findability and reusability of OER the paper reports the details of research on cost efficiency of the OER integration process as well as quality of the course materials as perceived by the learners.

Key words

Cost-Efficiency, Time-Efficiency, Findability, Reusability, OER integration, Quality

Introduction

This paper reports a study addressing five research questions included in one of the sub-projects within the Research on Open Educational Resources for Development (ROER4D) Project being coordinated by the University of Cape Town and funded by IDRC, Canada. The first three research questions included in part 1 of the sub-project address the processes involved in the findability and reusability of OER materials in creating an OER integrated package of course materials and the last two research questions forming part 2 of the study focused on the extent of cost-efficiency of the course development process as well as quality of the resultant course materials as perceived by learners. A summary of the findings of research questions under part-1 is presented in the beginning to provide the context and background to part-2 of the study. The main focus of the paper is on the research questions under part-2 of the study for which the methodological details, analysis and findings are presented in detail.

Since the start of OER movement the main priority has been the creation of OER for various subject areas and the assumption was if variety of digital resources with relaxation of copyright restriction are available, more and more institutions and individuals will easily reuse them in classroom instruction as well as for developing new course materials in their own local contexts. However, reuse OER and its integration to create new courses did not happen as expected. Integration of OER-based e-learning in course development was a relatively new challenge for academic and academic-support staff in open universities including Wawasan Open University (WOU), established in 2007. At that point in time, OERs were gaining much popularity in the academic community for many reasons, one of which was for quality and cost-efficiency. In WOU, 'ICT in Education' a course at Post-Graduate Level was one of the two courses that were first attempted with OER-based e-learning. The notion of OER-based e-learning was basically the delivery of OERs, or OER integrated courses, using the e-learning mode. Integration of OERs in the development of this course provided the basic knowledge, skills and experiences of engaging with ICT (Menon, 2014). The development of the course adhered to the normative course development process at WOU, but additional quality assurance (QA) processes were necessitated to ensure the quality of selecting OERs and its integration. Unlike the normal practice of outsourcing development and review of courses involving payment to external experts, the course on 'ICT in Education' course was developed entirely by internal staff of the University with only the quality review of the course being outsourced. This considerably reduced the actual cost of course development (Menon, 2014).

OER integration in course development seems to have brought about a positive impact on the cost and time involved without compromising the quality of either the course material or students' engagement in the learning process. It was also part of WOU's pioneer efforts to adopt a new course

development policy to minimise the use of paid, copyrighted material. This successful effort has spurred the University to revise many of its courses to include OERs as a more cost-effective measure. This action is also in line with measures taken by other universities in minimizing technical, legal and cost concerns that may facilitate and expedite production of self-contained course materials. Integration of OERs in course development was also attempted by other academic institutions in the region (Mythili, 2014).

Research Questions

The research questions addressed in part 1 and part 2 of this investigation are:

1. To what extent the course developers were able to search and find relevant OER materials;
2. What are the competencies required by the course developers in reusing OER;
3. What are the different ways in which the OER materials have been reused;
4. Will the course development involving integration of OER be cost-efficient; and
5. Will the use of OER integrated course materials expected to be of high quality from learners' perspective?

Conceptual Framework

The conceptual framework of the entire study involving both part 1 and part 2 is presented in Figure-1.

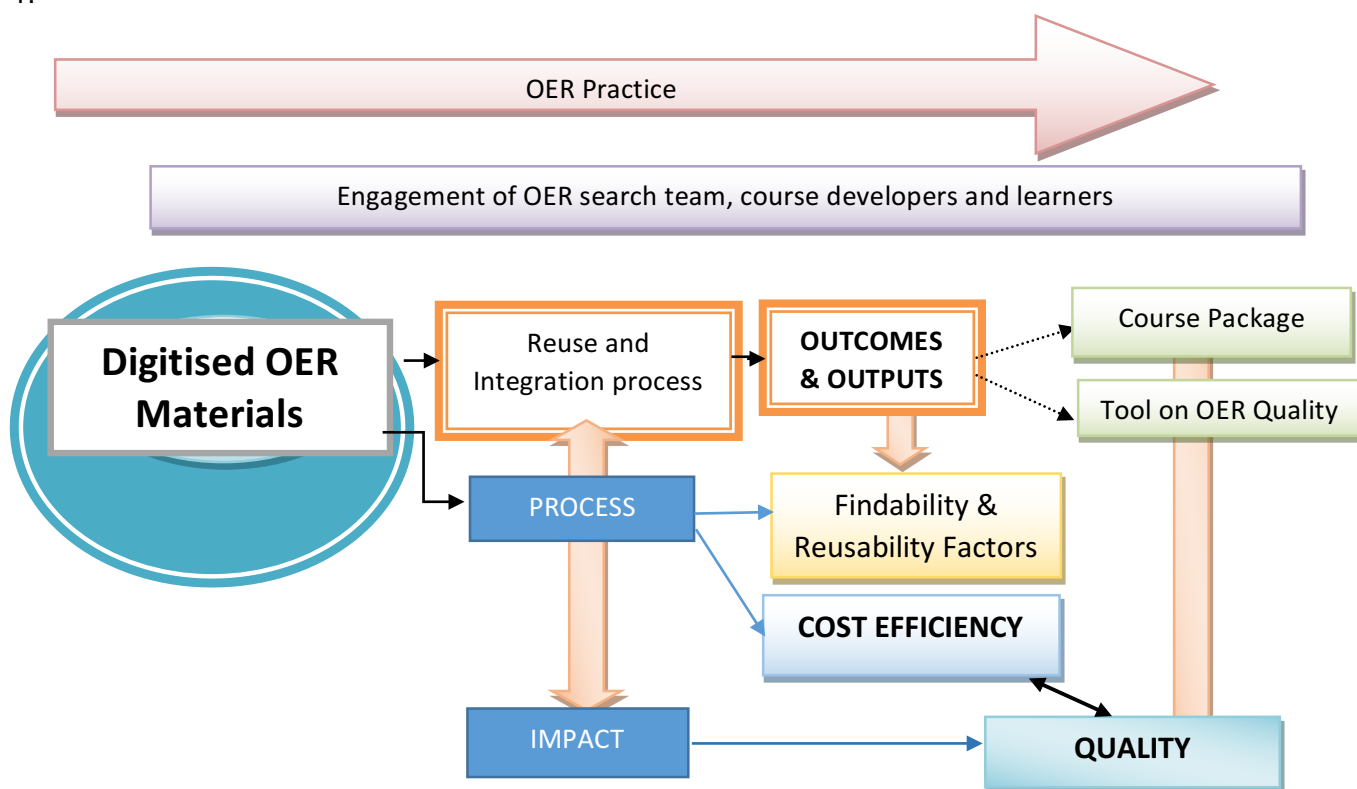


Figure 1: Conceptual Framework of the Study

Part 1 of the Study: Findability and Reusability

The project adopted an exploratory case study approach with a mixed method of collection of both qualitative and quantitative data using a variety of research instruments.

The main research findings of Part 1 of the study addressing the first three research questions of the project revealed that the OER search team and course developers found that adequate web resources, both textual and multi-media material with various levels of copyright relaxations relevant to the course content are available for use. However, a large chunk of these materials especially videos were copyrighted without the open licence limiting reuse and modification. The study also looked at the extent of findability of OER from course developers perspective on 8 aspects viz, *availability, variety (multi-media), variety (text), relevance, openness, quality, communication*

friendliness of the materials and format suitability. Both quantitative and qualitative data collected were analysed. The core factors influencing effective OER reuse and integration are *OER content awareness (OCA), OER reuse expertise (OCE), subject content expertise (SCE), content specific pedagogy (CSP), and local learning environment (LLE)* and the supportive factors are *language and writing skills (LWS) and IT related skills (ITS)*. The ways of reuse in the process of course development emerged in the findings are *Reuse As Is (RUS), Re-Mixing (RMX), adaptation (ADA), re-creation (RCR) and new creation of materials (NCR)* leading to an integration process and product. Course developers also revealed that reusing OER for course development although did consume time, but with training and experience and support from an OER search team the OER integration process could be more cost efficient and time efficient (CE & TE).

Part 2 of the Study: Cost-Efficiency and Quality

The main focus of part-2 of the study is probing into the issue of cost efficiency of the processes involved in integrating a variety of OER materials in developing a course and also to study the quality of such a product as perceived by the learners. Cost-efficiency and quality are related aspects and there is a need to keep an effective balance between the two. There is no attempt made in this study to compare the cost-efficiency and quality of an OER-integrated course with a newly created course without OER. The attempt made is to develop an OER integrated course with a quality assurance development process and then study the cost and time in developing such a course as well as get the sample course materials be reviewed and rated by learners to rate its quality on various aspects.

Research Questions

The two research questions of the study being reported here are the following:

1. Will the course development involving integration of OER be cost-efficient; and
2. Will the use of OER integrated course materials expected to be of high quality from learners' perspective?

'Cost/Time Efficiency': relates to a comparison of what is actually produced or performed (OER-integrated course development) with what can be achieved with the same consumption of resources in terms of money and time. Cost-effectiveness basically refers to the ratio of costing against efficiency. In the context of course development, cost-effectiveness refers to minimum costing in ratio to the expenses needed to develop a said course. OER offer the possibility of reducing costs through sharing and updating resources cost effectively by reusing existing resources developed by others.

'Quality of learning materials': One of the most important concerns for OER is the perceived lack of quality. Quality can be defined as 'appropriately meeting the stakeholders' objectives and needs which is the result of a transparent, participatory negotiation process within an organization' (Pawlowski, 2007). One of the challenges of OER is assuring the quality of resources. Some people are unable to believe that any process other than traditional peer review, licensing, and publication can result in content that is highly accurate. As quality is not necessarily a function of copyright status, neither traditionally copyrighted educational materials nor openly licensed educational materials can exclusively claim to be "high quality".

Methodology

In this project the exploratory case study approach was adopted to understand and critically reflect on the factors and processes involved in the integration of OER material in developing a new set of course materials. Within the exploratory case study design a mixed methods approach involving collection of both qualitative and quantitative data was employed in which the researcher tends to base knowledge claims on pragmatic grounds (e.g., consequence-oriented, problem-centred, and pluralistic). It employs strategies of inquiry that involve collecting data either simultaneously or sequentially to best understand research problems. The data collection also involved gathering both numeric information (e.g., on instruments) as well as text information (e.g., on interviews) so that the final database represents both quantitative and qualitative information (Creswell, 2009). The case under investigation was a situation involving a series of sequential activities in the process of development of self-instructional materials for a course on Research Methodology in Education (RM) with 5 independent modules for attempting OER integration. The processes involved to assure quality in the resultant course materials included structuring of module contents with expected learning outcomes, identification of relevant OER materials from search engines and repository in the

context of the RM contents, identification of course developers and their orientation to OER, development, try out on students/educators, review by peer group experts and editing by senior experts.

Sampling Process

The study adopted purposive sampling technique for selection of sample for the search team and course development team. For the learner group the sampling technique used was One-Stage Cluster Sampling. Five institutions of different types were identified and all the units in the available groups of educators or teacher trainees were included in the sample. Size and characteristics of the sample groups are given in the Table 1.

Sample groups	Expected Sample characteristics	Sample size		
		F	M	T
Search Group	Persons with good IT skills and experience in library or information science	3		3
Course Developers Group	Qualified and experienced Education specialist with expertise in research methodology in education either by teaching at post-graduate level or conducting research studies in education	3	3	6
Learner Group	Educators (teaching in both ODL and F2F institutions)	33	16	49
	Teacher Trainees (PG and doctoral students of Education)	31	12	43
	Total	64	28	92

Table 1: Sample profile

Research Instruments

A conceptual analysis of the two variables involved in the study viz. Cost/time efficiency and Quality of Learning materials was done by a group of experts in OER, Research Methodology and Self-instructional materials. This was followed by the development of instruments and their standardisation wherever needed to capture data for each variable (Table 2).

<i>Variables</i>	<i>Research Instruments</i>
Cost/time efficiency	<ol style="list-style-type: none"> 1. Log Format for OER-Findability (OER-F Log) 2. Pre and Post CD Workshop reflection questionnaire 3. Focus Group Discussion questions 4. Informal Interview questions
Quality of Learning Materials	<ol style="list-style-type: none"> 5. OER Quality Assessment Scale (OER-QAS) 6. Reflections of course learners

Table 2: Research Instruments

Analysis and Findings

For the qualitative data, content analysis followed by coding was used while descriptive statistics was employed for the quantitative data. While interpreting data the study adopted the triangulation approach using three types of triangulation viz. methods triangulation, triangulation of sources and analysts triangulation. William Tibben (2013) demonstrates the effectiveness of using triangulation in case study research. Data obtained through different tools from a variety of sources were both qualitative and quantitative.

Cost/Time Efficiency:

Findability data were collected from three sources viz. log records of the search team, narratives of the authors and observations and interviews/focus group discussions conducted by the research team. Table 3 shows the time taken by the search team in searching and downloading OER materials relevant to the content.

FINDABILITY TIME		
Less than 10 minutes	75	31.65
10 minutes	58	24.47

15 minutes	38	16.03
20 minutes	35	14.77
25 minutes	6	2.53
30 minutes	24	10.13
More than 30 minutes	1	0.42
TOTAL	237	

Table 3: Findability time

Sample reflections of the course developers (CDs) and Facilitators (F) on cost/time efficiency

All Course Developers had expressed their thinking about cost/time-efficiency based on their experience of finding and reusing and integrating OER for course development. Each course developer addressed this question based on their experience of developing the OER integrated course. The facilitators' reflections were based on what they observed during their close engagement with course developers while they were they were working on their respective modules. Some exemplar reflections/narratives are given in the following boxes.

CD1:

This in my view is an advantage for the OER based instructional design because students would be motivated to expand their learning by exploring material then and there if they so desire (QE). Whereas in a face-to-face classroom a teacher may motivate further exploration by students but the student may not sustain (LLE) the same due to the fact that he/she has to visit a library for the same (QA). Since the search and review part before actually writing a unit takes considerable amount of time, this could be outsourced to cut down to improve efficiency in terms of time (TE).

CD 3:

I think my own repertoire in the content area wasn't too bad given my several years of handling this course face-to-face and I had to consciously refrain from giving my 'wisdom' and learn to use the available OERs with some humility rather than creating new material consuming more time (TE), realizing that other materials in variety of media can only enhance the quality of presentation (QE). Institutions out sourcing course development could reduce cost for course writers if existing materials are re used or adapted (CE).

CD 4:

I could locate fairly fast (TE) few on-line audio and video inputs to support learning interventions of my module/units. I used 'case study' approach to make the module interesting and illustrative (CSP). However, the whole process initially took longer time duration as was predicted before but this got less time consuming subsequently (TE). If experienced search experts can help the authors time consumed for identifying relevant OER can be reduced further substantially(TE) do Because, one need not to develop/built each and every concept of the module (TE). Rather the module could be built on the existing concept and available resources (CE & TE).

CD 5:

The time required for integrating and making linking statements and establishing continuity required more time than initially anticipated, however, it would have taken more time if the entire content was to be newly written (TE). With more training and practice supported by good connectivity I think I would have reused the OER and developed the new course with less time (TE).

F1 about CD4:

Compared to authors of all other modules, CD4 took the least time in completing drafting his module (TE). He could complete the first draft of the course during the course development workshop itself while all other took more time after the workshop. He expressed in my interview with him that using OER did help in developing the module faster (TE) showing higher cost-efficiency (CE). In addition to enhancing the quality of the materials (QE). He thinks he could complete his tasks faster as he had prior experience of reusing OER for both course development and classroom teaching.

F1 about CD3

CD3 took a considerable amount of time to develop the first unit of the module during the workshop time. It was not because of lack of relevant OER but availability of a large number of alternative OERs. In subsequent units she could decide and use on the selection OERs faster (TE) and also realised that using variety of media and texts surely makes the materials qualitatively better as this caters to learners of different learning styles (QE).

Analysis of qualitative data obtained from the course developers and the facilitators were content analysed using a coding process. This led to the emergence of three codes related to cost-time efficiency as given in Table 4:

Cost/time-Efficiency codes emerged	<ol style="list-style-type: none">1. Direct cost saving due to use of OER2. Time saving due to use of OER3. Improvement of quality due to use of OER (QE)	<ol style="list-style-type: none">1. Cost Reduction (CR)2. Time Reduction (TR)3. Quality Enhancement (QE)
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Table 4: Codes emerged under cost/time efficiency

The evidence regarding *cost/time efficiency* is that when a large chunk of OER text materials are available in advance it became easier and less time consuming to use these materials and contextualise them. A good understanding about the instructional design and experience of writing materials also helped in completing the materials faster. When the OER used are a large number of smaller reusable learning objects (RLOs) it took more time to integrate them and develop the materials.

If all the OER materials are collected in advance for each concept or section of the modules by experienced and competent persons, the course writers seems to be faster in integrating them for developing the materials. The search team which made available the initial set of OERs for all the modules reported that over 80% of relevant OER materials could be searched, discovered and down loaded in about 20 minutes in each case. Of which over 55 % took only less than 10 minutes.

All course developers felt that it took initially more time to reuse the OER objects but with better understanding of the process OER use and integration would take less time in developing the course materials as compared to writing newly writing the material. And long with this all course developers are of the view that reuse of variety of multi-media OER materials would certainly increase the quality of the product. Continual upgrading of OER integrated course materials when newer and newer OER materials are reused by a community of course developers, the quality of the materials is bound to improve continuously.

Quality of learning materials:

Perceived quality of RM modules was assessed by administering a quality assessment scale after the participants went through few units of RM modules. The OER-QAS was administered on 92 learners of which 64 were female and 28 were male respondents. Of the total 92, 43 were teacher trainees and 49 were educators. The feedback on the module was received on a seven dimensions which included *Assessment, Self-learning, Interactivity, Inclusiveness, Resources, Format and Presentation, Language and Communication*. The total mean score of the scale being 141 in comparison to possible maximum score of 190 (38 items on five point scale) it can be seen that the modules are of good quality from the point of view of learners.

When it comes to the responses to the quality assessment scale, responses of female and male participants are similar. There were significant differences between the responses of teacher trainees and educators about the perceptions of quality of OER modules. Students' responses were more favourable than that of the educators ($p = 0.02$). Table-5 and Table 6 present the t-test results showing the comparative scores (perceived quality) across genders and nature of participants.

t test results (for entire scale) (df=94)					
	N	Mean	Standard deviation	t	P
Female	64	140.61	26.66	0.27	0.78
Male	28	142.25	24.77		

Table 5: Comparison of responses across gender

Table 5 presents the result of the t-test conducted to find the difference between the male and female participants for the quality assessment. The obtained p-value (0.78) indicates that there is no difference between the two groups with respect to quality of materials.

t test results (for entire scale) (df=94)					
	N	Mean	Standard deviation	t	P
Educators	49	135.57	29.72	2.42*	0.02
Teacher trainees	43	148.37	19.31		

* Significant at 0.05 level

Table 6: Comparison of responses across type of learners

From Table 6 one could notice that there is a difference in the perception of quality of materials between teacher trainees and educators. The difference is in favor of students, which means that student perceived the quality of the materials to be of higher quality.

Quality ratings provided by the respondents on all the seven aspects of the scale are given in Tables 7 and Table 8.

	Gender	N	Mean Score	Total score possible	Std. Deviation	Std. Error Mean
Total	Female	64	140.61	190	26.656	3.332
	Male	28	142.25	190	24.765	4.680
Assessment	Female	64	21.80	30	5.131	.641
	Male	28	21.79	30	4.630	.875
Self-Learning	Female	64	34.50	45	5.255	.657
	Male	28	35.00	45	4.562	.862
Interactivity	Female	64	17.11	25	4.741	.593
	Male	28	18.21	25	4.756	.899
Inclusiveness	Female	64	14.88	20	3.317	.415
	Male	28	14.93	20	3.042	.575
Resources	Female	64	15.22	20	3.782	.473
	Male	28	14.96	20	3.271	.618
Format and Presentation	Female	64	14.05	20	4.502	.563
	Male	28	14.29	20	4.799	.907
Language and Communication	Female	64	23.19	30	3.261	.408
	Male	28	23.29	30	3.113	.588

Table 7: Gender Wise Analysis of Quality ratings on Seven Aspects

	Participants	N	Mean		Std. Deviation	Std. Error Mean
Total	Educator	49	135.57	190	29.715	4.245
	Student	38	148.37	190	19.314	3.133
Assessment	Educator	49	20.92	30	5.715	0.816
	Student	38	22.89	30	3.944	0.640

Self-Learning	Educator	49	33.78	45	5.628	0.804
	Student	38	35.92	45	3.809	0.618
Interactivity	Educator	49	16.22	25	5.173	0.739
	Student	38	18.92	25	3.955	0.642
Inclusiveness	Educator	49	14.06	20	3.430	0.490
	Student	38	16.00	20	2.460	0.399
Resources	Educator	49	14.73	20	4.222	0.603
	Student	38	15.50	20	2.816	0.457
Format and Presentation	Educator	49	13.47	20	5.160	0.737
	Student	38	15.00	20	3.869	0.628
Language and Communication	Educator	49	22.71	30	3.410	0.487
	Student	38	24.03	30	2.890	0.469

Table 8: Nature of Learners wise analysis of Quality ratings on Seven Aspects

It is evident from the tables 5, 6, 7 and 8 that the overall quality ratings of course learners have been high. Indicating that all learners found the course material to be of high quality. This is also indicated in the sub-categories of the scale. Every aspect showed high quality rating. It also be observed that while both female and male learners showed similar quality rating, the teacher trainees group showed higher quality rating as compared to the educators. It is logical to think that the educators would have had higher expectations of quality than the teacher trainees.

Analysis of group reflections of the course learners do corroborate the findings obtained through the rating scale. Learners could see the advantage of being exposed to a variety of OER materials taken from various sources. They generally felt that the video and audio clippings were very informative and did help in their effective understanding of concepts and also facilitated further discussion. OER textual materials such as case studies were found helpful by the learners as these helped in internalising the applications of concepts in different research contexts.

Discussion

It is amply revealed from this study that reuse of OER is not an easy process. There are several factors/competencies which positively influence the process. If these factors are satisfied the process of OER reuse and integration becomes easier and more effective. The study shows that the course developers if competent in the subject content, subject specific pedagogy, and understanding of needs of the learning environment, along with possessing awareness of OER concepts and OER reuse skills will be able to carry out OER integration efficiently. Generic skills such as Language and writing skills and IT skills are also influencing factors. All course developers are in agreement that the use of variety of text and media materials enhances quality of the resultant integrated course materials. However using a large number of OER materials from different sources could make the process more time consuming as compared to adopting or adapting one two resources. Course developers also revealed that reusing OER for course development although did initially consume time, but with training and experience and support from an OER search team the OER integration process could be more cost/time efficient. Course learners (educators and teacher trainees) found the OER integrated materials to be of high quality. Being an exploratory case study the findings cannot be considered as conclusive and generalizable, but the study contributes to further hypothesising on the OER reuse and integration leading to formulation of more intensive studies in more controlled situations. The newly created materials are thus expected to be more effective and inclusive to the needs of all types of learners. This is endorsed by the positive ratings given by course learners (both educators and learners) in the quality assessment scale.

Conclusion

This is an exploratory case study in an area not sufficiently researched into especially in the Asian context. It has come out with some tentative initial findings about how course writers find and reuse

OERs in creating a new course for a given context. These initial findings can be considered as hypothesis which could be further investigated to gain better insight into the reuse process.

Although the findings are still tentative it is clearly evident that the reuse process is not mechanical as the popularly used terms such as mix, remix, repurpose, etc. may convey to a practitioner in education. It is evident from the study that course writer/developer requires certain knowledge and skills about OER, OER reuse, instructional design adopted etc. in addition to being an expert in the content area. Hence, all distance learning institutions intending to reuse OER for developing their course materials should orient/train their course writers (internal or external) in basic understanding about OER, open licence and skills related to findability and reuse of OER to develop an OER integrated course.

The course developers do indicate that the process involving OER integration leading to a new course is cost-efficient. However this study does not present a comparative picture. More intensive studies are required comparing the cost/time involved in OER integrated course development and a newly created course. The findings also indicate that the course materials on Research Methodology is of quality as shown by the quality assessment made by the course learners. The quality of the materials will have to be further studied by analysing the materials by experts against a set of quality criteria as well as understand the impact of OER integrated learning materials on learners' achievement scores.

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