Evaluation of CDL- CQI monitoring mechanism in open distance learning (ODL) of Materials Science and Technology Course during COVID-19 pandemic

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Received: 15 January 2024
Accepted: 25 February 2024
Date Published Online: 1 January 2024
Published: 1 January 2024

Abstract: *The COVID-19 pandemic has necessitated a rapid shift to online and distance learning modalities that may impact the quality assurance of teaching and learning process, particularly in higher education. This study focuses on the evaluation of a Closing the Loop - Continuous Quality Improvement (CDL-CQI) through monitoring mechanism implemented in an Open Distance Learning (ODL) of Materials Science and Technology programme. The primary objective is to evaluate the educational quality among the ODL students while being at home during COVID-19 pandemic. A comprehensive assessment of the CDL-CQI monitoring mechanism was conducted by employing a mixed-methods approach. Quantitative and qualitative data were gathered through various parameters such as examination grade, surveys and feedback , outcomes-based education-student centred learning (OBE-SCL), course-program-learning outcomes and soft skills. The CDL-CQI results indicated a statistically significant improvement of GPA grade in learning outcomes with the implementation of these monitoring tools. Learners reported increased engagement , enhanced self-directed learning skills, and improved interaction with course materials*

in ODL. The findings suggested that CDL-CQI tools have a positive effect on the quality of education in ODL environments. The implications of this study extend to both educational practitioners and policymakers involved in curriculum reviews. The results underscore the potential of CDL-CQI tools to foster a more dynamic and responsive learning environment, ultimately leading to enhanced learning outcomes attainment. By integrating these monitoring tools strategically, educators can better tailor their instruction and support to individual student's needs.

Keywords: *educational quality assurance, learning outcomes, monitoring mechanism, open-distance learning.*

1. INTRODUCTION

The impact of the COVID-19 pandemic has transcended national boundaries, affecting individuals, regardless of their nationality, educational background, income level, or gender. However, the aftermath of this crisis has not been evenly distributed; disproportionately burdening those who are most vulnerable. Education is no exception. COVID-19 pandemic crisis has unveiled numerous deficiencies and disparities within our education systems, ranging from unequal access to broadband and computers required for online learning to the absence of supportive learning environments. It has also highlighted the imbalance between available resources and the learners' actual needs . The pandemic had also severely impacted higher education as universities closed their premises and countries shut their borders in response to lockdown measures. Although higher education institutions were quick to replace face-to-face lectures with online learning, these closures could affect the learning and examinations outcomes (Andreas, 2020). Online learning has now firmly established itself as an indispensable method for both educators and learners. . Meanwhile, the online learning community plays a crucial role within the broader framework of online education. However, in educational practice, the online learning community is seen to lack learning enthusiasm and initiative, hence reducing the effectiveness of online learning quality (Li & Pei, 2023).

Amidst the COVID-19 pandemic, Universiti Teknologi MARA emerged as the largest institution for open distance learning (ODL) in Malaysia, offering

distance education to more than 180,000 students. The effectiveness in ODL teaching and learning during COVID-19 pandemic are evaluated using a specific approach through CDL-CQI monitoring tools. Implementing the Continuous Quality Improvement (CQI) process is essential within the framework of Outcome-Based Education (OBE) to consistently enhance the quality of teaching and learning in an educational program as well as to ensure the relevance of the curriculum to the market needs (Syamsul, 2023). Ensuring the alignment of educational objectives and the mission of a higher learning institution with the requirements of stakeholders necessitates the vital practice of closing the loop and continuously improving quality through the implementation of program monitoring and review processes.

In outcome-based education (OBE), achieving effectiveness in teaching, learning, and assessment is insufficient without the implementation of the Closed the Loop (CDL) process. The adoption of the Outcome-Based Education (OBE) approach in science and technology education is centred on preparing students with the knowledge, skills, and mindset essential for achieving success upon graduation (Sariwati et al., 2021). CDL serves as a vital mechanism for assessing the effectiveness of Student-Centred Learning (OBE-SCL) across all courses. The CDL system assesses the alignment of Course Outcomes (CO), Programme Outcomes (PO), Lesson Outcomes (LO), and Kemahiran Insaniah (KI) (Zarina Zainur Rashid et al., 2016). The findings from CDL analysis can then be leveraged for ongoing enhancements in quality (CQI). The continuous quality improvement (CQI), on the other hand,refers to the assessment and evaluation procedures that give educators and administrators vital information about how well educational programs are created, delivered, and led. Improvements based on feedback from evaluations will close the system loop and the process will continue yearly.

The evaluation of CDL-CQI implementation of Materials Science and Technology courses is observed by comparing the CDL-CQI report during and post-Covid-19. The teaching and learning outcome-based monitoring mechanism and review employing a mixed-methods approach through various parameters such as examination grade, surveys and feedbacks, outcomes-based education student centred learning (OBE-SCL) and course-program-learning outcomes and soft skills (CO-PO LO-KI).

2. MONITORING MECHANISM

The evaluation of a Closing the Loop - Continuous Quality Improvement (CDL-CQI) were carried out through several parameter of monitoring tools such as examination grade, surveys and feedbacks, outcomes based education-student centred learning (OBE-SCL), course-program-learning outcomes and soft skills. In general, the CQI process for programs is closely intertwined with the curriculum review process. The output of CDL-CQI was discussed in Jawatankuasa Akademik Fakulti (JAF), Faculty of Applied Science for quality improvement. Furthermore, this paper can also be used as an outline for the steps to be taken by the faculty to address the feedback inputs as part of their commitment to implementing the continuous quality improvement (CQI) process (Norbahiah et al., 2011).

Examination grade is the real monitoring tool of a student's performance . During COVID-19 pandemic, the final examination was performed online. However, the examination grade could be affected by the outcomes since the monitoring was not physically controlled by the lecturer. The student could have had an open access to the information for the exam.

The entrance-exit survey (EES) serves as a valuable instrument in gauging students' perceived understanding of a course. The EES was conducted to evaluate the effectiveness of teaching and learning using a self-assessment process by students (Anuar et al. 2023). Entrance survey was performed at the beginning of the course, while exit survey at the end. The gap between entrance and exit surveys determine the learning process which occurred among the students. An important step in closing the loop (CDL) of the process of continuous quality improvement (CQI) in the context of OBE is to ascertain the degree of student satisfaction with their attainment of PEO. Student's satisfaction is an essential part in Closing the Loop and can be evaluated by the SUFO survey mechanism (Bibi Norasyikin et al., 2020). In order to maintain the relevance of institutions of higher education (IHE), it is imperative to revise academic curriculum to align with the evolving demands of both the workforce and society. The Outcome-Based Education (OBE) framework was introduced in science and technological education, with a primary emphasis on preparing students with the knowledge, skills, and mindset essential for achieving success after graduation (Sariwati Md Shariff et al., 2011).

The expansion of online education has brought new challenges for teaching and assessment outcomes of ODL meanwhile scholars and stakeholders debate the attainment of course, program and learning outcomes. Thus, impacting the effectiveness of online courses could enhance students' soft skills and boost their overall satisfaction in online learning environment. Stakeholders still have negative perceptions regarding ODL , often perceiving that students may have fewer soft skills compared to those who engage in traditional offline learning (Valeny Suryaningsih, 2021). The recently introduced materials and technology programs under Outcome-Based Education (OBE) have established clear Program Educational Objectives (PEOs) as well as defined Program Outcomes (POs), Course Outcomes (COs), and Learning Outcomes (LOs) (Namasivayam et al. 2016).

3. METHODOLOGY

3.1 SAMPLE

All Materials Science and Technology students and lecturers participated in this study. There are over a hundred students in various capacities, together with eight lecturers. The CDL-CQI data for ODL delivery during the COVID-19 pandemic was obtained from March to July 2021, while face-to-face delivery of post-COVID-19 data was obtained from October to February 2023. The servicing courses were excluded since the data were not fully collected by the faculty for the study.

3.2 INSTRUMENTS

The instruments used as CDL-CQI monitoring tools to evaluate OBE outcomes during the COVID-19 pandemic and face-to-face delivery were obtained from the lecturer's UFUTURE system, which included the examination grade, entrance-exit survey (EES), Student Feedback Online (SUFO), OBE SCL and CO-PO-LO-KI attributes with information on average gap and score. The data obtained from U-Future was examined and evaluated on each parameter score. The compilation of the report produced an overview of the curriculum design in quadrant analysis, whether it needed to be reviewed or not.

3.3 DATA COLLECTION PROCEDURES

At the end of the semester, the lecturers of the respective courses performed self-evaluations of each course and submitted them to the resource person for course-level evaluation. The findings were submitted to the Nobel Committee and compiled to be evaluated at the program level. The overall evaluation of the program was presented in JAF for continuous quality improvement.

4. LEARNING OUTCOMES ATTAINMENT THROUGH CDL CQI MONITORING TOOLS

Figure 1 and Figure 2 highlight the five parameters of monitoring tools used to evaluate the outcomes of ODL throughout the semester. It can be observed that both ODL and face-to-face delivery approaches show an average score (3-5) for each parameter above 50%. However, the actual score of the examination grade shows a slightly higher score of 75% during ODL as compared to face-to-face delivery, which is 70%. Open distance assessment allowed students to assess information directly from online sources and reading materials, while in face-to-face delivery, students performed physical examinations that may be restricted to open information and are closely monitored by the lecturer.

The EES score data for ODL shows a similar percentage of an average score of 75%, while face-to-face shows a higher percentage of 92%. This indicates that the higher gap in EES presented a better learning process in face-to-face delivery than ODL delivery. The SUFO feedback from students reached a 100% average score for both ODL and face-to-face approaches. The score percentages for OBE-SCL and CO-PO-LO-KI seem to be higher in ODL delivery. This might be affected by interactive online learning, where students can learn new things through browsing websites and digital libraries. Distance learning enables the global distribution of information and knowledge when new technologies are introduced to the field of education (Hasifah, 2020). The evaluation of CO-PO-LO-KI in ODL is irrelevant since students will only perform simulations or videos; hence, the soft skill evaluations are not significantly affected by the attainment of the course outcomes.

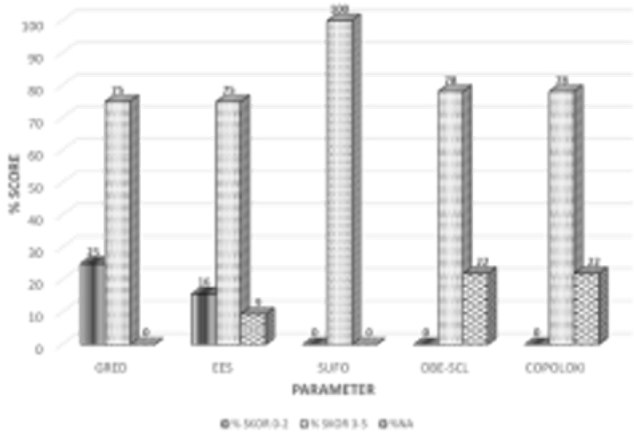

Figure 1: Percentage Score of each parameter during ODL

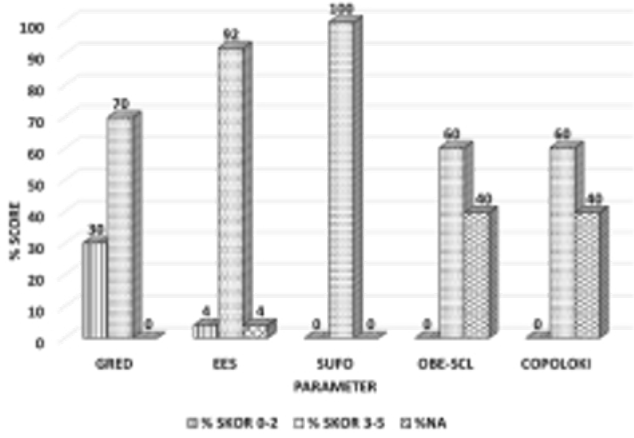

Figure 2: Percentage Score of each parameter during face-to-face learning post Covid-19 3.0 Score Percentage of Examination result

The percentage of examination grade shows a significant difference in score rate between ODL and face-to-face delivery, as shown in Figures 3 and 4. The 8% poor score in Part 2 might be due to the inexperience of the studenst during the ODL delivery course. It can be observed that during ODL delivery, most students achieved a fair to good score percentage, while in face-to-face delivery, the score percentage of the examination grade is scattered randomly from fair to excellence, except for most part 2 students who managed to get a good score.

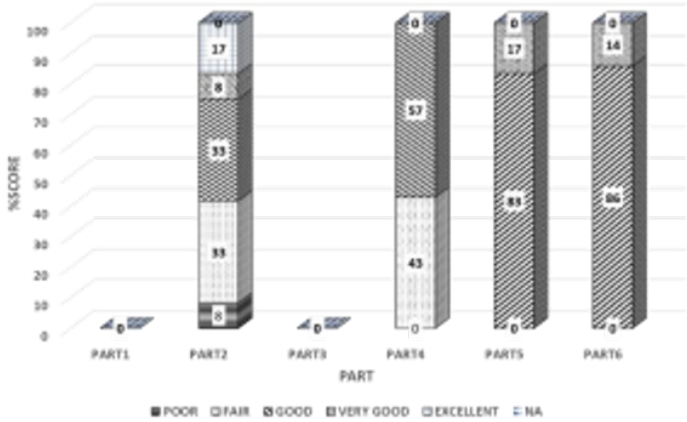

Figure 3. Percentage of examination grade in ODL delivery during pandemic Covid-19

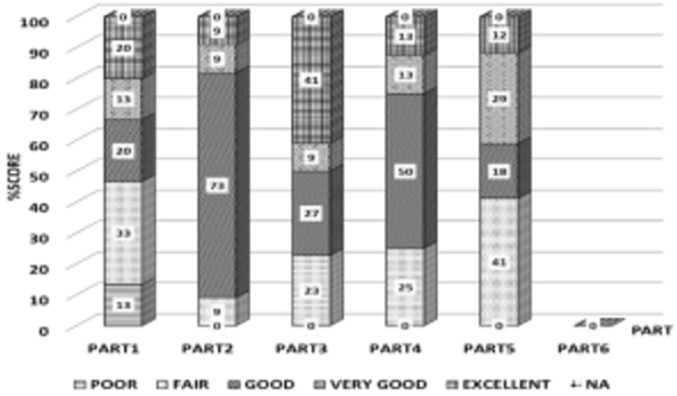

Figure 4. Percentage of examination grade during face-to-face delivery post Covid-19

5. OVERALL CDL-CQI REPORT OF MATERIALS SCIENCE AND TECHNOLOGY COURSE

The overall CDL-CQI report of the Materials and Technology course during ODL and face-to face delivery is tabulated in Tables 1 and 2. It can be seen that the overall data for ODL is higher than for face-to-face delivery. This might contribute to interactive online learning, where students can learn new things through browsing websites and digital libraries. Distance learning enables the global distribution of information and knowledge when new technologies are introduced to the field of education (Hasifah, 2020). Nor Fauziana (2020) explained that to strengthen their understanding, students can review previous lectures by re-watching teacher-made videos and obtaining information from books or the internet. As messages can be exchanged during a lecture utilising utilizing the meeting software's chat column, "Whatsapp,", "Telegram,", video calls, or phone calls, educators and students can also undertake bilateral conversations.

During the pandemic COVID-19 pandemic, the attainment of course outcomes from the SUFO instrument could is hardly to be achieved as students who join the online class might face disruptions in their surroundings. Zulaikha et al. (2021) claimed that the duration of online learning depends on the accessibility of the internet and the price of internet bundles. However, this study discovered that, in reality, students had restricted internet access due to their physical location or a lack of funds to pay for internet packages. The success of online learning also depends on the students' reading level and their capacity to use it. This resulted in the SUFO feedback finding that online learning is still new and unfavourable among students (Hazwani, 2020).

The average SUFO, CO-PO-LO-KI in face-to-face delivery shows an excellent a very good and excellent score, while ODL delivery shows a slightly lower score. These results were are expected since the possibility of physically hands on to the instrument is impossible. This demonstrates the ineffectiveness of online learning compared to with conventional classroom learning.

6. CDL OUTPUT AS INPUT FOR CURRICULUM REVIEW QUADRANT ANALYSIS

The output from CDL-CQI can serve as an input for curriculum review guidelines. CDL-CQI analyses are transformed into four quadrant analyses to assess the necessity of curriculum revisions. Figure 5 shows the quadrant analysis of CDL output Materials and Technology Programs during ODL. It can be observed that from CDL output, the average indicator falls into the ideal situation of a strong syllabus and performed/strived in face-to-face learning. It was also supported by academic performance through examination grade and the EES indicator. During ODL, all parameters are in an ideal, strong syllabus and performed/strive except indicator for performance students in semester 2 fall into must revise curriculum's quadrant. This might be contributed by some of the students who did have not performed EES especially at the end of the semester.

As for Figure 6, the analysed analyzed data of CDL-CQI from the face-to-face learning method falls into the third quadrant, which is an ideal situation with a strong syllabus and students performing or striving. It shows that students really understand and gain knowledge of the program through conventional methods compared to online learning methods. Thus, for the overall CDL-CQI analysis, the materials and technology program show a strong and ideal curriculum, with the accumulative results falling to the third quadrant, which is an ideal situation, a strong syllabus, and students performing. Does it mean - …an ideal situation of a strong syllabus and students' performance?

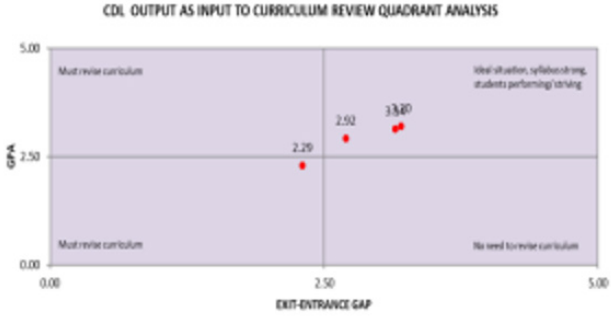

Figure 5. ODL Quadrant analysis of CDL output during COVID-19 pandemic for curriculum review Covid-19

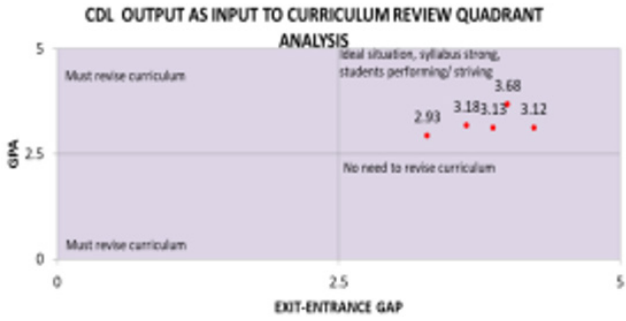

Figure 6. Face-to-face Quadrant Analysis of CDL output post pandemic COVID-19 for curriculum review

During the COVID-19 pandemic, although the examination grade shows significant improvement, the performance of ODL students do not portray the actual quality of OBE outcomes. In summary, the ODL monitoring tools during the pandemic should be improved since the teaching methodology was an online delivery method. Students might lose their focus due to surrounding factors compared to face-to-face learning, in which students have more focus and are practically learning most of the technical courses such as Materials and Technology. Thus, the soft skills in ODL learning are not properly implemented, reducing the attainment of CO-PO-LO-KI outcomes.

7. CONCLUSION

As a conclusion, ODL can be a good alternative method for students to gain knowledge instead of conventional methods during the COVID-19 pandemic. The results of the CDL-CQI evaluation show significant data where the GPA performance of the student is slightly higher compared to the face-to face learning method. OBE-SCL attainment also shows significant improvement since students need to do self-learning with minimal guidance from the lecturers. Nevertheless, traditional approaches continue to offer optimal performance and student experiences during the

learning journey, particularly in achieving CO-PO-LO-KI attributes, thus ensuring the fulfilment of MOHE learning outcomes. The students also gave positive feedback on face-to-face delivery compared to ODL. The quadrant analysis showed that curriculum revision is not necessary for the Materials Science and Technology Program, Faculty of Applied Sciences, Universiti Teknologi MARA.

8. ACKNOWLEDGEMENTS

The authors would like to express a sincere gratitude to Fakulti Sains Gunaan, UiTM Shah Alam for providing the financial support for this study. This endeavour would not have been possible without the contribution and constructive recommendations of all the authors, Associate Prof. Dr. Rosnah Zakaria, Dr. Judith Gisip, Dr. Norazura Ibrahim and Ts. Dr. Nuraimi Jani. during the completion of this study.

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