

Evaluation of Affective Domain for Civil Engineering Design Project Before and During COVID-19: A Case Study in UiTM Johor

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Abstract: The affective domain is one of the three Bloom's Taxonomy domains that deal with emotions, attitudes, and feelings. It includes values, fervour, and motivations. In order to ensure that the Programme Outcomes (POs) established in the Engineering Technology Accreditation Council (ETAC) Manual 2020 for engineering education are met, it is crucial that students be evaluated in this affective domain. This study aims to evaluate the affective domain of the Civil Engineering Design Project course at UiTM Johor before and during the COVID-19 outbreak, which swung the country. The evaluation of the Programme Outcome (PO) for the affective domain mapped to this topic is divided into two primary sections. The first PO is PO8, which addresses understanding and commitment to professional ethics, responsibilities, and norms of technician practice. The second PO, PO10, focuses on communicating effectively on well-defined engineering activities with the engineering community and society, by being able to comprehend the work of others, document their own work, and give and receive clear instructions. The results of these two POs from five semesters before and during COVID-19 were analyzed and discussed to achieve the objective of the study. The result has shown significant changes in the aspect of different mediums of teaching which respond to the face-to-face and online distance learning (ODL) study. The results indicate that the performance in the affective domain of PO8 and PO10 is better before the pandemic compared to performance during the pandemic.

Keywords: Affective Domain, Civil Engineering, COVID-19, Design Project, Programme Outcome

1. Introduction

The nation as a whole has felt the impact of the SARS-CoV-2 or COVID-19 virus since it has been affecting our education system since 2020. The classroom has shifted from an in-person setting to an e-screen medium, posing challenges for both students and teachers. Educators and lecturers develop more innovative teaching techniques to ensure that knowledge is effectively transmitted. Class and laboratory accessing the skills and ethics of the students may be challenging in the online course, also known as Online Distance Learning (ODL).

Previously, during the face-to-face class, students' skills and values would be openly assessed based on their behaviour and performance. Nevertheless, during the ODL course, the affective skills have contributed significantly to the assessment task. Principally, student performance is affected by the difficulty of students completing their coursework without their peers present. The learning process is a combination of receiving knowledge and subsequently interpreting and comprehending the course. Therefore, an active learning environment is necessary for student performance.

In the course of the Civil Engineering Design Project, the Outcome-Based Education (OBE) affective domains PO8 and PO10 were assessed as required by Engineering Technology Accreditation Council (ETAC) Manual 2020 for engineering education. PO8 demonstrates knowledge and dedication to professional ethics, responsibilities, and standards of technician practice while PO10 is addressing the communication effectively on well-defined engineering activities with the engineering community and with society at large, by being able to comprehend the work of others, document their own work, and give and receive clear instructions. The total marks for these two domains account for 50% of the total mark for this course. A significant proportion of the current outbreak of COVID-19 is to be encountered.

20% of PO8 consists of progress work and 10% of the technical report. While 10% of the PO10 consists of oral presentations and 10% of written communication reports. The same percentage of POs was applied to the affective domain assessment for semesters prior to and during the outbreak of COVID-19. Hence, a decent comparison could be done. This study's objective is to evaluate the affective domain of the Civil Engineering Design Project course at UiTM Johor. In addition, this study is intended to answer the two research questions which is involving the student's performance in terms of affective domain before and during the COVID-19 pandemic and how does the teaching and learning environment affect the students' affective domain.

2. Literature Review

COVID-19 had spread globally by the end of 2019 and subsequently affected the majority of countries. The education system was one of the globally affected sectors. During pandemic seasons, the traditional education system that required students to attend class is no longer permitted. Consequently, the e-learning system has become the primary instrument for educators and students to ensure that the learning process continues (Razali et al., 2022).

During the pandemic seasons of COVID-19, the Malaysian Ministry of Education required all educators in schools, colleges, and universities to switch from face-to-face to online classrooms (Chung et al., 2020). Universiti Teknologi MARA (UiTM) is one of the largest universities in Malaysia that was affected by the pandemic and required all the educators to initiate the virtual classroom immediately.

However, educators have many questions regarding the implementation of the education system when the pandemic strikes the world. Since 2004, the College of Engineering Studies at UiTM has implemented Outcome-Based Education (OBE) (Mohamad et al., 2021). According to Mohamad et al. (2021), the implementation of OBE requires the establishment of Programme Educational Objectives (PEOs), followed by Programme Outcomes (POs), curriculum design, teaching and learning (T&L) methods, assessments, Continuous Quality Improvement (CQI), and monitoring.

According to Mohd Saim et al. (2021), the outcomes of engineering education emphasise employability-related knowledge, skills, and attitudes. The learning classification includes cognitive, psychomotor, and affective domains. The objective of engineering education is to produce engineers with cognitive, psychomotor, and affective domains. In the cognitive domain, knowledge and the development of thinking skills were categorised. There are six levels in this domain, known as knowledge, comprehension, application, analysis, and synthesis. In addition, the psychomotor domain consists of seven distinct levels: awareness, preparation, controlled mobility, process, specific mobility, solution, and novelty. In the meantime, Hassan (2011) reported that psychomotor learning encompasses students' practical abilities. This domain emphasises the student's precision, fluidity, and speed in performing motor tasks.

Additionally, the affective domain is important in engineering education. This domain emphasises characteristics of personality and behaviour involving feelings, attitudes, and emotions.

This domain is divided into five levels: receiving, responding, evaluating, organising, and characterising. This affective domain has been linked to achieving the vision of engineering knowledge through the acquisition of skills and abilities (Lynch et al., 2009). Moreover, according to Aoudia and Abu-Alqahsi (2015), students must acquire the following essential competencies: communication, business, and management, safety, legal and social, leadership, teamwork, attitude, lifelong learning, and professional and ethical responsibility.

In order to ensure that the Programme Outcomes (POs) established in the Engineering Technology Accreditation Council (ETAC) Manual 2020 for engineering education are met, it is crucial that students be evaluated on the three previously mentioned domains (Zainudin et al., 2015). There are twelve POs needed to satisfy the cognitive, psychomotor, and affective domains. According to the Board of Engineers Malaysia (2019), the cognitive domain necessitates PO1, PO2, and PO3 to assess knowledge and problem-solving. Therefore, PO4 and PO5 are required for students to acquire the skills and experience necessary to solve the given problem.

In contrast, the affective domain is comprised of PO6, PO7, PO8, PO9, PO10, PO11, and PO12 and relates to the student's attitude and emotions. The affective domain for PO8 stipulated that students should understand their role and adhere to professional ethics as a civil engineering technician, and PO10 stipulated that they should be able to communicate effectively; this enables them to communicate on the given problem, give and receive instructions when engaged in an engineering project (Board of Engineer Malaysia, 2019). These are the essential domains to evaluate during the COVID-19 outbreak.

A previous study conducted by Jainudin et al. (2021) on the evaluation of undergraduate students in a construction and project management course in terms of cognitive, psychomotor, and affective domains concluded that there is room for improvement in the knowledge of engineering management skills in the construction industry. According to another study by Noor et al. (2020), students performed better in the psychomotor and affective domains than in the cognitive domain. Moreover, according to Standal et al. (2013), the university's incorporation of practical experience into academic courses has resulted in improved student performance.

Students' incorrect information-seeking behaviour and limited peer assistance resulting from a lack of participation in campus life may have contributed to their low assessment scores in fully online mode (Lee et al., 2022). Problems with implementing online learning in the affective and psychomotor domains were found to be associated with student interest in learning, the importance of honesty and a sense of student responsibility, student discipline, and the limited teacher assessment of student movement skills. However, the results' contributing factors must be thoroughly analysed and evaluated. Therefore, this paper aims to present the analysis of the affective domain attainment before and during COVID-19 for the Civil Engineering Design Project course in UiTM Johor.

3. Methodology

This study was conducted on all diploma students enrolled in Civil Engineering Design Project course from semester 20194 (October 2019 – February 2020) to semester 20214 (October 2021 – February 2022). There are 170 students in semester 20194, 42 students in semester 20202 (March 2020 – August 2020), 254 students in semester 20204 (October 2020 – February 2021), 43 students in 20212 (March 2021 – August 2021) and 150 students in 20214. In the Civil Engineering Design Project course, all students must satisfy the affective domains PO8 and PO10, which relate to professional ethics and communication skills in well-defined engineering activities. The affective domain of this course was delivered through lectures and studio sessions. It was held seven hours per week for fourteen weeks. According to the syllabus, the domain of affective skills (PO8 and PO10) in this course is derived from the project's development, the technical report, and the oral presentation. The specified rubrics are used as the basis for evaluating the affective domain by the lecturers. Table 1 provides a description of the course's affective objectives, its teaching and learning methodology, and its assessment weighting for this course before and during COVID-19.

For the progress of the project and technical report (PO8), each student must produce structural key plans and perform structural analysis and design calculations of structural elements (i.e., slab, beam, column, staircase, and pad footing) for the building in accordance with Eurocode 2 using both manual calculations and software or computer applications. The structural elements must be designed in

accordance with applicable codes of practice and safety and cost considerations. Throughout the lecture, structural element design calculations were evaluated progressively. Additionally, each student received a case study of the proposed site. For the case study, each student must investigate the infrastructure or geotechnical condition and propose solutions to improve the infrastructure of the proposed site and enhance public health and safety. Students are then required to submit their projects in hard copy during face-to-face classes prior to COVID-19, and in PDF format via WhatsApp or Google Classroom during COVID-19. This project's 30% integration of ethics and responsibilities (PO8) has been evaluated using evaluation rubrics.

Table 1. The affective Program Outcomes (POs) and the assessment weightage

No	POs	Description	Taxonomy Domain	Teaching & Learning Activity	Assessment Weightage (%)	
					Project	Technical Report
1	PO10	Communicate effectively on well-defined engineering activities with the engineering community and with society at large, by being able to comprehend the work of others, document their own work, and give and receive clear instructions.	A3 (Valuing)	Face-To-Face/ Online Distance Learning	10%	10%
2	PO8	Understand and commit to professional ethics and responsibilities and norms of technician practice.	A4 (Organisation)	Face-To-Face/ Online Distance Learning	20%	10%

In addition, each student was required to give a presentation on the reinforced concrete building design project they have completed. A semester prior to COVID-19, the presentation was conducted face-to-face in the classroom, whereas during COVID-19, the presentation was conducted via Microsoft Teams/Webex/Google Meet at the end of the semester, contributing to the 10% oral communication skills (PO10) requirement. The evaluations were conducted using the ratings provided in the rubrics. In addition to oral presentation, each student must compose a technical report. The technical report must be written in a formal report writing format and properly bound.

After all the affective domain task has been assessed by the teaching lecturer, the total score attained by the students were recorded in a system called Revolution on Assessment for Student Monitoring System (i-RAS). The POs attainment is computed by the system and displayed automatically.

4. Results and Discussion

The evaluation of performance in the affective domain of PO8 and PO10 was done based on the average percentage of attainment of the assessment marks for each respective POs throughout five selected semesters.

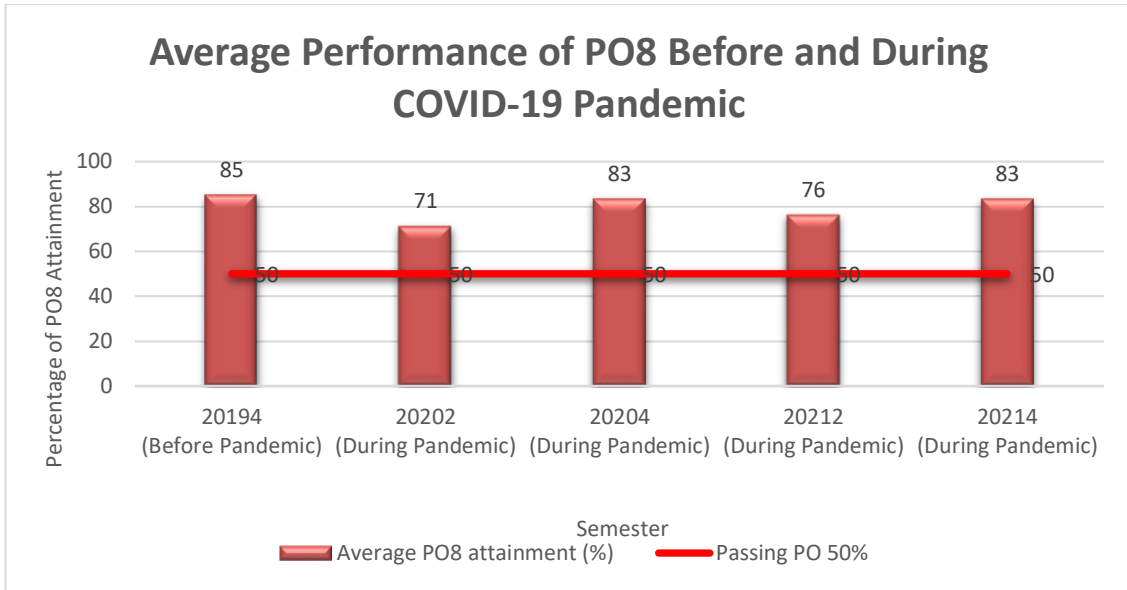


Fig. 1 Average performance of PO8 before and during Covid 19

The graph depicted in Fig. 1 represents an analysis of the average performance for PO8 over the course of five semesters. The graph reveals that the average performance of PO8 is at its highest during the face-to-face session of semester 20194 with an achievement of 85 % attainment and then drops abruptly to its lowest score of 71 % attainment in semester 20202, just as the pandemic strikes the country. The subsequent semesters during the pandemic demonstrate a slight improvement in performance, with a percentage of attainment of 83 % attainment in semesters 20204 and 20214, but a slight decline to the second-lowest score of 76 % attainment in semester 20212. The cumulative performance of PO8 in these five selected semesters exceeds the minimum passing requirement of a 50 % attainment rate.

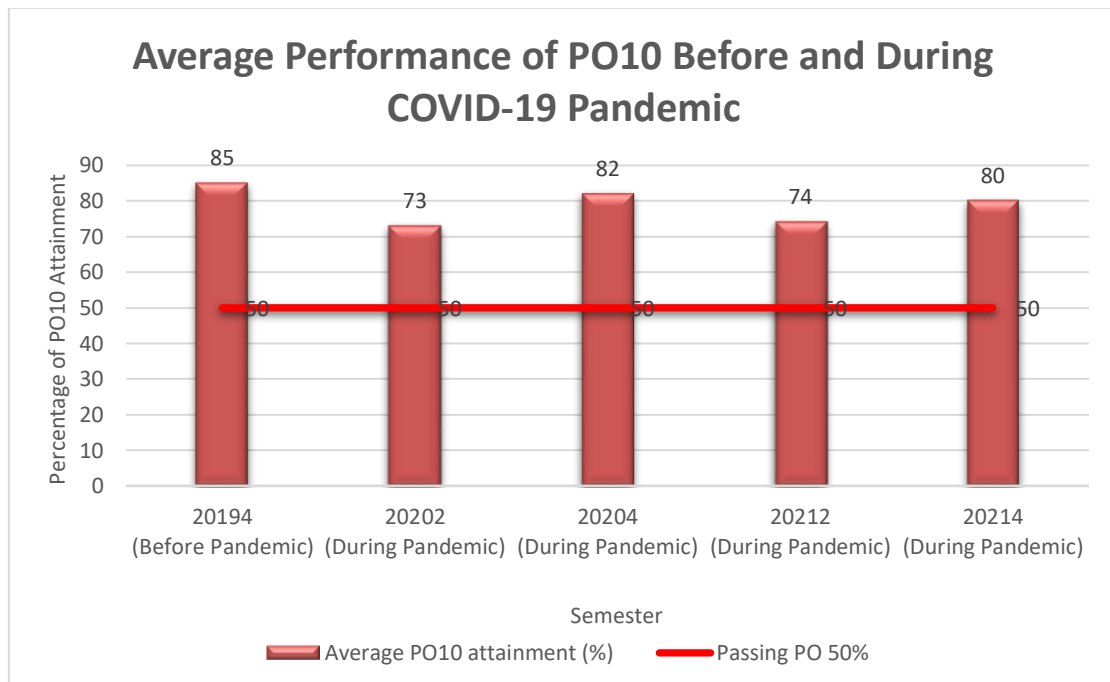


Fig. 2 Average performance of PO10 before and during Covid 19

Fig. 2 depicts the performance of PO10 during the same selected semesters. From the findings, the trend of the performance for PO10 throughout the period is similar to the performance of PO8 with the highest score recorded during the face-to-face session in semester 20194 with the attainment of 85 % and dips to the lowest score right when the pandemic started in semester 20202 with a percentage of 73 %. The up and down trend for the following semesters is also similar to the performance of PO8 with a percentage of attainment of 82 % and 80 % for semesters 20204 and 20214 respectively and a decrease to the second-lowest score of 74 % in semester 20212. Each semester achieved the minimum passing attainment of 50 % for the performance of PO10.

Fig. 3 and Fig. 4 illustrate the percentage of students meeting the minimum requirement of 50 % attainment on the assessment marks for each respective PO throughout the same selected semesters when evaluating student performance in relation to PO8 and PO10.

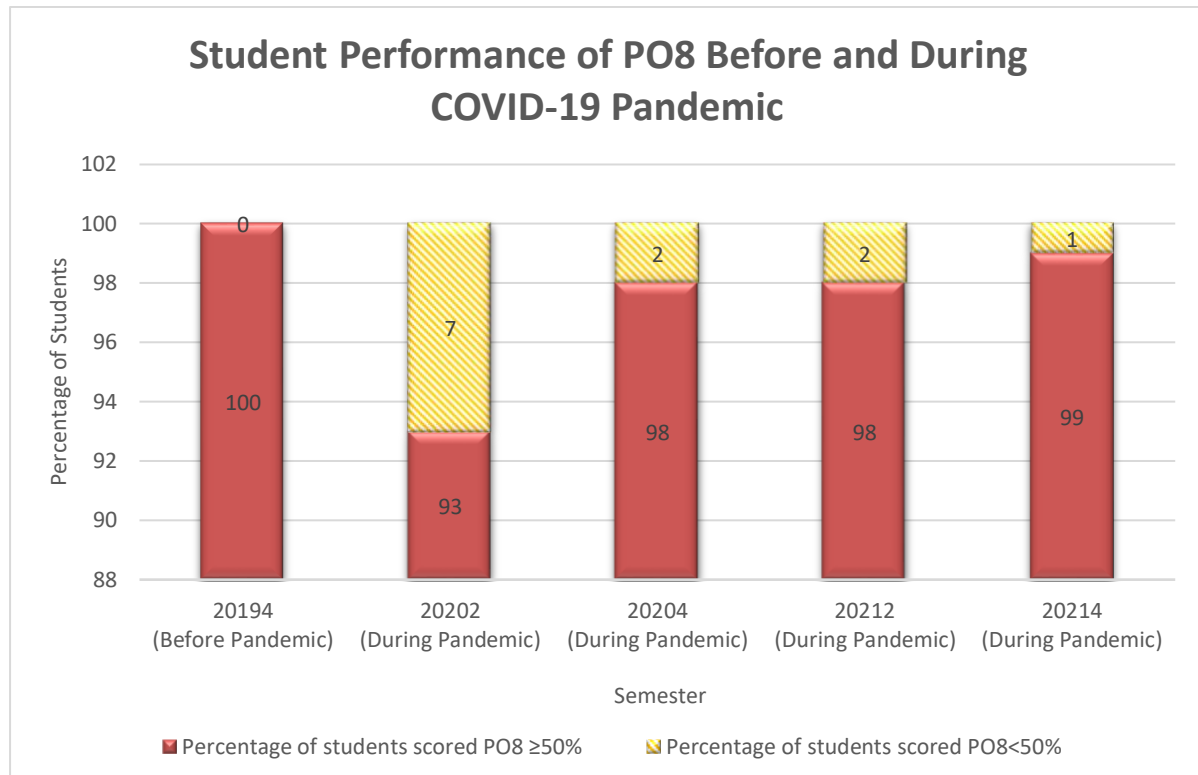


Fig. 3 Student performance of PO8 before and during Covid 19

Fig. 3 illustrates that all students performed satisfactorily in PO8 prior to the pandemic in semester 20194. In the semester of 20202, when the pandemic begins, only 93% of students achieve the minimum passing grade of 50%. The trend reverses in the subsequent semesters, as the percentage of students who pass with a score of at least 50% increases to 98 % in semesters 20204 and 20212, and continues to rise to 99% in semester 20214.

In Fig. 4, similar to the performance on PO8, 100 % of the students are able to attain more than 50 % for PO10 before the pandemic in semester 20194 and experience the same decline as the performance on PO8 with only 93% of students passing at the beginning of the pandemic in semester 20202. The performance trend for the subsequent semester during the pandemic demonstrates an unstable change, with 99 % achieving at least a 50 % grade in semesters 20204 and 20214 but dropping to 95% in semester 20212.

Before and during the COVID-19 pandemic, a decline in performance with respect to PO8 and PO10 was observable, as depicted in Fig. 1, 2, 3, and 4. These findings indicate that the change in the learning environment before and during the COVID-19 pandemic affected the affective learning outcomes of PO8 and PO10. The reason for the decline in performance could be that the adoption process of a new online distance learning system as the primary learning tool has a steep learning curve,

resulting in a delay in maximizing the benefits and becoming accustomed to the system (Sarkam et al., 2022). This is also supported by the upward trend in performance throughout the period of the pandemic, which indicates that both educators and students are becoming accustomed to the new learning tool and are able to gradually improve their performance.

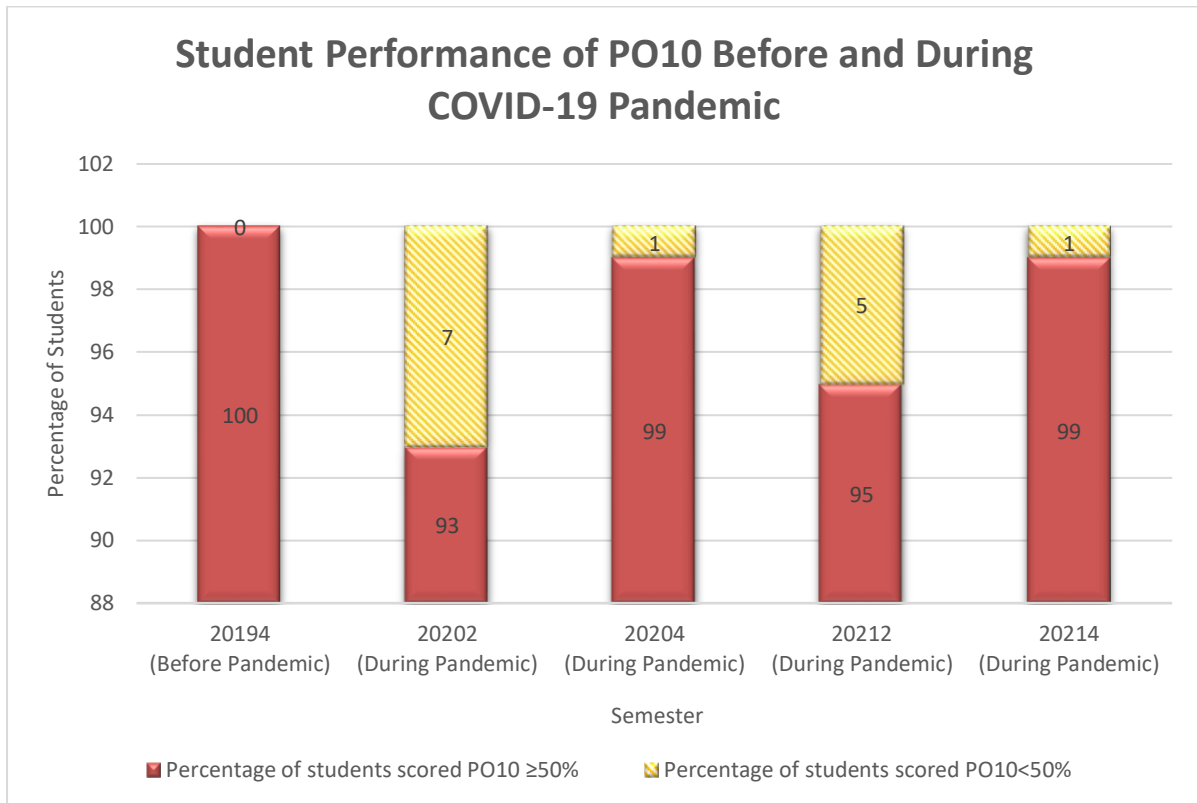


Fig. 4 Student performance of PO10 before and during Covid 19

In addition, the drastic changes in daily routine and learning environment brought on by the pandemic have become a distraction and a source of stress, negatively affecting the emotions and attitudes of students during the learning process. The restrictions imposed by the pandemic, which limit the value of peer assistance and knowledge-seeking, further demotivate students to engage in a more proactive learning process (Markova et al., 2017). This is the result of the limitation in communication and interaction in ODL which prevents students to study collaboratively and cooperatively with their peers and lecturers. Further, according to Abdullah et al. (2022), some student might not have a conducive learning environment at home which could disrupt their focus and consequently affects their disposition and motivation to learn. Additionally, the absence of students in class affects their disposition and motivation to learn (Mohd Saim et al., 2021).

In addition, the restrictions imposed by the pandemic prevent the educator from effectively monitoring and supervising the student throughout the entire learning session. As the outcome of the affective domain relates to the student's attitudes and behaviours, it requires sufficient exposure, self-discipline, and self-awareness for students to develop an interest in the topic (Hamzah et al., 2020). In conventional face-to-face sessions, educators can observe the class, evaluate student performance through direct interaction, and determine the optimal method for guiding students in developing their interests. The lack of effective interaction caused by pandemic restrictions impedes the educator's ability to provide adequate support, thereby impeding the student's development in the affective domain.

The unique personality and character of each student during each semester should also be considered as a variable influencing the results of this study. Each of the semesters evaluated in this study is based on the performance of a different group of students (Xu et al., 2020). In nature, each

individual possesses a distinct personality and a set of skills that influence their performance in the affective domain (Keskin & Yurdugül, 2020). This explains the fluctuating average performance of the two POs, even during the pandemic.

Overall, the results indicate that PO8 and PO10 performed better in the affective domain before the pandemic. This leads to the conclusion that the performance of students in the affective domain is contingent on the teaching and learning approach and that they would perform better in a properly controlled learning environment, as was the case prior to the pandemic. For PO8, which focuses on students' discipline, diligence, ethics, and responsibility, the declines in performance reflect the students' reliance on the lecturer's instruction and guidance for the project's progression, compliance with the project's requirements, and timely submissions, which could not be provided as effectively during the pandemic. Moreover, for PO10, which evaluates students' ability to present the project report in both written and oral form, the findings indicate that a decline in performance during the pandemic period reflects the student's inability to study and comprehend the project independently with limited and immediate peer and lecturer support, preventing them from writing a good report and presenting it satisfactorily.

Referring to the findings of this study, the performance in the affective domain, regardless of the teaching and learning method, can be enhanced by implementing a good monitoring strategy through active online or offline platforms that enable participants to interact and receive responses at all times (Ghani et al., 2022). In addition, for effective time management, a feasible and practical submission and progress schedule could be provided to help students stay on track with their progress and to enable lecturers to identify students who are falling behind so that they can provide the necessary support. To maintain students' morale throughout the semester, the lecturer should provide continuous positive moral reinforcement without undermining their performance or interest in the subject (Abdullah et al., 2022). In addition, an internal or external sharing session regarding the subject could be organised to raise awareness and provide exposure to the student, which will aid in developing the student's interest in the subject. In terms of student's communication skills, conducting regularly scheduled sharing sessions on their work progress in class could prepare them to comprehend and describe their work clearly.

5. Conclusion

This study demonstrates that the different teaching and learning approaches prior to and during the pandemic have an effect on affective domain performance. Performance in the affective domain of PO8 and PO10, as measured by the average percentage of attainment, is highest before the pandemic compared to performance during the pandemic. When a transition is required, both educator and student struggle to catch up with the new learning system due to the conventional face-to-face system's high degree of dependability. In addition, the new asynchronous online distance learning affects students' mental motivation, which in turn affects their attitude and interest in the subject due to a lack of immediate and adequate peer and instructor support.

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