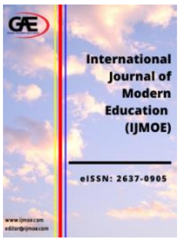
International Journal of Modern Education IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061



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

GLOBAL ACADEMIC EXCELLENCE

CONSTRUCTIVE ALIGNMENT FOR TEACHING, LEARNING AND ASSESSMENT IN ENGINEERS IN SOCIETY COURSE

Che Maznah Mat Isa[1*], Janmaizatulriah Jani[2], Nurul Noraziemah Mohd Pauzi[3]

[1] Civil Engineering Studies, College of Engineering, Universiti Teknologi MARA Pulau Pinang Branch, Permatang Pauh, 13500 Pulau Pinang, MALAYSIA
Email: chema982@uitm.edu.my
[2] School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, Shah Alam, 40450 Selangor, MALAYSIA
Email: janmaizatulriah@uitm.edu.my
[3] School of Civil Engineering, College of Engineering, Universiti Teknologi MARA, Shah Alam, 40450 Selangor, MALAYSIA
Email: noraziemah@uitm.edu.my
[*] Corresponding Author

Article Info:

Article history:
Received date: 31.07.2024
Revised date: 13.10.2024
Accepted date: 10.03.2025
Published date: 19.03.2025

To cite this document:

Mat Isa, C. M., Jani, J., & Pauzi, N. N. M. (2025). Constructive Alignment For Teaching, Learning And Assessment In Engineers In Society Course. *International Journal of Modern Education, 7* (24), 850-866.

DOI: 10.35631/IJMOE.724061

This work is licensed under CC BY 4.0

Abstract:

Using a systematic constructive alignment, the Engineers in Society course (ECC589) is designed to align with the Engineering Accreditation Council (EAC) Standard 2024. This paper explores the steps in constructive alignment that includes planning, implementation, and assessment within the context of ECC589. In the planning stage, learning outcomes (LOs) are developed to align with program objectives, Bloom's Taxonomy, and sustainable development goals (SDGs). These LOs encompass cognitive and affective domains, ensuring a comprehensive educational approach. The implementation stage focuses on diverse teaching and learning activities, such as collaborative teaching, flipped learning, active and cooperative learning, community-based projects, design thinking, and problem-based learning. These activities are designed to foster critical thinking, teamwork, and practical skills, aligning with the intended LOs. The assessment stage employs various techniques, including formative and summative assessments, direct and indirect assessments, and classroom assessment techniques. An alternative assessment approach known as EiS-Dt was developed to ensure that assessments are constructively aligned with the LOs, providing a comprehensive evaluation of student competencies. Overall, the constructive alignment in ECC589 addresses the EAC Standard 2024 by ensuring coherence between learning outcomes, teaching activities, and assessment tasks. This approach equips students with the necessary knowledge, skills, and attitudes to prepare them as future engineers and contribute to sustainable development.

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

Keywords:

Constructive Alignment, Engineers In Society, Learning Outcomes

Introduction

Outcome-Based Education (OBE) is a student-centric teaching and learning methodology that focuses on achieving specific outcomes in terms of knowledge, skills, and attitudes upon completion of an educational program. In Malaysia, OBE has been widely adopted across various levels of education, particularly in higher education institutions. The Malaysian higher education system, driven by the need to enhance educational quality and ensure global competitiveness, has embraced OBE to align educational programs with the demands of the 21st century. OBE in Malaysia aims to produce graduates who are not only academically proficient but also equipped with essential soft skills and professional competencies that meet the needs of the industry and society. This approach requires clear articulation of learning outcomes, effective teaching and learning strategies, and robust assessment methods to ensure that students achieve the desired competencies. Constructive alignment, a principle emphasizing the harmony between learning outcomes, teaching activities, and assessment tasks, is important to achieve programme outcomes (POs) towards achieving programme educational objectives (PEOs) required by the Board of Engineers Malaysia.

The Board of Engineers Malaysia (BEM) plays a crucial role in regulating the engineering profession and ensuring the quality of engineering education in Malaysia. BEM has established a comprehensive set of standards known as the Engineering Accreditation Council (EAC) Standard to guide engineering programs in Malaysian universities. These standards emphasize the attainment of specific graduate attributes or known as programme outcomes that engineering students must possess upon completing their programs. These graduate attributes serve as the foundation for engineering education in Malaysia, ensuring that engineering graduates are well-prepared to meet the challenges of the modern world and contribute positively to the profession and society. The adoption of OBE and adherence to BEM EAC standards reflect Malaysia's commitment to producing high-quality engineering graduates who are globally competitive and capable of driving national development.

The latest standard was released on the 23rd of July 2024 known as the EAC Standard 2024. There are 11 programme outcomes in the new EAC Standard 2024 as compared to the 12 programme outcomes in the EAC Standard 2020. Therefore, it is very important for the engineering programme to adhere to the latest requirements by BEM to ensure that the students attain all programme outcomes upon completion of the programme. Furthermore, there is a need for the current engineering courses to better integrate course intentions with student experiences, as discussed by Kumar et al. (2022), particularly through community-based projects that have a real-world impact. While Lawrence (2023) offers a framework for designing and assessing learning outcomes, its practical application within the curriculum planning and assessment stages requires further exploration. Additionally, the alternative assessment method developed by Mat Isa et al. (2022) integrating the SULAM approach, though relevant to engineers and the world’s attribute adaptation to community service requirements under pandemic conditions, has yet to be fully operationalized and improved. This paper focuses on constructive alignment process in one selected engineering course,

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

namely Engineers in Society (ECC589). Thus, it presents on how to address these gaps to ensure it achieves its outcomes and objectives in alignment with EAC Standard 2024.

Literature Review

Table 1 Shows The Comparison Between The EAC Standard 2020 And The EAC Standard 2024

(Source: Board Of Engineers Malaysia (bem.org.my))

EAC Standard 2020	EAC Standard 2024
PO1: Engineering Knowledge - Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation as specified in WK1 to WK4 respectively to the solution of complex engineering problems;	PO1: Engineering Knowledge - Apply knowledge of mathematics, natural science**, computing and** engineering fundamentals, and an engineering specialization as specified in WK1 to WK4 respectively to **develop** solutions **to** complex engineering problems
PO2: Problem Analysis - Identify, formulate, conduct research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences (WK1 to WK4;	PO2: Problem Analysis - Identify, formulate, research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences **with holistic considerations for sustainable development** (WK1 to WK4)
PO3): Design/Development of Solutions - Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations (WK5);	PO3: Design/Development of Solutions - Design **creative** solutions for complex engineering problems and design systems, components or processes **to** meet **identified** needs with appropriate consideration for public health and safety, **whole-life cost, net zero carbon as well as resource,** cultural, societal, and environmental considerations **as required** (WK5)
PO4: Investigation - Conduct investigation of complex engineering problems using research-based knowledge (WK8) and research methods, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;	PO4: Investigation - Conduct investigation of complex engineering problems using **research methods** including research-based knowledge, including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions **(WK8);**
PO5: Modern Tool Usage - Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, with an understanding of the limitations (WK6);	PO5: Tool Usage - Create, select and apply, **and recognize limitations of** appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering problems, (**WK2 and** WK6);
PO6: The Engineer and Society - Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional	PO6: The Engineer and **the World - Analyze and evaluate sustainable development impacts to: society, the economy, sustainability**, health and safety, legal frameworks, **and the environment**,

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

engineering practice and solutions to complex engineering problems (WK7);	**in solving complex engineering problems** (**WK1, WK5**, and WK7)
PO7: Environment and Sustainability - Understand and evaluate the sustainability and impact of professional engineering work in the solutions of complex engineering problems in societal and environmental contexts. (WK7);	
PO8: Ethics - Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice (WK7);	PO7: Ethics - Apply ethical principles and commit to professional ethics and norms of engineering practice **and adhere to relevant national and international laws. Demonstrate an understanding of the need for diversity and inclusion (WK9);**
PO9: Individual and Team Work - Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings	PO8: Individual and **Collaborative** Teamwork - Function effectively as an individual, and as a member or leader in diverse **and inclusive** teams and in multidisciplinary**, face-to-face, remote and distributed** settings **(WK9)**
PO10: Communication - Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions;	PO9: Communication - Communicate effectively **and inclusively** on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, making effective presentations, **taking into account cultural, language, and learning differences**;
PO11: Project Management and Finance - Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments	PO10: Project Management and Finance - **Apply** knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, **and** to manage projects in multidisciplinary environments;
PO12: Lifelong Learning - Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change	PO11: Lifelong Learning - Recognise the need for and have the preparation and ability **for i)** independent and life-long learning ii) **adaptability to new and emerging technologies and iii) critical thinking** in the broadest context of technological change **(WK8).**

These graduate attributes play a crucial role in civil engineering education, adhering to the EAC Standard 2024, which necessitates constructive alignment to ensure the learning outcomes and educational objectives are met. The new standard consolidates the 12 graduate attributes into 11 by combining "The Engineer and Society (PO6)" and "Environment and Sustainability (PO7)" under the new heading "The Engineers and the World (PO6 – Standard 2024)." Furthermore, the revised standards emphasize critical thinking, innovation, emerging

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061
technologies, and lifelong learning (PO11 – Standard 2024), as well as knowledge and awareness of ethics, diversity, and inclusion (PO7 – Ethics – Standard 2024).

Constructive alignment enhances learning outcomes, teaching activities, and assessment tasks, a principle emphasized by Munir (2023) for achieving targeted programme outcomes. Despite its recognized importance, the engineering courses that incorporates these programme outcomes face challenges in effectively implementing constructive alignment. The alignment of curricular components with institutional vision and performance indicators, as highlighted by Abejuela et al. (2022), remains insufficiently addressed.

Implementation of Constructive Alignment

At the programme level, constructive alignment is pivotal in aligning institutional outcomes with program outcomes, performance indicators, and assessment methods to ensure curriculum coherence, while at the course level, it ensures alignment between learning outcomes, teaching activities, and assessment tasks, significantly enhances student learning outcomes in engineering education. The constructive alignment principle emphasizes the harmony between what is taught (learning outcomes), how it is taught (instruction), and how learning is assessed (assessment), thus fostering a more effective educational experience as shown in Figure 1.

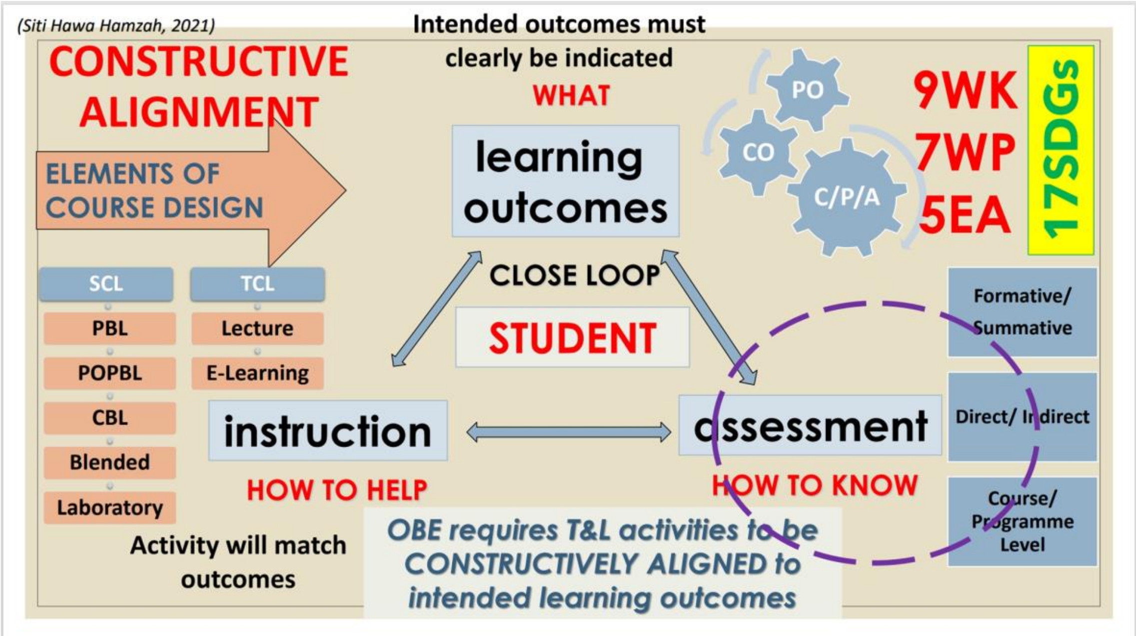


Figure 1: Constructive Alignment Principle between Learning Outcomes, Instructional Methods and Assessment

Various studies have explored the implementation and impact of constructive alignment across different educational contexts, providing insights into its effectiveness and the challenges encountered.

Recent research, such as Ford et al. (2024), highlights the significance of modality alignment in course design. They found that the effectiveness of different teaching modalities (synchronous vs. asynchronous) in higher education courses is closely tied to the student-professor connection. Their study suggests that even in asynchronous formats, improving student engagement and connection with instructors can enhance course outcomes,

Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

underscoring the need for alignment between modality and course objectives (Ford et al., 2024). Moreover, Dagdag et al. (2024) investigated the alignment between institutional vision and mission statements and program outcomes in teacher education. Their findings indicate a strong correlation between stakeholders' awareness of these statements and the acceptance of the aligned program outcomes. However, the research also identified a gap in awareness, especially among parents and officials, pointing to the importance of more effective communication and engagement strategies to ensure alignment and acceptance across all stakeholders (Dagdag et al., 2024).

Constructive alignment is a powerful framework for ensuring curriculum coherence, these studies reveal ongoing challenges. The focus on student engagement and institutional alignment shows that simply aligning learning outcomes with assessments is insufficient. There is a need for improved communication, stakeholder involvement, and technological integration to support this alignment effectively. Additionally, emerging technologies such as open-source exam systems and automated assessment tools, as explored by Bernius (2023) and Linhuber et al. (2023), show promise in streamlining assessment processes but require careful consideration of academic integrity and scalability to maintain reliability (Bernius, 2023) (Linhuber et al., 2023). While constructive alignment remains a valuable approach to enhancing educational outcomes, it must continuously evolve to address new challenges in modality alignment, stakeholder engagement, and technological integration in assessment strategies.

Challenges in Constructive Alignment Implementation

Constructive alignment, a key pedagogical strategy that ensures coherence between learning outcomes, teaching activities, and assessment tasks, faces several challenges when being implemented in educational institutions under various aspects, different levels and different education fields such engineering, computing, entrepreneurship etc. These challenges can hinder the effective application of constructive alignment and limit its potential benefits.

At higher educational levels, Romanowski et al. (2023) discuss the challenges of pedagogical hegemony, implementation fidelity, and policy enactment in higher education, particularly in Gulf Cooperation Council countries. They highlight the difficulty of achieving genuine alignment due to these blind spots, which can lead to superficial compliance with constructive alignment principles rather than meaningful integration into the curriculum. At institutional and programme level, Suherdi (2019) examines the role of constructive alignment in education quality management systems, arguing that aligning teaching-learning activities with assessment and learning outcomes is crucial for sustaining continual quality improvement. The study highlights challenges such as slow-growing quality concern and the need for supportive mindsets and effective academic traditions. At different educational fields, Bernius (2023) discusses the complexity and resource-intensive nature of implementing comprehensive skills assessments in computing education. Traditional paper-based examinations often emphasize rote memorization, which misaligns instructional objectives with assessment techniques. The introduction of innovative exam modes that incorporate anti-cheating protocols and automated grading can mitigate these limitations but require substantial institutional support and resources. In a team-based experiential entrepreneurship education, Scott et al. (2019) investigated "constructive misalignment" and they find that unexpected aspects such as linguistic-cultural challenges and non-participation can significantly affect the learning process. These issues highlight the difficulty of ensuring consistent and meaningful engagement among students, which is critical for the success of constructive alignment. In

International Journal of Modern Education
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

addition, the difficulties students faced during emergency remote teaching required the programme to carry out the constructive alignment to address student perceptions and abilities to bridge self-efficacy gaps (Booysen & Wolff, 2022). This highlights the need for adapting teaching methods to maintain alignment during unforeseen circumstances such as a shift to remote learning.

At a course level, the limited implementation of constructive activities in teaching suggested a need for more active learning methods to better align teaching practices with learning outcomes. It was found that traditional lecturing methods often prevail over interactive and constructive activities, which can impede the full realization of constructive alignment's benefits (Md Jani et al., 2020). In summary, while constructive alignment has the potential to significantly enhance educational outcomes, its implementation is challenged by factors such as adapting to remote teaching environments, the persistence of traditional teaching methods, the need for active learning strategies, resource limitations, and the complexities of maintaining genuine alignment in diverse educational contexts.

Methodology

This study adopts a qualitative method based on a document review specifically for the Engineers in Society course, which includes syllabus that contains the course information, course assessment plan, lesson plans, instructional guidance, assessment tools and performance criteria matrix or rubrics and other relevant information.

Result And Discussion

The discussion is based on the three important principles in carrying out constructive alignment between planning stage (what are the outcomes to be achieved by students), implementation stage (how to help the students achieve the outcomes) and assessment stage (how to know that students achieve the outcomes). Figure 2 shows the constructive alignment framework used for ECC589 course.

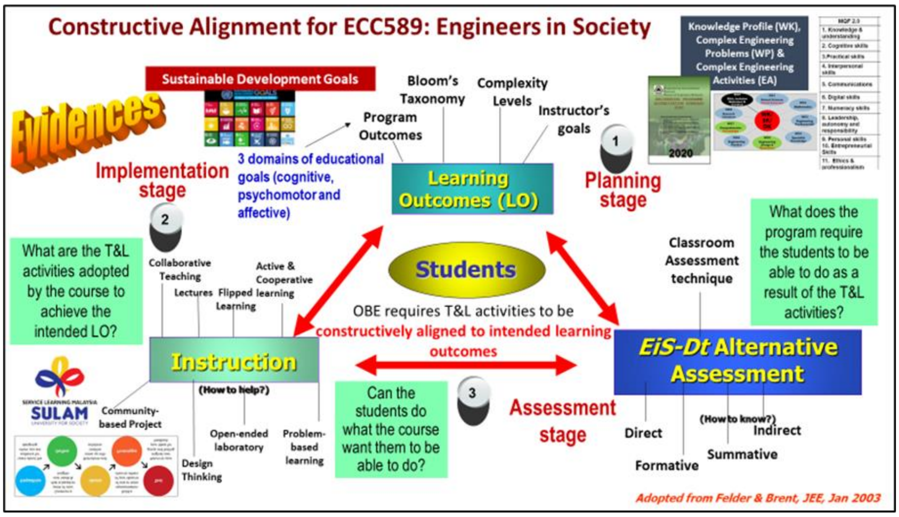


Figure 2: Constructive Alignment Framework for ECC589

Planning Stage

The planning stage sets the foundation for achieving constructive alignment in ECC589. The primary focus is on defining Learning Outcomes (LOs) aligned with the course's objectives,

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

Bloom's Taxonomy, complexity levels, and the instructor's goals. These LOs are framed to address the cognitive, psychomotor, and affective domains of educational goals, ensuring a comprehensive development of students' knowledge, skills, and attitudes. The integration of SDGs into the LOs reflects the commitment to global sustainability and social responsibility, crucial aspects of modern engineering education. The alignment of the course outcome with programme outcomes is illustrated in Figure 3.

COURSE ASSESSMENT PLAN

COURSE CODE	ECC 589	FACULTY / ACADEMY	FACULTY OF CIVIL ENGINEERING
COURSE NAME (IN ENGLISH)	ENGINEERS IN SOCIETY	CREDIT UNIT	2.0
COURSE NAME (IN MALAY)	JURUTERA DALAM MASYARAKAT	RESOURCE PERSON	PROF MADYA IR DR CHE MAZNAH MAT ISA

COURSE OUTCOME (CO)	OUTCOME STATEMENT	PO	PLO MQF 2.0 - LO (AIMS)	TAXO-NOMY	WP/EA	TEACHING METHODOLOGY	ASSESSMENT COMPONENT		
							PRESENTATION	CASE STUDY	PROJECT
CO1	Engage with the community as a prospective civil engineer in solving problems involving the civil engineering profession	PO6	PLO4 – LO11	C6	WP1 & at least two of WP1, WP2, WP3, WP4, WP5, WP6 & WP7	Lectures, Project based learning			70
CO2	Comprehend the ethical and professional conduct that guide a civil engineer's professional practice and service to the community	PO8	PLO11-LO17	A4		Lectures, Case Study, Presentation	20	10	
			TOTAL				20	10	70

Nama Fakulti: Kejuruteraan Awam
Nama Program: Ijazah Sarjana Muda Kejuruteraan (Kepujian) Awam
© Hak Cipta Universiti Teknologi Mara

Tahun Mula: 2012
Tahun Semakan: 2017

Figure 3: Course Assessment Plan showing the Alignment of Course and Programme Outcomes for ECC589 following the EAC Standard 2020

Implementation Stage

The implementation stage involves the execution of Teaching and Learning (T&L) activities designed to meet the intended LOs. ECC589 employs a diverse range of pedagogical strategies, including (1) Collaborative teaching and lectures to promote knowledge sharing and interactive learning, (2) Flipped learning to encourage students to engage with course material before class, fostering active participation during lectures, (3) Active and cooperative learning to enhanced teamwork and problem-solving skills through group activities, (4) Community-based projects to integrate SULAM initiative with real-world community service, emphasizing the social impact of engineering, (5) Design Thinking and Problem-based learning to cultivate innovative and critical thinking skills through practical problem-solving exercises. These activities are designed to ensure students can achieve the LOs effectively, fostering a deep understanding of the subject matter and its applications.

Collaborative Teaching

To further bridge the gap between theoretical knowledge and practical application, a collaborative, online educational approach is being evaluated for its impact on enhancing student preparedness. This method aligns with findings that Collaborative Online International

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

Learning (COIL) significantly develops student outcomes across diverse competencies essential for global engineering practice (Lara-Prieto et al., 2023). Previous studies suggest that COIL programs foster intercultural competence and improve project performance compared to traditional methods (Appiah-Kubi & Annan, 2020). Moreover, during periods of physical isolation, such as the COVID-19 pandemic, collaborative learning models have demonstrated their effectiveness in maintaining high levels of student engagement and learning outcomes (Chan & Zhang, 2020). These models are particularly pertinent to online software engineering education, where they address the challenges of remote collaboration and enhance learning through structured team projects (Neill, DeFranco & Sangwan, 2017). Figure 4a to 4d shows the poster to inform students about collaborative teaching by various invited speakers from the industry.

Figure 4a: Webinar on Ethics and Professional Conducts for Engineers by a Consultant

Figure 4b: Webinar on Local and Federal Authorities' Rules and Regulations by a Professional Engineer (Consultant)

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

Figure 4c: Webinar on Malaysian Law and Legal System by Professional Lawyer

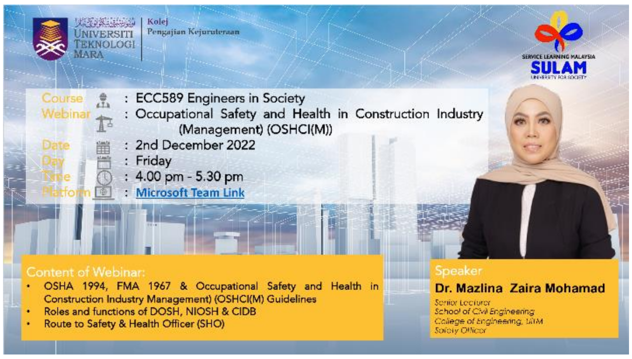


Figure 4d: Webinar on Occupational Safety and Health in Construction Industry by Certified Safety Officer

Flipped Learning

Various information and contents for the course is available in the university's learning management system (LMS) known as u-Future and Microsoft Team and other relevant sources on the four (5) important elements in the course which are (1) Malaysian Legal System, (2)Roles and Responsibilities of Engineers, Code of Ethics and Professional Conduct for Engineers, (3) Local and Federal Authority Regulations, and (4) Occupational Safety and Health Act, as well as the role and function of DOSH, NIOSH, and CIDB, etc. Figure 5 shows the screen shot of the LMS, namely u-future that contains the above information for students' reference.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

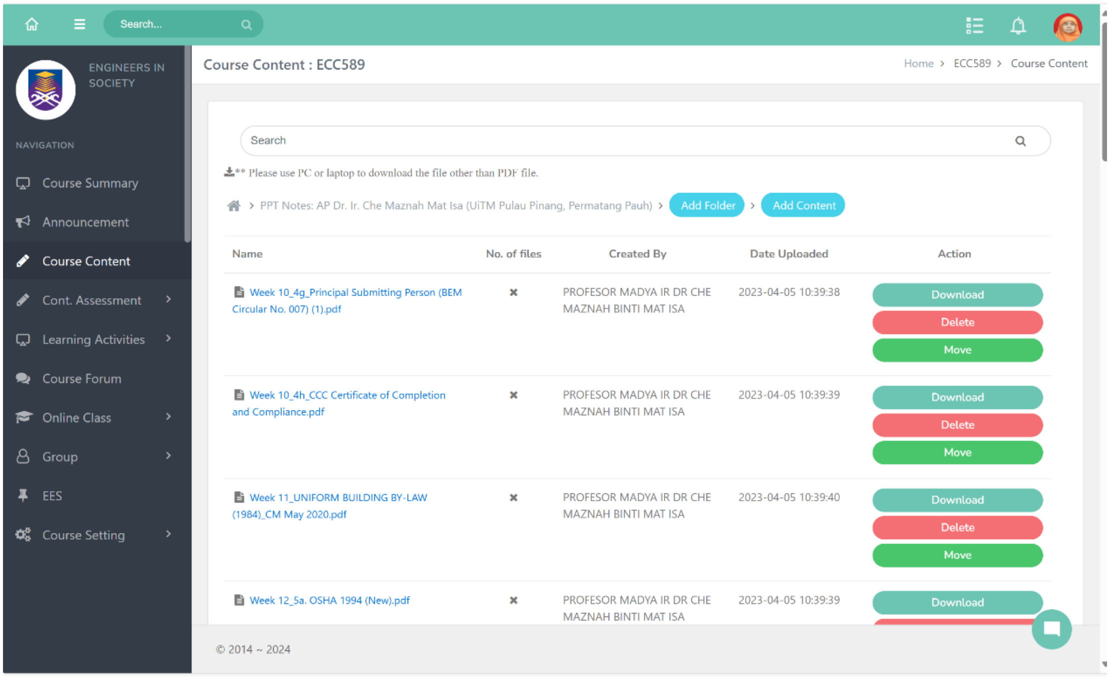


Figure 5: Learning Management System (LMS) – U-Future for ECC589 Course

Design Thinking Approach

As a group, the students are required to participate in a structured service activity (community project) related to civil engineering that meets identified community needs through complex ***engineering*** problem solving using the Design Thinking process as shown in Figure 6.

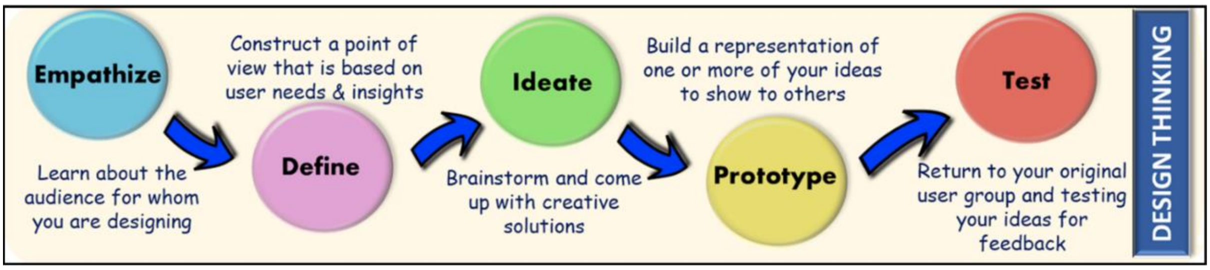


Figure 6: Five (5) Steps Design Thinking Process adopted based on Hasso-Plattner Institute of Design, University of Stanford)

Assessment Stage

This evaluates whether students have achieved the intended LOs through various assessment techniques, including (1) Formative and summative assessments to providing ongoing feedback and evaluating overall learning outcomes, (2) Direct and indirect assessments to measure students' knowledge and skills through practical tasks and self-assessments, (3) Classroom assessment techniques by implementing diverse assessment methods to gauge student performance and learning progress. The EiS-Dt alternative assessment approach ensures that the assessments are constructively aligned with the LOs, providing a holistic evaluation of student competencies. Table 2 shows the alignment of course outcomes, programme outcome, assessment tools and the percentage of mark distribution for ECC589 course.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

Table 2: Constructive Alignment based on Mapping of CO-PO, Taxonomy Leves and Assessment Tools, Percentage of Mark Distribution

No	CO-PO	Taxonomy Level/WP/WK	Assessment Tool	%
1	CO1-PO6	C5-C6/ WP&WK	Case Study	10%
2	CO2-PO8	A4/WK	Presentation	20%
3	CO1-PO6	C5-C6/ WP&WK	Final Report	60%
4	CO2-PO8	A4/WK	Video Montage	10%

Direct Assessment

The four (4) components of the assessment tool used to directly measure the outcomes are case study (10%), final report (60%), presentation (20%), and video montage (10%). Both the case study and the final report are suitable to measure high cognitive levels (C5-C6) to solve complex problems, while presentation and video montage are used to assess the affective domain based on ethics and behaviors (A4). Each tool is accompanied by a specific performance criteria matrix (rubrics) mapped to the learning outcomes, knowledge profile, complex engineering problems, and learning domains. The instructional guidance encapsulates the EiS-Dt components which constitute the course introduction, mapping (course outcomes, programme outcomes, knowledge profiles, and complex problems), specific learning outcomes and tasks, DT process, Sustainable Development Goals (SDG 3: Good Health and Well-being; SDG 4: Quality Education; and SDG 11: Sustainable Cities and Communities), course assessment table, report format, and rubrics for each assessment tool. An example of direct PO attainment for both programme outcomes based on the direct assessment tools used are shown in Figure 7a extracted from myCOPO system while Figure 7b shows the comparison of PO attainment for different semesters for the purpose of monitoring the students' performance.

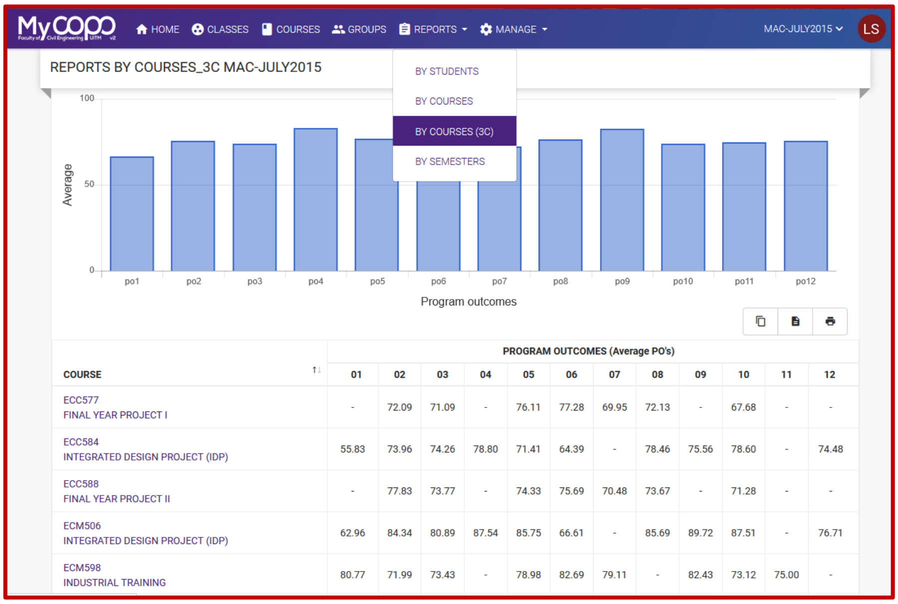


Figure 7a: Students' Performance Extracted from myCOPO System

International Journal of Modern Education
EISSN: 2637-0905
IJMOE
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

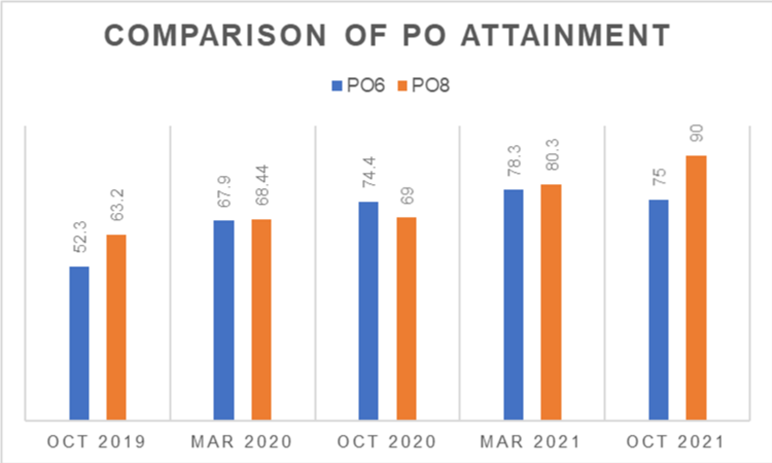


Figure 7b: Comparison of PO Attainment from Various Semesters to Monitor Students' Performance

Indirect Assessment

For indirect attainment, entrance-exit surveys (EES), students' feedback online (SuFO), and facilitator-run surveys support the usefulness of this assessment. An example of entrance-exit surveys is shown in Figure 8 and Table 3.

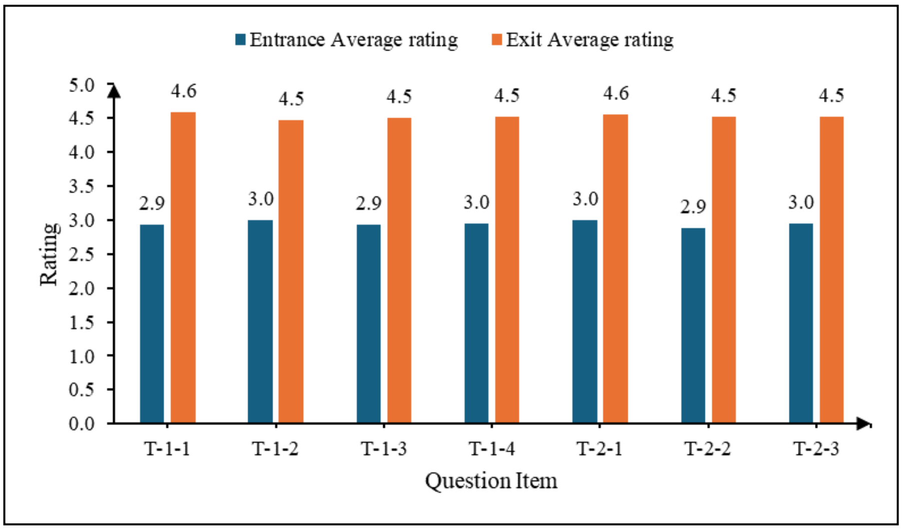


Figure 8: Entrance-Exit Survey (EES) Results of the ECC589 Course for February 2024 Semester

Table 3 shows the items or statement to be responded by the students in the entrance and exit survey to measure the indirect attainment for the course. For LO1, Item T-1-1, there is a significant improvement in understanding and confidence in engaging with the community as a civil engineer, indicating that the course effectively enhances students' practical problem-solving skills in a real-world context. Next, for LO1 Item T-1-2, the substantial increase in ratings suggests that students feel more capable of applying classroom knowledge to community issues, reflecting the course's effectiveness in bridging theoretical knowledge with practical applications. For Item T-1-3, the improvement shows that students gain a clearer understanding of the SULAM initiative and its importance in providing practical learning experiences through community engagement. Next, for Item T-1-4, students' understanding of

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

the broader educational and social goals of SULAM improves, indicating that the course successfully communicates the importance of community engagement in higher education. For Item T-2-1, there is a significant improvement in understanding ethical and professional conduct, suggesting that the course effectively teaches the ethical frameworks and professional standards relevant to civil engineering. Next, for item T-2-2, the increased rating indicates that students feel more confident in adopting ethical and professional behaviours, reflecting the course's success in instilling these values. Finally, for Item T-2-3, the improvement shows that students better understand the broad impacts of engineering activities and the importance of ethical responsibility in engineering practices.

Overall, the graph and question items illustrate a significant improvement in students' knowledge, skills, and attitudes towards community engagement, ethical conduct, and professional responsibilities in civil engineering. The course appears to be highly effective in enhancing students' practical abilities and understanding of their roles as future civil engineers. The consistent improvement across all items suggests a well-rounded and comprehensive educational approach.

Table 3: Entrance-Exit Survey (EES) Ratings with Descriptions to Address the Course Learning Outcomes (CLO)

Course Learning Outcomes (CLO)	Items	Description	Entrance Rating	Exit Rating
LO1	T-1-1	I am able to engage with the community as a prospective civil engineer in solving complex problems involving the civil engineering profession	2.9	4.6
	T-1-2	I am able to contribute to the community by applying knowledge and skills learned in the classroom to help solve local problems	3.0	4.5
	T-1-3	I do understand that the Service-Learning Malaysia University for Society or known as SULAM is an initiative that provides a learning experience by integrating theory and practice to expose students to real-world problem solving in the community	2.9	4.5
	T-1-4	I do understand that SULAM is one of the important agendas in Ministry of Higher Education translated at the university level which can be considered as a noble effort by the university in producing holistic graduates by engaging them in helping the local community.	3.0	4.5
LO2	T-2-1	I understand and comprehend the ethical and professional conduct that guide a civil engineer's professional practice and service to the community	3.0	4.6
	T-2-2	I am able to adopt ethical and professional behavior that guides the professional practice and services of civil engineers to the community	2.9	4.5

Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

	T-2-3	I do comprehend the role of engineering ethics and the professional responsibility of an engineer to public safety; the impacts of engineering activity: economic, social, cultural, environmental and sustainability	3.0	4.5

Conclusion

Constructive alignment in the ECC589 course effectively addresses the EAC Standard 2024 by ensuring a coherent connection between learning outcomes, teaching activities, and assessment tasks. The integration of Sustainable Development Goals (SDGs) and the comprehensive approach to educational domains foster a well-rounded engineering education. By employing diverse pedagogical strategies and robust assessment techniques, ECC589 equips students with the necessary knowledge, skills, and attitudes to excel in their engineering careers and contribute to sustainable development. The study found that the implementation of constructive alignment in ECC589 significantly enhances the attainment of learning outcomes. The integration of flipped learning, collaborative teaching, and community-based projects resulted in higher student engagement and participation. In addition, the use of design thinking and problem-based learning fostered critical thinking and practical problem-solving skills. Students showed a marked improvement in understanding and adopting ethical and professional behaviours, as reflected in the entrance-exit surveys while the course successfully integrated SDGs into the learning outcomes, promoting global sustainability and social responsibility among students. Despite the positive outcomes, the study faced several limitations where the findings are specific to the ECC589 course and may not be generalizable to other engineering courses. The implementation of diverse pedagogical strategies required substantial resources, which may not be feasible for all institutions. The development and operationalization of alternative assessment methods like EiS-Dt faced challenges in ensuring consistency and reliability. The study was conducted during the COVID-19 pandemic, which may have influenced the effectiveness of certain teaching and learning activities. Future research should focus on addressing the limitations identified in this study and exploring new areas for improvement such as to investigate the applicability of constructive alignment across different engineering courses and institutions to enhance generalizability, to develop strategies to optimize resources for implementing diverse pedagogical approaches in resource-constrained environments, to further refine and validate alternative assessment methods to ensure their reliability and consistency across different contexts, to conduct longitudinal studies to assess the long-term impact of constructive alignment on student learning outcomes and career development, to explore the use of advanced technologies, such as AI and digital learning platforms, to enhance the implementation of constructive alignment in engineering education. By addressing these recommendations, future research can contribute to the continuous improvement of engineering education, ensuring that it remains aligned with industry needs and global standards.

Acknowledgement

The authors would like to express their gratitude and thanks to Universiti Teknologi MARA, Pulau Pinang and Shah Alam, for supporting this research.

Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061

References

Abejuela, H. J. M., Castillon, H. T., & Sigod, M. J. G. (2022). Constructive alignment of higher education curricula. Asia Pacific Journal of Social and Behavioral Sciences.

Appiah-Kubi, P., & Annan, E. (2020). A Review of a Collaborative Online International Learning. International Journal of Engineering Pedagogy (iJEP), 10(1). doi:10.3991/IJEP.V10I1.11678.

Bernius, J. P. (2023). Constructive alignment in modern computing education: An open-source computer-based examination system. Technische Universität München.

Booysen, M. J., & Wolff, K. (2022). Exclusion from constructive alignment unmasked by emergency remote teaching. In 9th Research in Engineering Education Symposium (REES 2021) and 32nd Australasian Association for Engineering Education Conference (REES AAEE 2021).

Borrego, M., & Cutler, S. (2010). Constructive alignment of interdisciplinary graduate curriculum in engineering and science: An analysis of successful IGERT proposals. Journal of Engineering Education, 99(4), 355-369. https://doi.org/10.1002/j.2168-9830.2010.tb01068.

Chan, R. Y., & Zhang, Y. (2020). Collaborative Learning in Engineering Students under Social Distancing: An Action Research. Frontiers in Education Conference. doi:10.1109/FIE44824.2020.9274005.

Dagdag, J. D., Palapuz, N. A., Caliboso, J. C., Peru, E. I., & Mauro, R. P. (2024). Stakeholders' awareness and acceptance of the vision, mission, goals, and outcomes statements of a teacher education college. International Journal of Evaluation and Research in Education (IJERE). https://doi.org/10.11591/ijere.v13i1.25395.

Ford, M. A., Graden, B. S., Hawkins, S. R., & Lee, J. E. (2024). Course modality and student outcomes: The mediating role of connection. Journal of Education and Training. https://doi.org/10.5296/jet.v11i1.21399

Kumar, S. S., James, M. B., & Case, J. R. (2022). Engineering design for community impact: Investigating constructive alignment in an innovative service-learning course. Proceedings of the 2022 IEEE Frontiers in Education Conference (FIE).

Lara-Prieto, V., Ruiz-Cantisani, M. I., Membrillo-Hernández, J., Caratozzolo, P., García-García, R., Mejía-Manzano, L. A., & Vázquez-Villegas, P. (2023). The Role of Collaborative Online International Learning (COIL) as a Tool to Meet Engineering Accreditation Student Outcomes. IEEE Global Engineering Education Conference.

Lawrence, J. E. (2023). The application of constructive alignment theory in designing a curriculum unit in information systems. The Education Review, USA.

Linhuber, M., Bernius, J. P., & Krusche, S. (2023). Constructive alignment in modern computing education: An open-source computer-based examination system. Preprint.

Mat Isa, C. M., Lian, O. C., & Pao, L. C. (2022). Design of an innovative assessment instrument integrating SULAM approach for engineers in society course during COVID-19 pandemic. ASEAN Journal of Engineering Education, 6(1).

Md Jani, D. B., Abdul Latif, A., Talib, R. B., & Mohd Is, N. B. (2020). The implementation of constructive alignment at the Teachers Education Institute using Rasch analysis. Malaysian Institute of Teachers Education.

Munir, H. (2023). Doctoral education process and product using constructive alignment in software engineering and computer science. Journal of Teaching and Learning, 4(2), 85-101.

International Journal of Modern Education
IJMOE
EISSN: 2637-0905
Volume 7 Issue 24 (March 2025) PP. 850-866
DOI: 10.35631/IJMOE.724061
Neill, C. J., DeFranco, J. F., & Sangwan, R. S. (2017). Improving collaborative learning in online software engineering education. European Journal of Engineering Education. doi:10.1080/03043797.2016.1203293.

Romanowski, M. H., Alkhateeb, H., & Chaaban, Y. (2023). Problematizing constructive alignment in higher education in Gulf Cooperation Council countries. Teaching in Higher Education.

Salleh, D. N. S. D. A., Lit, A., & Lias, K. (2013). Implementation of constructive alignment approach in Department of Electronic Engineering, Faculty of Engineering, Universiti Malaysia Sarawak. IEEE International Conference on Teaching, Assessment, and Learning for Engineering.

Scott, J. M., Pavlovich, K., Thompson, J. L., & Penaluna, A. (2019). Constructive (mis)alignment in team-based experiential entrepreneurship education. Journal of Education and Training, 61(6), 31-46.

Suherdi, D. (2019). Weaving pearls into necklaces: The significance of constructive alignment in education quality management systems. In EDULEARN19 Proceedings.