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Open Educational Resources to Improve Students' Learning & Performance: A Case Study with Practitioner's Approach

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Abstract Technology continues to play a pivotal role in every field. With each passing day, technology has gained an exponential prominence in the field of education. This paper attempts to survey the open educational resources along with their unique and major role across several educational sectors. A study is conducted to launch open educational resources using freely available resources, followed by active learning conduction. Then an analysis is carried out by authors related to the usage of open educational resources (OER) with respect to the performance of the students. Finally, a conclusion is derived regarding the impact of OER on the learning and performance of students

Keywords: Open Educational Resources, course websites, video lessons, active learning

1. Introduction

Open educational resources (OER) refer to materials used for improving students' learning. These are open source material, freely available on the internet. Teachers provide additional material related to their lessons, online using OER. OER eases out reusability of educational materials for learning (Chung, Khor, 2015). There are several variations to OER. Open educational resources include complete courses, course supportive materials, modules, text books, videos, test components, software, tools and techniques which facilitate accessing knowledge (Chung, Khor, 2015)(Weili, Klotzkin, Myers, Wagoner, White, 2015). By the end of a course, a particular students' level of learning is measured using surveys or questionnaires. (Phillip, Wan, 2014) (Zeng, Zhang, Huang, Dong, 2014). In this paper, the authors have given their experimentation work with OERs and their usages. In Section 2, OER related works are described. In section 3, the case study carried out is briefed. In section 4, analysis of OER and in section 5 discussion and analysis are given. In section 6, conclusion is given.

2. Related works on OER to improve learning of students

E-chalk project helps in transforming lecturer input from large touchscreens to intelligent electronic chalk board. The usage of these video lectures is analyzed to develop next generation educational tools. Lecture recording system is used to record lectures and is later launched on the web. Educational Tools like Lectern, Synote, Media rich repository of learning objects, Opencast Matterhorn are helpful in recording lectures. Matterhorn provides the facility for teachers to upload their lecture materials using powerpoint slides and videos. Students can refer to the material through Matterhorn and usages can be analyzed. Analysis of students' OER usage helps teachers in providing the appropriate feedback. (Phillip, Wan, 2014)(Hugh, Gillian, 2013) (Edmundo, 2013) .Cloud based Virtual laboratory helps students in testing their experiments online. This is highly helpful in subjects such as networking, network security and cloud computing. These virtual labs improve the real time computer networks, resource sharing, access control, knowledge sharing and learner centric resource management. Students can conduct experiments and submit their work online as well. They can update the V-lab facility using their code. The faculty in turn can login to the V-lab and grade the work, remotely. Thus, crowd sourcing facility is made available with Cloud based V-lab (Le, Dijiang, Wei, 2014) (Qinran , Fangxing, Chien, 2015). Moodle software is used for conducting assessments. This allows students to take up exams from the luxury of their homes. OER resources facilitate multi hierarchy level and systematic teaching. It is used at multi institutional level to create large repositories. Collaborative OER initiatives

like MIT open courseware, Open University, NMEICT and CMU open learning are few examples of engineering content development (Liisa , Taina , 2015) (Sousa, Antao, Germano, 2013).

3. Case Study

3.1 Course Website

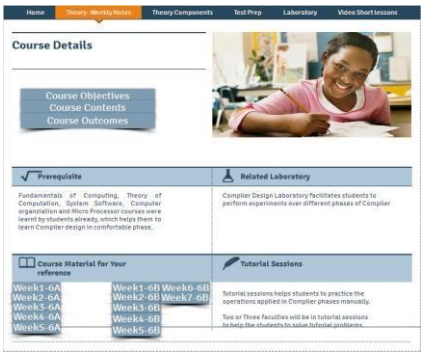

Figure 1. Course website with Course material created for CS612-Compiler Design

This paper discusses some of the open educational resources that have been used. Figure 1 depicts the work launched on a certain theory reference material. Free website provisions like Google and Wix are used to carry out the work. Students who miss out on classes can later refer to the relevant material on these course websites. The test preparatory kits are provided as well. These kits provide a better idea about the expected questions for a particular course (Edmundo, 2013). The authors have created the video lessons and hosted the same through the website. (Llamas, Mikic, 2014). The authors have hosted Laboratory manual, simulators and assignment questions on the Laboratory course website. Lab manuals help students to learn about the tools used for the experiments. Sample programs are also given in the lab manual, so that the students can easily try similar code on their own which make the students to actively learn the theoretical concepts. Simulators to work and test theoretical concepts are also given in the course website. Students can clearly test the working nature of concepts that they have learnt in the theory classes (Robert, 2015). Students are given assignments which they are supposed to complete individually or in a team and they need to work on the assignments using the tools they have learnt. (Raman, Achuthan, Nedungadi, Diwakar, Bose, 2014).

4. Analysis OER referred by Students

4.1 Analysis of Course website visits

The students, who have missed their theory or practical sessions, can refer to the website with ease. They can view the assignment questions on the website for their active learning component to imply the theory concept what they have learnt, find out the solution and submit solutions, all of these online, even if they have missed the classes (Ynette, Carolyn, Fran, Andrew, 2015). On Jan 17th, when the course began, the authors launched the website using Open source website provider, for free of cost. They purchased premium scheme from the Wix website providers, to facilitate course website usage analysis. The authors generated the tracking ID for the course website as provided by the web server. This tracking ID would be given to the Google analytics for capturing the users' visit on the course website beginning May 2015. The Analytic graph is as shown in Figure 2. From this graph, it's observed that the website was most visited on the day before the Internal Practical exams. The internal practical assessment was on May 15, 2015. Before May 15th 2015, the web site visitors' count increased slowly. The number of times the course website was referred to was 104, as on 14th May 2015, Then the visitors count decreased slowly. Again the number of visitors to the course website increased during the beginning of June. Semester end theory examinations on June 5th explain this increase in the visitor count. Then, the number declined slowly post June 5th 2015.

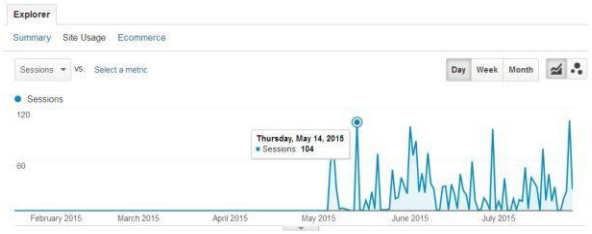

Figure 2. CS612-Compiler Design Course Website usage by students on May 14,2015

After the students' result have been declared in the mid of June, the supplementary fast track course began on June 18th, 2015. Due to this they continued to visit the course website after mid of June, 2015. As the students had supplementary practical internal assessment on 30th June, 2015, the number of visits was 96 on 29th June, 2015. Post that, the students' visits to the course website declined. This would be due to the Theory internal assessment on 25th July, 2015. The number of visits to course website again increased before the day of exams (Elizabeth,1984) .

4.2 Analysis of Video lessons' visits

The students would approach the teachers (authors) for doubts, during their study vacations. As similar doubts were be asked repeatedly, the authors decided to create a short video on such lessons. Videos explaining these frequently asked queries were shot and uploaded on YouTube, as shown in Figure 3. The number of views on these video lessons was analyzed too (Ros, Rodriguez, Diaz , 2014) . Documenting author's observation as in Figure 3, the number of visits to the video lesson was found to be increasing until the day of the Semester end theory examination, which was on 5th of May 2015. The total number of views was about 114, since the video was launched on YouTube. After the 4-minute short video was made, the students were informed about it through group mails. Post examination, the number of visits to the website declined. The supplementary fast track course is conducted during the months of June and July. It's noticed that the students come back to referring these websites and video lessons, as indicated in Figure 3. (Ching, Gwo, Chien, Chih, 2012)(Hemingway, Angell, Hartwell, Richard, 2011) .Authors observe a similar pattern to another OER video lesson that was uploaded on YouTube the total number of visits is 92. Similar to the previous instance, the views on this video increased until the day of semester end theory examinations and post that the visits declined. Again, during the month of July, when the supplementary courses were held, the visits increased(Samuel , Christian , Richard , 2014).

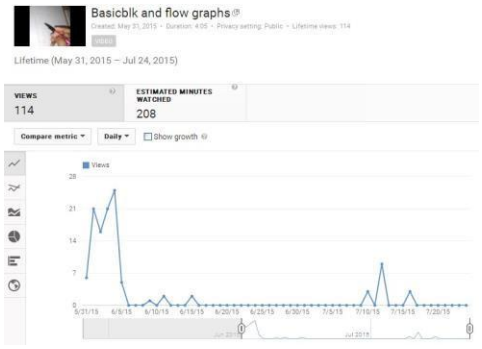

Figure 3. CS612-Compiler Design: Video short lesson Sample 1 and analysis of visitors count

5. Discussion and Analysis of students performance using active learning and OER

Students' knowledge standard for this analysis considered is same for the two batches. Students' performance improves considerably on using Open educational resource facilities. The count of average performing students reduces. For analyzing the students' performance with respect to open educational resources we have considered all the students performance that have registered and undergone the

course in two different continuous years. Table 1 shows the performance comparison in the batch of 2014 with the students in the batch of 2015. The course considered for this comparison is CS612-Compiler Design. Continuous internal evaluation (CIE) of internal assessment examinations consists of theory descriptive based questions and answers. There are 3 internal assessments; each of them will be conducted for 30 marks. CIE will be calculated for 30 marks which is the average of best of two internal assessment marks. In 2015, 1.7% of students scored between 0 and 5 marks. This is lesser than 1.9% of students who scored between 0-5 marks in 2014. In 2015 there are more number of students who have scored between 16 to 20 and 21 to 25 marks as shown in Table 1. This is greater than the number of students in 2014 batch within the same range. This could be credited to the usage of OER. The authors find out that OER provisions should be improved so that the performance of top scorers between 25 and 30 can also be improved.

Table 1. Continuous Internal Evaluation of Internal Assessment Examinations (Theory Descriptive) - Comparison of Students performance based on OER

		No. of Students		Percentage of students	
CIE-IA		2015	2014	2015	2014
arks ange	0 – 5	3	3	1.7	1.9
	6 – 10	11	9	6.4	5.8
	11 – 15	27	17	15.7	11.0
	16 – 20	51	28	29.7	18.2
	21 – 25	60	54	34.9	35.1
	26 – 30	21	43	12.2	27.9
	No. of students registered for the course	172	154		

Table 2. Continuous Internal Evaluation of Collaborative active learning Assessment - Comparison of Students performance based on OER

		No. of Students		Percentage of students	
CIE- Active learning Component		2015 Technical Paper Writing	2014 Practical Assignment Using tool	2015	2014
Marks Range	0-5	1	2	0.6	1.3
	6-10	1	4	0.6	2.6
	11-15	5	5	2.9	3.2
	16-20	165	143	95.9	92.9
	No. of students registered for the course	172	154		

5.1 Active Learning: Technical Paper writing with reference to OER

As a part of CIE, the authors introduced technical paper writing as an active learning collaborative work. For technical paper writing, OER is provided through google shared drive. Students are provided with the compiler related research papers in this shared drive. The authors created this drive with the help of their Institution digital library repository. Due to this OER provisions, below average scorers count reduced in 2015 compared to 2014 as shown in Table 2. Additionally, the number of students who scored in between 16 to 20 is 95.9%. This is better than the students' performance in year 2014 which is 92.9%. In 2014, students have done practical assignment using tool as part of the active learning component for internal assessment.

Table 3. Continuous Internal Evaluation of Internal Assessment Including assessment of collaborative active learning - Comparison of Students performance based on OER

		No. of Students		Percentage of students	
CIE		2015	2014	2015	2014
Marks Range	0-10	1	0	0.6	0.0
	11-20	5	4	2.9	2.6
	21-30	14	8	8.1	5.2
	31-40	77	35	44.8	22.7
	41-50	75	107	43.6	69.5
	Total no of students registered	172	154		

In this case study, there was no OER provided to the students by the faculty in 2014. According to CIE, for the year 2015 the number of students who scored in the range of 20 to 50, on an average, is better than in the year 2014. This comparison is shown in Table 3. In 2015, the total number of students count is more than in 2014. Open educational resources like course websites, YouTube short videos lessons and google shared drives are used during 2015 for conducting the course. In Table 4, semester end examination result statistics are shown for 2014 and 2015.

Table 4. Semester End Examination results - Comparison of Students performance based on OER

	No. of Students		Percentage of Students	
Grades (Marks range in brackets)	2015	2014	2015	2014
S (90-100)	0	4	0.0	2.6
A (80-89)	38	41	22.1	26.6
B (70-79)	83	73	48.3	47.4
C (60-69)	36	18	20.9	11.7
D (50-59)	4	8	2.3	5.2
E (40-49)	1	5	0.6	3.2
F (failed)	6	5	3.5	3.2
Total no. of students registered	172	154		

In Table 4, the authors observe that the below average scorers have reduced in 2015, when Open educational resources were used. This is better than 2014 when there are no OER usages. The D, E, F grade scorers are lesser in 2015 compared to 2014. The authors observe that the percentage of students in the range of 70-79 and 60-69 marks are more in 2015 than in 2014. This is the impact of open educational resources provisioned by the authors to the students. The authors observe that to improve the top range scorers' performance, OER enhancements need to be done.

6. Conclusion

The observation is derived from the analysis done regarding the number of students using OER. It has been found that the students refer to course websites effectively. As these course reference materials

cover theory and laboratory sessions, the students refer to them for both theory and practical exams. This explains the increase in number of visitors just before the commencement of exams. Authors recommend using free resources to create OER for students, so that students can refer to them in need of any clarification during their active learning components for performing their assignments or technical paper writing which are done individually or collaboratively. This will further help the students perform better during their internal and semester end assessments.

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