EFFECT ON IMPLEMENTATION OF OPEN AND DISTANCE LEARNING (ODL) DURING COVID-19 FOR BASIC STRUCTURAL ANALYSIS COURSE

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Abstract: COVID-19 pandemic dominates the world. It affects all sectors and the global educational systems are no exception. Based on this scenario, the Open and Distance Learning (ODL) program for the Basic Structural Analysis Course of the Civil Engineering Diploma (EC110) program analysed the data on the effect of the Movement Control Orders (MCO) on students' performance. This analysis therefore aims to assess the achievement of Program Outcomes (PO) and Course Outcomes (CO) for the semesters of September to January 2020 (face-to-face) and March to July 2020 (ODL). The findings showed the PO1 and PO2 increased by 22% for semester ODL and 1% for semester face-to-face respectively. However, CO1 and CO2 increased by 20% and 10% for semester ODL and semester face-to-face respectively. This research indicated ODL has not greatly affected the results and performance of the students during MCO. The finding demonstrated that it is possible to achieve the Course Learning Outcomes (CLO).

Keywords: Open and distance learning, course learning outcomes, program outcomes, course outcomes, COVID-19

1. Introduction

1.1 Open and distance learning (ODL)

ODL is a way to learn online without a teacher in the classroom. It requires daily face-to-face interaction (Al-azzam *et al.*, 2020; Hussein *et al.*, 2020). However, COVID-19 shocked the world at the beginning of 2019 (Kapasia *et al.*, 2020) and radically changed the educational environment. Since March 2019, most universities in Malaysia and around the world prepared to implement ODL. The delivery methods of ODL can be divided into two which are synchronous and asynchronous methods (Azlan *et al.*, 2020; Chen *et al.*, 2020; Chung *et al.*, 2020; Hussein *et al.*, 2020; Nennig *et al.*, 2020; Rapanta *et al.*, 2020), that could involve online or offline learning. If all students can participate in teaching and learning, lecturers can use either synchronous, asynchronous, or both. Several factors, including the nature of the content and the available technologies (Rapanta *et al.*, 2020), may influence the choice of the delivery method. Lecturers prepare the materials for the lectures in digital form (PDF, PPT, MOOC, and video) and upload the materials to this online platform (Azlan *et al.*, 2020; Oyediran *et al.*, 2020). This involves Google Meet, Google Classroom, Microsoft Teams, U-Future (UiTM e-learning) for content transmission. The lectures' materials are given by email and followed-up by the lecturer for students who do not have computers and/or internet.

1.2 Course outcome and program outcome

The establishment of learning outcomes and the design of the curriculum is one of the criteria required by Malaysian Qualifications Agency (MQA) accreditors. The Civil Engineering program diploma was built on the basis of the Outcome-Based Education (OBE) (Alias & Bhkari, 2007). Course Learning Outcomes (CLO) are statements that specifically describe the essential, observable, and measurable skills, abilities, and arrangements that students will gain in this course. Program Outcomes (PO) explains what students are supposed to know and able to do or achieve by the end of the

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programme (Mohamed *et al.*, 2010). Course outcomes can be quantified with the assistance of assessments. Continuous assessments via periodic tests, quizzes, reports, assignments and laboratory sessions are the assessment methods in this case (Ramchandra *et al.*, 2015). Although the goals for the Civil Engineering Program (EC110) (Alias & Bhkari, 2007; Manaff Ismail *et al.*, 2010) are the result of the outcome of the program, it is sufficiently informative to clarify how these broad goals are accomplished within a specific program. Table 1 provides the descriptions of course outcomes and program outcomes, which in this course are CO1/CLO1, CO2/CLO2, PO1/PLO1, and PO2/PLO3. The explanations show that fundamental analysis that relates to CO1 and PO1, while analysis of well-defined engineering problems includes CO2 and PO2.

Table 1: Descriptions Course Outcome and Program Outcome for Course Basic Structural Analysis

Outcomes	CO/PO	Descriptions
Course Outcome	· CO1/CLO1	Compute forces and stability in statically determinate and indeterminate structures (C3) *.
	· CO2/ CLO2	Evaluate structural analysis problems in statically indeterminate structures (C6) **.
Program Outcome	· PO1/PLO1	Apply knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialization to wide practical procedures and practices.
	· PO2/PLO3	Identify and analyse well-defined engineering problems reaching substantiated conclusions using codified methods of analysis specific to their field of activity.

Notes: * C3– Application, **C6– Evaluation

2. Methodology

The Basic Structural Analysis course is one of the Civil Engineering courses introduced for second-year diploma students. This three-credit unit course introduces the students in civil engineering to statically determinate and indeterminate structures using various methods applied in structural designs. This includes analysis of pin jointed trusses, three-hinged arches, portal frame, suspended cable and continuous beam.

The cumulative number of students enrolling in the course during face-to-face learning and ODL are 267 and 256 students. The evaluation of this course is based on the continuous assessments and the final examination. For the normal semester, the evaluation is graded into 40% of the test and assignment continuous assessment while 60% is allocated for the final examination. In the meantime, the test elements of the course were modified for the ODL semester and 100% focused on the continuous assessments. These assessments contain Quiz 1, Quiz 2, Assignment 1, Assignment 2, Assignment 3, Test 1, and Test 2. The percentage of assessment breakdown for face-to-face learning (normal semester) and ODL is shown in Table 2. The table reveals that the percentage portion for the test is still 30% for face-to-face and normal semester. However, 10% of overall assignments for both semester and final assessment evaluations are turned into quizzes, assignment and ODL learning measures that consist 60% in total.

Table 2: Assessment Mapping for normal and ODL semesters for course Basic Structural Analysis

Normal semester			ODL semester		
Type of assessment	CLO/PLO	Percentage breakdown	Type of assessment	CLO/PLO	Percentage breakdown
Test	· CLO1/PLO1	30%	Test 1	· CLO1/PLO1	30%
Assignment	· CLO1/PLO1	10%	Assignment 2	· CLO1/PLO1	5%
			Assignment 3	· CLO2/PLO3	5%
Final	· CLO1/PLO1	60%	Quiz 1	· CLO1/PLO1	3%
	· CLO2/PLO3		Quiz 2	· CLO1/PLO1	9%
			Assignment 1	· CLO1/PLO1	21%
			Test 2	· CLO1/PLO1	27%
				· CLO2/PLO3	

The cognitive domains of the assessment tasks for both the normal and ODL semesters applied in this course are shown in Table 3. Table 3 indicates that only two assignments during the normal semester are given as asynchronous assessments. Synchronous and asynchronous assessments have been updated and modified during ODL, based on the mapping tabulated in Table 2.

Table 3: Cognitive Domains based on the assessment activities (synchronous and asynchronous) for normal and ODL semesters for course Basic Structural Analysis

| Cognitive Domain | Assessment activities | | | |
| | Normal semester | | ODL semester | |
	Synchronous***	Asynchronous****	Synchronous***	Asynchronous****
Applying (C3) *: Compute forces and stability in statically determinate and determinate structure	· Test: Introduction, Cable, Three Hinged Arch and Trusses	· Assignment: Trusses	· Quiz 1: Introduction · Quiz 2: Cable · Test 1: Introduction, Cable, Three Hinged Arch and Trusses	· Assignment 1: Three Hinged Arch and Trusses · Assignment 2: Frame
Operating (C6) **: Evaluate structural analysis problem in statically indeterminate structure		· Assignment: Moment Distribution Method	· Test 2: Frame and Moment Distribution Method	· Assignment 3: Moment Distribution Method

Notes: * C3– Application, **C6– Evaluation, ***Synchronous – real time assessment, ****Asynchronous – non-real time assessment

Based on the assigned assessments, the average COs and POs for each semester was attained and compared accordingly.

3.   Result and Discussion

The bar chart in Figure 1(a) indicates the average outcome of the program (PO) for face-to-face semester learning and open and distance learning (ODL) semester for Basic Structural Analysis course achievement. For the ODL semester, PO1 and PO2 are both marginally higher than the face-to-face learning semester. The percentage for the ODL semester increases by 22% for PO1 and 1% for PO2 of the face-to-face learning semester. The percentage of PO1 for the ODL semester is 70% higher than the face-to-face learning semester which is 48%. Meanwhile, for PO2, the ODL semester rate is 40%, and the face-to-face learning semester is 39%. The bar chart in Figure 1 (b) shows the average course outcome (CO) attainment for face-to-face learning semester and Open and Distance Learning (ODL) semester for Basic Structural Analysis course.
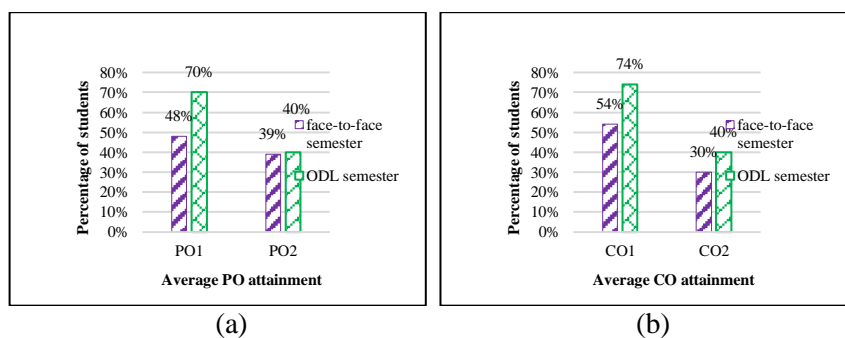

(a)   (b)

Figure 1: Average outcome of the program (PO) for face-to-face semester learning and open and distance learning (ODL) semester for Basic Structural Analysis course (a)Average PO Attainment. (b) Average CO attainment

The charts display that both CO1 and CO2 are higher for the ODL semester than the face-to-face learning semester. Meanwhile, the percentage for the ODL semester increases 20% for CO1 and 10% for CO2 of the face-to-face learning semester. For CO1, the ODL semester percentage is 74%, and the face-to-face learning semester is 54%. As for CO2, the ODL semester rate is 40% higher than the face-to-face learning semester, which is 30%. In this way, all these course outcomes are linked to curriculum outcomes. The standard program results for this case are derived from the EAC Manual (Mohamed *et*

al., 2010). All of COPOs are analysed using the system developed by the Faculty of Civil Engineering, UiTM Penang, Malaysia, called i-RAS (Revolution on Assessment for Student Monitoring System). In an attempt to improve inefficient COPO analysis, this system has been developed (Samsudin *et al.*, 2020).

The results indicate that ODL has a positive effect on CO and PO attainment. A similar finding stated that the students' performance was not affected despite the transition of learning delivery methods (Mohamed *et al.*, 2010; Nennig *et al.*, 2020; Radha *et al.*, 2020; Ramchandra *et al.*, 2015). The excitement to use e-learning tools available online can be one of the reasons that contribute to this outcome. Besides, a significant feature of ODL is the ability to record the session. Even for the synchronous learning method like Zoom, Google Meet, and Webex, they too can record the learning session. The students can replay the recorded session at their convenient time. A study also showed that students preferred recorded lecture videos compared to other approaches (Chung *et al.*, 2020).

Moreover, for the ODL semester, the assessment is divided into a few more parts than the normal semester. For example, for the normal semester, 60% of the evaluation is the final examination. For the ODL semester, the percentage is broken down into several parts, which are 3% for Quiz 1, 9% for Quiz 2, 21% for Assignment 1, and 27% for Test 2. Thus, the topic discussed for each assessment is not repeated for the next assessment. Students may be more focused, organized, and prepared for each assessment. It can also help students in scoring and increasing CO and PO achievement.

4.   Conclusion

Although COVID-19 outbreak has triggered an alarming impact on the implementation of educational system, the study reveals that ODL can be an effective method to teach Basic Structural Analysis course because the cognitive domain is achievable. Also, PO and CO attainments are higher by 22% and 1% for PO1 and PO2, and 20% and 10% for CO1 and CO2 during ODL as compared to the face-to-face learning. Looking on the bright side, the transition into online learning has developed independent learning among students, equipped with sufficient training and materials provided by lecturers. The whole learning process during ODL may contribute in achieving the cognitive attributes as students are engaged more into lecturers and 100% of the assessments are measured based on individual performances. Besides, extra quantity of assessments given to students during ODL session increase the chances of getting higher grades; hence, raises the PO and CO attainment.

References

Al-azzam, N., Elsalem, L., & Gombedza, F. (2020). Heliyon A cross-sectional study to determine factors affecting dental and medical students ' preference for virtual learning during the COVID-19 outbreak. *Heliyon*, *6*(October), e05704. https://doi.org/10.1016/j.heliyon.2020.e05704

Alias, A., & Bhkari, N. M. (2007). A model of outcome-based education (OBE) for engineering education. *Gading Business and Management Journal*, *11*(2), 71–87.

Azlan, C. A., Wong, J. H. D., Tan, L. K., Muhammad Shahrun, M. S. N., Ung, N. M., Pallath, V., Tan, C. P. L., Yeong, C. H., & Ng, K. H. (2020). Teaching and learning of postgraduate medical physics using Internet-based e-learning during the COVID-19 pandemic – A case study from Malaysia. *Physica Medica*, *80*(October), 10–16. https://doi.org/10.1016/j.ejmp.2020.10.002

Chen, T., Peng, L., Jing, B., Wu, C., Yang, J., & Cong, G. (2020). The impact of the COVID-19 pandemic on user experience with online education platforms in China. *Sustainability (Switzerland)*, *12*(18), 1–31. https://doi.org/10.3390/SU12187329

Chung, E., Subramaniam, G., & Dass, L. C. (2020). Online learning readiness among university students in Malaysia amidst Covid-19. *Asian Journal of University Education*, *16*(2), 45–58. https://doi.org/10.24191/AJUE.V16I2.10294

Hussein, E., Daoud, S., Alrabaiah, H., & Badawi, R. (2020). Exploring undergraduate students' attitudes towards emergency online learning during COVID-19: A case from the UAE. *Children and Youth Services Review*, *119*(November), 105699. https://doi.org/10.1016/j.childyouth.2020.105699

Kapasia, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., Barman, B., Das, P., & Chouhan, P. (2020). Impact of lockdown on learning status of undergraduate and postgraduate students during

COVID-19 pandemic in West Bengal, India. *Children and Youth Services Review*, *116*(June), 105194. https://doi.org/10.1016/j.childyouth.2020.105194

Manaff Ismail, A., Ismail, R., Zakwan, F. A. A., & Nizam Ismail, B. (2010). Implementation and assessment of outcome based education (OBE) in the Faculty of Civil Engineering at Universiti Teknologi MARA (UiTM). *2010 2nd International Congress on Engineering Education: Transforming Engineering Education to Produce Quality Engineers, ICEED2010*, 211–214. https://doi.org/10.1109/ICEED.2010.5940793

Mohamed, Z., Taib, M. Y., & Reza, M. S. (2010). Assessment Method for Course Outcome and Program Outcome In Outcome Based Education (OBE). *Malaysian Technical Universities Conference on Engineering and Technology*.

Nennig, H. T., Idárraga, K. L., Salzer, L. D., Bleske-Rechek, A., & Theisen, R. M. (2020). Comparison of student attitudes and performance in an online and a face-to-face inorganic chemistry course. *Chemistry Education Research and Practice*, *21*(1), 168–177. https://doi.org/10.1039/c9rp00112c

Oyediran, W. O., Omoare, A. M., Owoyemi, M. A., Adejobi, A. O., & Fasasi, R. B. (2020). Prospects and limitations of e-learning application in private tertiary institutions amidst COVID-19 lockdown in Nigeria. *Heliyon*, *6*(11). https://doi.org/10.1016/j.heliyon.2020.e05457

Radha, R., Mahalakshmi, K., Kumar, V. S., & Saravanakumar, A. R. (2020). E-Learning during Lockdown of Covid-19 Pandemic: A Global Perspective. *International Journal of Control and Automation*, *13*(4), 1088–1099.

Ramchandra, S., Maitra, S., & Mallikarjunababu, K. (2015). Method for estimation of attainment of program outcome through course outcome for outcome based education. *Proceedings of the 2014 IEEE International Conference on MOOCs, Innovation and Technology in Education, IEEE MITE 2014*, 7–12. https://doi.org/10.1109/MITE.2014.7020231

Rapanta, C., Botturi, L., Goodyear, P., Guàrdia, L., & Koole, M. (2020). Online University Teaching During and After the Covid-19 Crisis: Refocusing Teacher Presence and Learning Activity. *Postdigital Science and Education*, *2*(3), 923–945. https://doi.org/10.1007/s42438-020-00155-y

Samsudin, M., Hamid, A., Hafizah, N., Abdullah, H., Hassan, S. H., Tukiar, M. A., Karim, N. A., Hassan, A. S., Azwan, F., Ismail, S., Fauzi, M. A., & Noor, S. M. (2020). *Revolusi Penilaian dalam Sistem Pemantauan (Revolution on Assessment for Student Monitoring System (i-RAS). i*, 42–63.