



INTERNATIONAL JOURNAL OF
MODERN EDUCATION
(IJMOE)
www.ijmoe.com



**RESILIENCE AND ADAPTABILITY IN CIVIL ENGINEERING
EDUCATION: EVALUATING THE IMPACT OF
TRANSITIONING FROM ONLINE TO FACE-TO-FACE
ASSESSMENTS DURING COVID-19**

Muhamad Faizal Pakir Mohamed Latiff^{1*}, Nor Hafida Hashim², Mohd Azrizal Fauzi³, Md Rasul Mohamad Nor⁴, Anas Ibrahim⁵

- ¹ Civil Engineering Studies, College of Engineering, Universiti Teknologi MARA Cawangan Pulau Pinang, Kampus Permatang Pauh, Pulau Pinang, Malaysia
Email: faizal.pakir@uitm.edu.my
- ² Civil Engineering Studies, College of Engineering, Universiti Teknologi MARA Cawangan Pulau Pinang, Kampus Permatang Pauh, Pulau Pinang, Malaysia
Email: norhafida995@uitm.edu.my
- ³ Civil Engineering Studies, College of Engineering, Universiti Teknologi MARA Cawangan Pulau Pinang, Kampus Permatang Pauh, Pulau Pinang, Malaysia
Email: azrizal@uitm.edu.my
- ⁴ Civil Engineering Studies, College of Engineering, Universiti Teknologi MARA Cawangan Pulau Pinang, Kampus Permatang Pauh, Pulau Pinang, Malaysia
Email: rasul@uitm.edu.my
- ⁵ Civil Engineering Studies, College of Engineering, Universiti Teknologi MARA Cawangan Pulau Pinang, Kampus Permatang Pauh, Pulau Pinang, Malaysia
Email: ceanas@uitm.edu.my
- * Corresponding Author

Article Info:

Article history:

Received date: 31.07.2024
Revised date: 13.10.2024
Accepted date: 20.02.2025
Published date: 16.03.2025

To cite this document:

Latiff, M. F. P. M., Hashim, N. H., Fauzi, M. A., Nor, M. R. M., & Ibrahim, A. (2025). Resilience And Adaptability In Civil Engineering

Abstract:

The COVID-19 pandemic necessitated an abrupt shift from in-person to online education, challenging traditional teaching modalities, especially in practical disciplines like civil engineering. This study evaluates the impact of transitioning from online to face-to-face assessments at Universiti Teknologi MARA (UiTM) Pulau Pinang, focusing on the courses Hydraulics (CEW442) and Engineering Hydrology (CEW541). Using a mixed-methods approach, this research integrates quantitative performance metrics and qualitative feedback from faculty interviews, providing a comprehensive understanding of the transition's effects on student outcomes. The results reveal significant fluctuations in pass rates and Program Outcomes (POs), particularly PO1, PO2, and PO3, during the 20224 semester, which coincides with the shift back to traditional assessments. The findings suggest that while online platforms

Education: Evaluating The Impact Of Transitioning From Online To Face-To-Face Assessments During Covid-19. *International Journal of Modern Education*, 7 (24), 763-776.

DOI: 10.35631/IJMOE.724055

This work is licensed under [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/)



facilitated theoretical learning, they fell short in supporting practical components, leading to lower PO attainment and passing rates. The study highlights the need for hybrid educational strategies that enhance resilience and adaptability against future disruptions, specifically through continuous assessment improvements and pedagogical adjustments.

Keywords:

Civil Engineering Education, Online Learning, Educational Transition, Hybrid Strategies, Program Outcomes (POs), Student Performance

Introduction

The COVID-19 pandemic brought about an unprecedented disruption to global education, prompting a rapid shift from traditional classroom settings to online platforms. This transformation posed significant challenges, particularly in disciplines like civil engineering, which rely heavily on hands-on training and practical assessments. The abrupt transition affected not only the delivery of content but also the assessment methods, impacting students' learning experiences and outcomes.

At Universiti Teknologi MARA (UiTM) Pulau Pinang, the courses Hydraulics (CEW442) and Engineering Hydrology (CEW541) experienced a critical transition in assessment formats, shifting from online during the pandemic to face-to-face assessments post-pandemic. This shift aimed to restore the rigour of in-person evaluations but also introduced challenges as students readjusted to traditional methods after an extended period of online learning.

This study aims to evaluate the impact of transitioning from online to face-to-face assessments on student performance and Program Outcomes (POs), specifically focusing on PO1, PO2, and PO3. It adopts a mixed-methods approach, combining quantitative data on pass rates and PO attainment with qualitative insights from faculty interviews. The results from the 20224 semester highlight significant fluctuations in both pass rates and PO scores, indicating that the return to traditional assessments affected student performance, particularly in mastering practical components of the curriculum.

The findings underscore the limitations of online learning platforms in fully supporting practical education. The study proposes hybrid educational strategies that integrate online tools with traditional teaching methods to enhance resilience and adaptability against potential future disruptions. These strategies emphasize the importance of continuous assessment improvements, aligning them more effectively with course objectives to support student success in both theoretical and practical aspects.

Literature Review

The onset of the COVID-19 pandemic marked a significant shift in the educational landscape, necessitating a transition from traditional, in-person teaching to fully online learning environments. This shift was especially challenging in engineering disciplines, where hands-on training and practical assessments are central to student learning. Civil engineering, in particular, relies heavily on practical applications to achieve Program Outcomes (POs), which include competencies such as problem-solving, experimentation, and design implementation (Hope et al., 2021).

Impact of Online Learning on Engineering Education

Research indicates that online education can deliver theoretical content effectively, but struggles to support practical training. For example, Choo et al. (2019) and Lee et al. (2021) found that Microsoft Teams and Google Meet, widely adopted platforms during the pandemic, facilitated remote learning but fell short in terms of delivering practical components, which are essential for achieving POs in civil engineering courses like Hydraulics (CEW442) and Engineering Hydrology (CEW541). This aligns with studies by Finlay et al. (2022), which argue that online platforms generally lack the interactivity needed for hands-on skills, leading to limited engagement and understanding in technical subjects.

The transition to online education during the pandemic was not without its challenges. Many students, particularly those in rural areas, faced technological barriers such as poor internet connectivity and inadequate learning environments, which further impacted their engagement and performance (Hester et al., 2021; Khalid, 2014). Cai (2021) emphasizes that these disparities in access contributed to unequal learning opportunities, resulting in lower motivation and active participation. This was particularly evident in courses like CEW442 and CEW541, which require sustained student engagement to master complex concepts and skills.

Online to Face-to-Face Assessment Transitions

The return to face-to-face assessments following the online learning period has been a subject of considerable debate in the literature. The shift aimed to restore the rigour of traditional assessments but introduced new challenges as students struggled to readapt to conventional methods after relying on digital platforms for extended periods. According to Scaringella et al. (2022), the transition back to in-person assessments often led to significant dips in student performance, particularly in hands-on engineering courses, where skills and understanding need to be demonstrated in practical settings. Similarly, Patel et al. (2022) found that Program Outcomes (POs) like PO1, PO2, and PO3 were harder to achieve during this transition, as students had adapted to less rigorous online evaluation formats.

In the case of UiTM Pulau Pinang, this study observed a marked decline in pass rates during the 2022/23 semester, the period when traditional assessments were reinstated. Pass rates in CEW541 dropped to 43.44%, while CEW442 also saw a decline to 69.39%. This aligns with observations by Reynolds and Peters (2021), who found that transitioning between assessment modes can cause significant disruptions in learning continuity, particularly for complex subjects like fluid mechanics and hydraulics. These findings suggest that abrupt changes in assessment formats can negatively impact student outcomes, highlighting the need for better-integrated strategies to support learning during transitions.

Pedagogical Adjustments and Innovations

To address these challenges, scholars have advocated for pedagogical innovations that incorporate blended or hybrid learning approaches. Sosu and Pheunpha (2019) argue for the development of models that combine real-time simulations with hands-on training, offering an alternative that can better meet the needs of engineering students. Real-time simulations and virtual labs, though limited in replicating real-world experiences, can serve as supplemental tools to bridge the gap between online and physical classrooms (Almaiah et al., 2022). However, as UNESCO (2020) highlights, such innovations require robust infrastructure and sufficient technological support to be effective, particularly in resource-constrained settings.

Further, the literature emphasizes the need to review and adapt the Continuous Assessment Plan (CAP) to align assessment methods more closely with the learning objectives of practical courses (Sandhu et al., 2019). For courses like CEW442, where practical skills are critical, CAP revisions could include the integration of more frequent, formative assessments that focus on core skills, even during online phases. This approach aims to maintain learning continuity while adapting to the constraints imposed by different learning environments.

Implications for Future Educational Strategies

The findings from the literature underscore the need for hybrid educational strategies that balance theoretical and practical elements in civil engineering education. These strategies not only enhance learning continuity but also ensure resilience against future disruptions. Integrating both synchronous and asynchronous teaching methods can cater to diverse learning needs and technological access, as recommended by Moreno and Carter (2022). Moreover, implementing regular feedback loops through formative assessments can help students adjust to various assessment formats while maintaining performance standards.

This literature review establishes the context for examining the impacts of transitioning from online to face-to-face assessments in CEW442 and CEW541. It provides a foundation for understanding how changes in assessment modes influence student performance, particularly in terms of POs and pass rates, during critical transition periods like the 20224 semester.

Methodology

Research Design

This study adopts a mixed-methods approach to evaluate the impact of transitioning from online to face-to-face assessments on student performance in Hydraulics (CEW442) and Engineering Hydrology (CEW541) at Universiti Teknologi MARA (UiTM) Pulau Pinang. The research integrates quantitative analyses of student grades and Program Outcome (PO) achievements with qualitative insights derived from faculty interviews. This comprehensive approach provides a multidimensional understanding of how assessment transitions influenced learning outcomes during the 20224 semester.

Participants and Data Collection

The study focuses on students enrolled in CEW442 and CEW541 courses from 2019 to 2023, covering three distinct phases:

1. Pre-pandemic (2019-2020): In-person learning and assessments.
2. During the pandemic (2020-2022): Online learning and assessments.
3. Post-pandemic (2022-2023): Transition back to face-to-face assessments.

Quantitative Data Collection

Quantitative data were collected from the university's academic records, specifically focusing on student grades, pass rates, and average PO scores across each semester within the specified timeframe. The data were divided into:

- Pre-pandemic semesters (e.g., 20192 for Oct 2019 - Mar 2020).
- Pandemic semesters (e.g., 20202 for Mar 2020 - Aug 2020).
- Post-pandemic semesters, with emphasis on the 20224 semester (Oct 2022 – Mar 2023), which marked the return to traditional assessments.

The Program Outcomes (POs) measured included PO1 (Engineering Knowledge), PO2 (Problem Analysis), and PO3 (Design/Development of Solutions), as these are critical indicators of student competencies in civil engineering education.

Qualitative Data Collection

Qualitative data were gathered through semi-structured interviews with faculty members who taught CEW442 and CEW541 during the study period. The interviews aimed to capture faculty perspectives on:

- Pedagogical challenges faced during online and face-to-face transitions.
- Observations of student engagement and performance shifts across assessment phases.
- Reflections on changes in assessment design, delivery, and alignment with course objectives.

Additionally, faculty reports documenting student performance and teaching strategies were reviewed to supplement interview data. The qualitative component aimed to provide depth and context to the quantitative findings, particularly regarding learning experiences and PO attainment during the critical transition phases.

Data Analysis

Quantitative Analysis

Statistical analyses were conducted to identify significant differences in student performance across the three phases. Key methods included:

- Descriptive statistics: Used to summarize pass rates and average PO scores.
- t-tests and ANOVA: Applied to compare performance metrics across pre-pandemic, pandemic, and post-pandemic semesters, with a particular focus on differences observed during the 20224 semester. This analysis aimed to determine whether the shift back to face-to-face assessments led to statistically significant changes in student outcomes.
- Correlation analysis: Conducted to assess the relationship between PO scores and pass rates, with emphasis on PO2 and PO3, which were expected to be more impacted by changes in assessment formats.

The quantitative results were presented in a series of tables and graphs showing pass rates, PO trends, and statistical significance, allowing for clear comparisons across semesters.

Qualitative Analysis

Thematic analysis was employed to analyze the interview transcripts and faculty reports. Key themes identified included:

1. Adaptation to online vs. face-to-face assessments: Faculty noted difficulties in maintaining student engagement and PO attainment during online phases, but reported improvements in hands-on skills following the return to traditional assessments.
2. Challenges in assessment design and alignment: Participants emphasized the need for more frequent formative assessments to support learning continuity across transitions.
3. Variations in student preparedness: Interviews revealed that students faced

difficulties adapting to traditional assessments after relying on less rigorous online formats.

The qualitative insights were integrated with the quantitative findings to offer a comprehensive understanding of the factors that influenced performance changes, particularly during the 20224 semester.

Ethical Considerations

The study was approved by the UiTM Ethical Review Board, ensuring compliance with ethical standards. Informed consent was obtained from all participating faculty members, and all student data were anonymized to maintain confidentiality and privacy.

Limitations

The study acknowledges several limitations:

- The reliance on existing academic records may limit the scope of analysis, as certain variables (e.g., socio-economic factors) were not included.
- The generalizability of the findings may be restricted to similar academic settings in Malaysia.
- Potential external factors (e.g., varying levels of technological access among students) could have influenced performance, beyond assessment format changes.

Despite these limitations, the study offers valuable insights into the effects of transitioning assessment methods in civil engineering education, emphasizing the need for continuous assessment adaptations and hybrid teaching strategies to support student success across different learning environments.

Results and Discussion

This section provides a comprehensive analysis of student performance, focusing on pass rates, failure rates, and Program Outcome (PO) attainment in CEW541 Engineering Hydrology and CEW442 Hydraulics during the transition from online to face-to-face assessments. The results cover three phases: pre-pandemic, pandemic, and post-pandemic, with particular emphasis on the 20224 semester, which marked the shift back to traditional assessment formats.

Performance Trends in CEW541 Engineering Hydrology and CEW442 Hydraulics

The analysis of pass rates and failure rates across semesters reveals a clear pattern of disruption during the 20224 semester, indicating significant challenges as students readapted to in-person examinations.

Pass and Failure Rates

Table 1 summarises the pass and failure rates for CEW541 across semesters. Prior to the pandemic, pass rates remained high, averaging 87.91% in 20192 (Oct 2019 - Mar 2020) and increasing to 98.03% by 20194 (Apr 2020 - Aug 2020). However, during the 20224 semester (Oct 2022 - Mar 2023), a sharp decline in pass rates to 43.44% was observed, indicating the difficulties students faced in transitioning back to traditional assessments.

Table 1: Summary of Course Performance for CEW541 Engineering Hydrology

Semester	Total Students	Passed (%)	Failed (%)
20192 (Pre)	91	87.91	12.09
20194 (Pre)	356	98.03	1.97
20202 (Pandemic)	104	97.12	2.88
20204 (Pandemic)	276	97.83	2.17
20212 (Pandemic)	112	94.64	5.36
20214 (Pandemic)	183	95.08	4.92
20222 (Pandemic)	40	95.00	5.00
20224 (Post)	122	43.44	56.56
20232 (Post)	107	66.36	33.64
20234 (Post)	132	93.94	6.06

Similar trends were observed in CEW442 Hydraulics as shown in Table 2. Pass rates remained relatively stable during pre-pandemic semesters, reaching 95.42% in 20192 (Oct 2019 - Mar 2020), but dropped to 69.39% in the 20224 semester (Oct 2022 - Mar 2023), highlighting the impact of the transition on student performance.

Table 2: Summary of Course Performance for CEW442 Hydraulics

Semester	Total Students	Passed (%)	Failed (%)
20192 (Pre)	262	95.42	4.58
20194 (Pre)	138	89.86	10.14
20202 (Pandemic)	23	86.96	13.04
20204 (Pandemic)	144	97.92	2.08
20212 (Pandemic)	146	96.58	3.42
20214 (Pandemic)	68	95.59	4.41
20222 (Pandemic)	67	97.01	2.99
20224 (Post)	49	69.39	30.61
20232 (Post)	27	85.19	14.81
20234 (Post)	10	60.00	40.00

The trend analysis for pass rates, depicted in Figure 1, shows the clear drop in performance during the 20224 semester for both courses, reflecting students' challenges in adapting to face-to-face assessment formats.

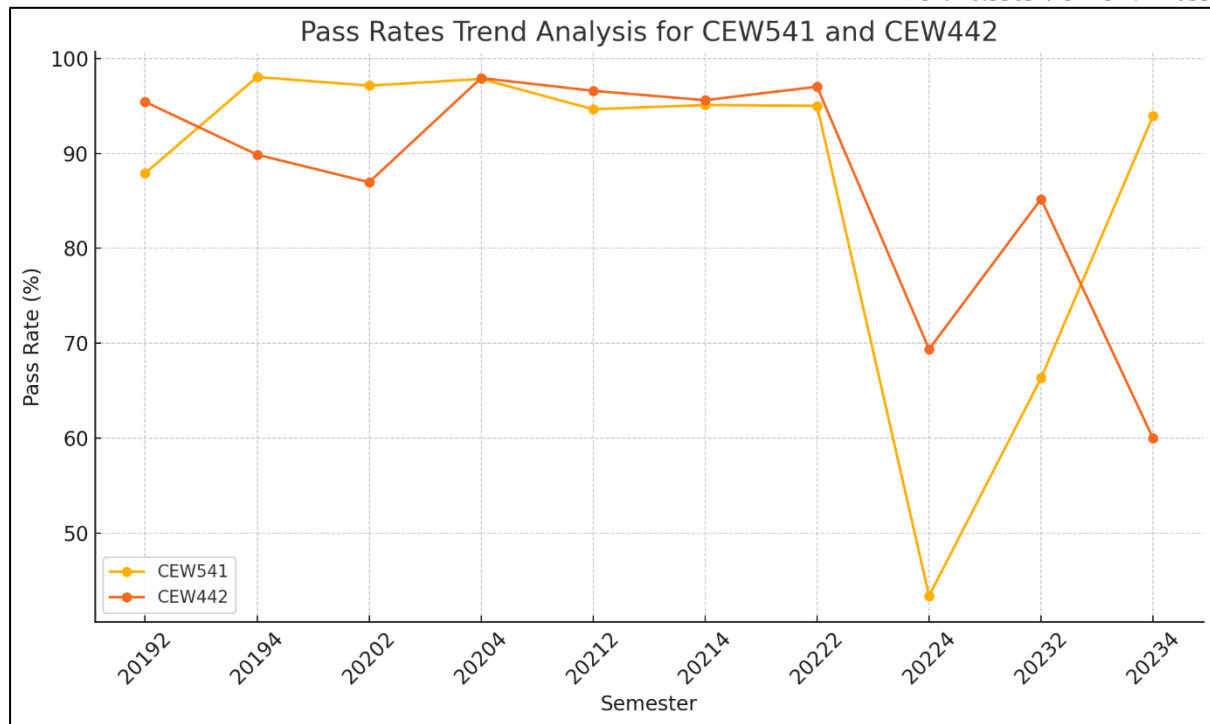


Figure 1: Trend Analysis of Pass Rates for CEW541 and CEW442

PO Attainment Trends

The analysis of PO scores reveals significant declines during the 20224 semester, particularly in CEW541. As shown in Table 3, PO1 scores dropped from 67 to 50, PO2 scores from 59 to 35, and PO3 scores from 58 to 46, suggesting challenges in mastering core concepts under traditional examination conditions.

Table 3: PO Attainment Scores for CEW541 Engineering Hydrology

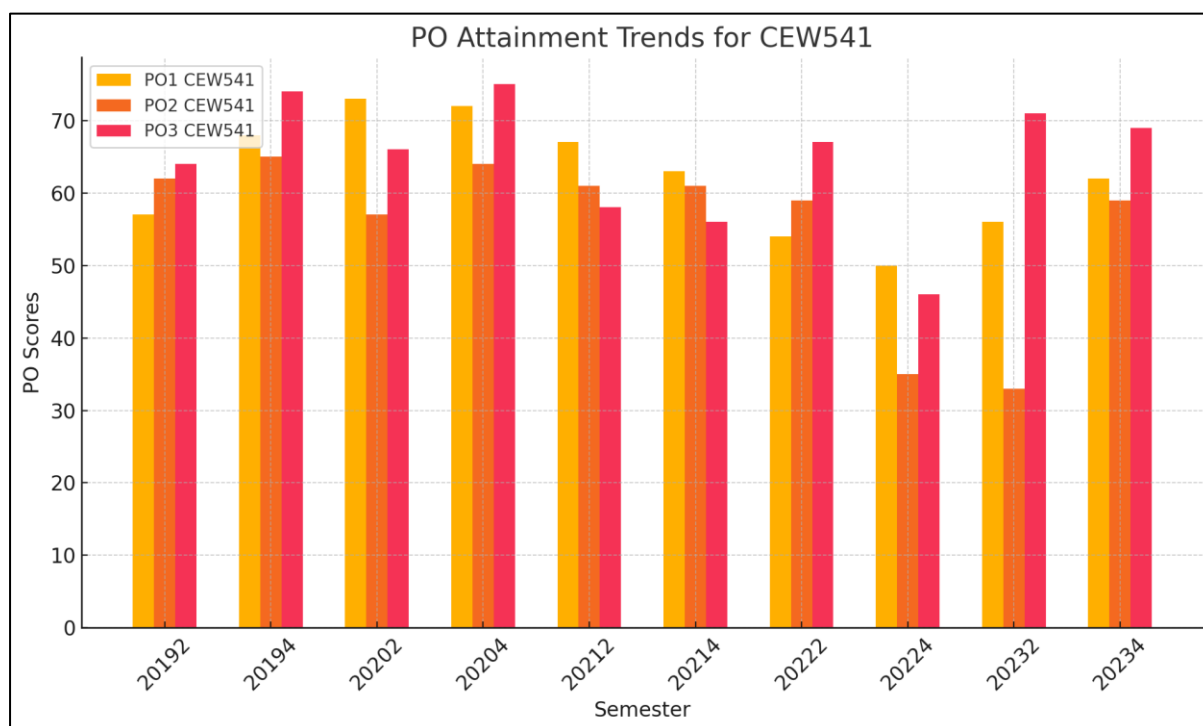
Semester	PO1	PO2	PO3
20192 (Pre)	57	62	64
20194 (Pre)	68	65	74
20202 (Pandemic)	73	57	66
20204 (Pandemic)	72	64	75
20212 (Pandemic)	67	61	58
20214 (Pandemic)	63	61	56
20222 (Pandemic)	54	59	67
20224 (Post)	50	35	46
20232 (Post)	56	33	71
20234 (Post)	62	59	69

Similar trends are evident in CEW442 Hydraulics, as shown in Table 4, where PO1 scores decreased from 71 to 44 and PO2 scores from 72 to 54 during the 20224 semester.

Table 4: PO Attainment Scores for CEW442 Hydraulics

Semester	PO1	PO2
20192 (Pre)	38	71
20194 (Pre)	56	63
20202 (Pandemic)	62	73
20204 (Pandemic)	67	67
20212 (Pandemic)	71	63
20214 (Pandemic)	67	61
20222 (Pandemic)	53	72
20224 (Post)	44	54
20232 (Post)	41	61
20234 (Post)	39	50

Figure 2 illustrates the PO attainment trends for CEW541, showing the decline during the 20224 semester, which coincides with the return to traditional exams. The figure visually demonstrates the extent of the drop in PO1, PO2, and PO3 scores.

**Figure 2: PO Attainment Trends for CEW541**

Correlation Analysis

The correlation analysis in Tables 5 and 6 shows the relationship between pass rates and PO attainment. CEW541 exhibited a strong correlation between PO2 attainment and pass rates ($r = 0.912$), indicating that problem-solving skills were critical for overall performance. In contrast, CEW442 showed a weaker correlation between PO1 scores and pass rates ($r = 0.598$), suggesting greater variability in practical skills.

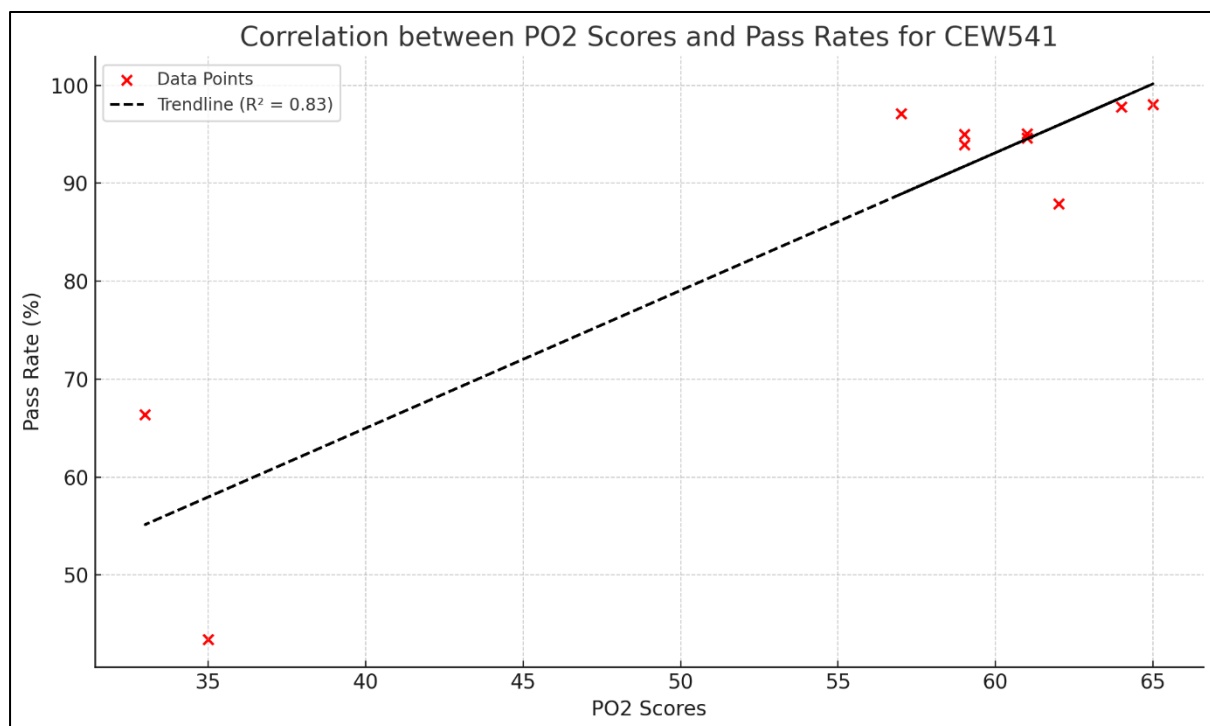
Table 5: Correlation Between Pass Rates and PO Attainment in CEW541

PO	Correlation
PO1	0.719
PO2	0.912
PO3	0.576

Table 6: Correlation Between Pass Rates and PO Attainment in CEW442

PO	Correlation
PO1	0.598
PO2	0.788

Figures 3 and 4 represent these correlations, with Figure 3 demonstrating the strong relationship between PO2 scores and pass rates in CEW541, while Figure 4 depicts the weaker correlation observed in CEW442.

**Figure 3: Correlation between PO2 Scores and Pass Rates for CEW541**

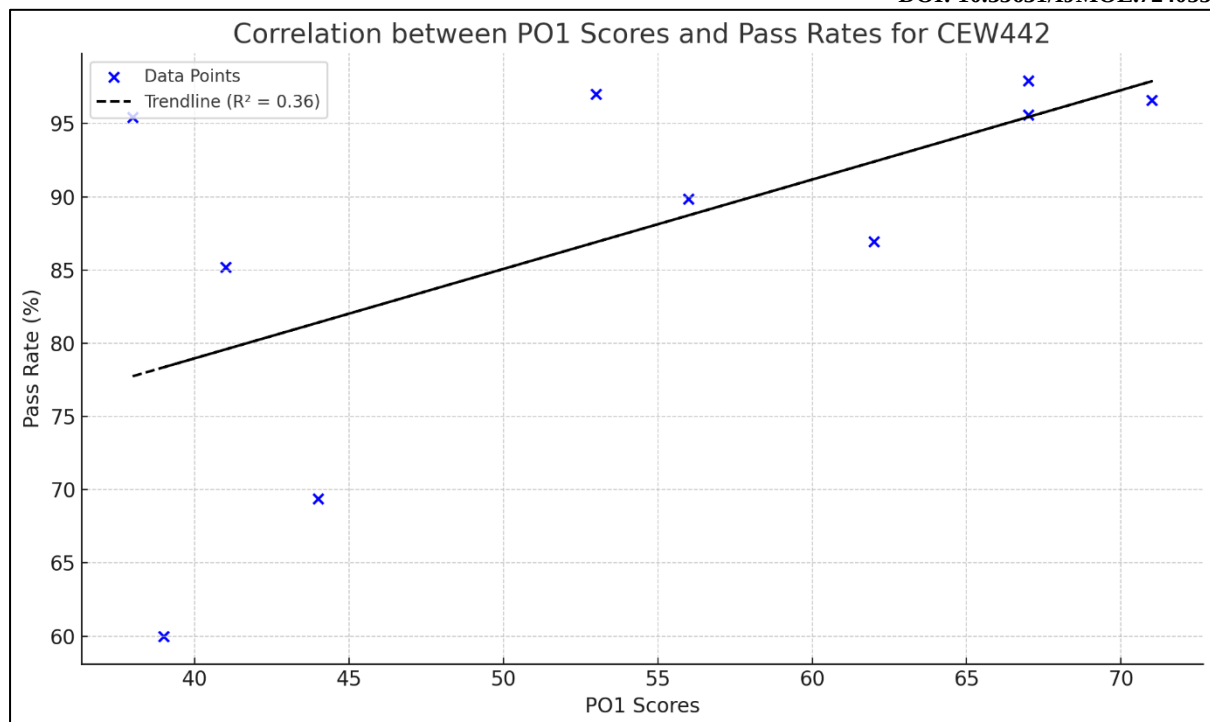


Figure 4: Correlation between PO1 Scores and Pass Rates for CEW442

Qualitative Results

The thematic analysis of faculty interviews revealed key insights into the impact of transitioning from online to face-to-face assessments, particularly during the 20224 semester. Faculty consistently reported that students experienced difficulty readapting to traditional examination formats, which aligns with the quantitative drop in pass rates and PO scores. Many instructors noted that students struggled with the sudden return to in-person exams, having become accustomed to the flexibility of online assessments. This challenge was particularly evident in problem-solving and design tasks associated with PO2 and PO3 in CEW541, as well as practical skills measured by PO1 in CEW442.

The lack of consistent hands-on practice during the pandemic phase was another recurring theme. Instructors highlighted that the prolonged absence of physical lab sessions contributed to reduced practical competencies, making it harder for students to demonstrate skills effectively in a traditional exam setting. This finding corroborates the weaker correlation between PO1 scores and pass rates in CEW442, which emphasizes the gap in hands-on skills.

Faculty recommended integrating hybrid assessment models that blend online and face-to-face evaluations, allowing students to gradually adjust to traditional formats. This approach aligns with prior studies (e.g., Sandhu et al., 2019), which suggest that hybrid models enhance student adaptability and maintain engagement across different learning environments.

Discussion

The results from both quantitative and qualitative analyses indicate that the transition back to face-to-face assessments significantly impacted student performance and PO attainment, particularly during the 20224 semester. The observed trends reflect broader challenges in civil

engineering education, where practical skills and problem-solving competencies are integral to learning outcomes.

The significant drop in pass rates and PO scores during the 2022/23 semester indicates that the sudden reintroduction of traditional assessments created adaptation challenges for students. The marked decline in PO2 and PO3 scores in CEW541, as well as PO1 scores in CEW442, underscores the difficulty students faced in demonstrating complex skills through traditional exams after an extended period of online learning.

These findings suggest that abrupt transitions in assessment formats can lead to discrepancies in measuring student competencies, especially in practical-oriented courses. The strong correlation between PO2 scores and pass rates in CEW541 further emphasizes the importance of problem-solving skills for student success, while the weaker correlation in CEW442 indicates the need for more frequent practical assessments to better align with hands-on skills.

Conclusion

This study explored the impact of transitioning from online to face-to-face assessments on student performance and Program Outcome (PO) attainment in CEW541 Engineering Hydrology and CEW442 Hydraulics at UiTM Pulau Pinang. The findings underscore the considerable challenges faced during the 2022/23 semester, which marked the abrupt return to traditional assessment formats following the prolonged phase of online education due to the COVID-19 pandemic.

The results revealed significant declines in both pass rates and PO scores during the transition phase, with CEW541 experiencing marked drops in PO2 (problem-solving) and PO3 (design skills), while CEW442 showed greater variability in PO1 (practical competencies). The strong correlation between PO2 scores and pass rates in CEW541 highlights the critical role of problem-solving skills in achieving overall course success. Conversely, the weaker correlation between PO1 scores and pass rates in CEW442 suggests that practical competencies were more difficult to assess effectively through traditional exams.

The qualitative insights gathered from faculty interviews corroborate these quantitative findings. Faculty observed that students struggled to readjust to conventional examination formats, having adapted to more flexible online assessments during the pandemic. The lack of consistent hands-on practice, particularly in CEW442, further exacerbated these difficulties, impacting students' ability to demonstrate practical skills effectively.

These findings point to a need for more adaptable and resilient assessment strategies in civil engineering education. Implementing hybrid assessment models that integrate online and face-to-face components can facilitate smoother transitions and support both theoretical and practical learning outcomes. Additionally, revising the Continuous Assessment Plan (CAP) to include more frequent formative assessments can help maintain engagement, provide timely feedback, and better align assessments with intended learning outcomes. Enhancing student support mechanisms, such as targeted preparatory sessions, can also aid in rebuilding competencies that were underdeveloped during the online learning phase.

In conclusion, the transition back to face-to-face assessments highlighted the limitations of traditional exams in measuring complex skills, especially in courses with a strong practical focus. By adopting hybrid approaches and continuous assessment improvements, civil

engineering education can be better positioned to sustain student performance and skill development across different instructional modalities, ensuring resilience against future disruptions.

Acknowledgment

The authors would like to express their gratitude to Universiti Teknologi MARA Cawangan Pulau Pinang for the financial and institutional support that made this research possible. The continuous encouragement and resources provided by the institution have significantly contributed to the completion of this study.

References

- Aboutajeddyne, I., Aboutajeddine, A., & Salih Alj, Y. (2021). Development of an extended constructive alignment model for redesigning courses to fit disrupted contexts. *2021 IEEE Frontiers in Education Conference (FIE)*, 1–5. IEEE. <https://doi.org/10.1109/FIE49875.2021.9637307>
- Almaiah, M. A., Ayouni, S., Hajjej, F., Lutfi, A., Almomani, O., & Awad, A. B. (2022). Smart mobile learning success model for higher educational institutions in the context of the COVID-19 pandemic. *Electronics*, 11(8), 1–13. <https://doi.org/10.3390/electronics11081278>
- Cai, P. (2021). Thinking skills development in mobile learning: The case of elementary school students studying environmental studies. *Thinking Skills and Creativity*, 42, 100922. <https://doi.org/10.1016/j.tsc.2021.100922>
- Choo, C. C., Devakaran, B., Chew, P. K. H., & Zhang, M. W. B. (2019). Smartphone application in postgraduate clinical psychology training: Trainees' perspectives. *International Journal of Environmental Research and Public Health*, 16(21), 1–11. <https://doi.org/10.3390/ijerph16214206>
- Finlay, M. J., Tinnion, D. J., & Simpson, T. (2022). A virtual versus blended learning approach to higher education during the COVID-19 pandemic. *Journal of Hospitality, Leisure, Sport & Tourism Education*, 30, 100363. <https://doi.org/10.1016/j.jhlste.2021.100363>
- Hester, L., Reed, B., Bohannon, W., Box, M., Wells, M., & O'Neal, B. (2021). Using an educational mobile application to teach students to take vital signs. *Nurse Education Today*, 107, 105154. <https://doi.org/10.1016/j.nedt.2021.105154>
- Hope, D., Davids, V., Bollington, L., & Maxwell, S. (2021). Candidates undertaking (invigilated) assessment online show no differences in performance compared to those undertaking assessment offline. *Studies in Higher Education*, 46(2), 266–276. <https://doi.org/10.1080/03075079.2021.1854013>
- Khalid, F. (2014). Students' views on the use of e-portfolio and support given to promote their computer learning for educational purposes. *Malaysian Journal of Learning and Instruction*, 11, 1–15.
- Lee, S. W., Hazizi, J. M., Amran, J. M., Johan, M. I. M., Nizam, S. M., & Anuar, H. (2021). Forensic investigation on the high failure rate of civil engineering solid mechanics course. *International Journal of Mechanical and Civil Engineering*, 18(5), 86–97. <https://doi.org/10.5281/zenodo.4682450>
- Mostafavi, S., Mohseni, A., & Abbasian, G. R. (2021). The pedagogical efficacy of ESP courses for Iranian students of engineering from students' and instructors' perspectives. *Journal of Language and Linguistic Studies*, 17(3), 1605–1625. <https://doi.org/10.17263/jlls.954857>

- Okuboyejo, S. (2021). Examining users' concerns while using mobile learning apps. *Education and Information Technologies*, 26, 6259–6281. <https://doi.org/10.1007/s10639-021-10517-8>
- Sandhu, M. R. S., Qamar, N., & Nazir, S. (2019). Course reduction can reduce failure rates of students: Lessons from the study of an e-learning university of Pakistan. *Asian Journal of Distance Education*, 14(2), 29–42.
- Scaringella, L., Gorska, A., Calderon, D., & Benitez, J. (2022). Should we teach in hybrid mode or fully online? A theory and empirical investigation on the service–profit chain in MBAs. *Journal of Business Research*, 142, 781–790. <https://doi.org/10.1016/j.jbusres.2022.04.057>
- Sengupta, S. (2022). Possibilities and challenges of online education in India during the COVID-19 pandemic. *Journal of Educational Research and Innovation*, 10(1), 95–110.
- Sosu, E. M., & Pheunpha, P. (2019). Trajectory of university dropout: Investigating the cumulative effect of academic vulnerability and proximity to family support. *Studies in Higher Education*, 44(8), 1284–1298. <https://doi.org/10.1080/03075079.2019.1607580>
- UNESCO. (2020). COVID-19 and higher education: Today and tomorrow. *UNESCO Policy Brief*. Retrieved from <https://unesdoc.unesco.org/ark:/48223/pf0000373278>