2023 Jurnal Kejuruteraan, Teknologi dan Sains Sosial
Volume 9 Issue 1, July 2023, e-ISSN: 27166848

CONSTRUCTIVE ALIGNMENT GUIDELINE IN PREPARING ASSESSMENT FOR TECHNOLOGY PROGRAM

Seri Bunian Mokhtar [1], Mohd Ridhwan Mohammed Redza[2] & Mariah Awang[3]

[1]Politeknik Ungku Omar, Ipoh, Perak
mseribunian@gmail.com
[2]Universiti Teknologi MARA, Terengganu
ridhwanredza@uitm.edu.my
[3]Universiti Tun Hussein Onn Malaysia,Johor
mariah@uthm.edu.my

ARTICLE INFO

Article history:

Article history:
Received
10 May 2023
Received in revised form
11 June 2023
Accepted
12 June 2023
Published online
10 July 2023

***Keywords**:*
ETAC, Technology Program, Guideline, Rubric, Constructive Alignment

ABSTRACT

Accreditation serves to confirm that graduates adhere to the standards established by the Board of Engineers Malaysia (BEM) for engineering technologists. In outcome-based education, the teaching context must be created so that students may master the learning outcome, and each evaluation must be in line with the desired learning outcome (OBE). In order to assist in the process of constructing a rubric that is in line with learning outcomes, the purpose of this article was to develop constructive alignment guideline in preparing assessment for technology program. This study used document analysis to obtain data using a qualitative technique. All information was obtained from public records, such as on-going records of an organization's activities, policy manuals, Engineering Technology Accreditation Council (ETAC) guideline, strategic plans, and previous studies. From the document analysis, maps for all 12 Program Learning Outcome (PLO) and type of assessment were produced. Whilst, all 12 PLOs mapping with SP (Problem Solving) and SK (Knowledge Profiles) also been developed to eased the process of identifying the best SP and SK according to the depth of assessment and requirement by each PLO. Later, the rubrics for each assessment were developed to ensure all tasks given to student were being assessed. Finally, lecturers will have an option to choose the best mapped for their assessments according to the assessment guideline framework that has been developed. As a result, all assessment created by lecturers will aligned with CLOs, PLOs and lastly PEO were measured correctly.

© 2023 Politeknik Ungku Omar | All rights reserved.

1. Introduction

The body of information used in the TVET curriculum has changed as a result of many phases of change in the curriculum's growth. The adjustments are made in response to technology advancements, the Industrial Revolution 4.0, internet usage, and policies developed by institutions of higher learning (IHL). The creation of curricula must align with the standards set by the Engineering Technology Accreditation Council (ETAC), the sole accreditation body recognized in Malaysia for engineering technology bachelor's degrees, engineering diplomas, and engineering technology diplomas. ETAC, which is a division of the Board of Engineers Malaysia (BEM), aims to guarantee that the accredited programs meet the equivalent standards of engineering technology qualifications recognized by the signatories of the Sydney Accord and Dublin Accord. ETAC was established by the Board of Engineers Malaysia (BEM) to ensure the equivalent quality of the accredited engineering technology bachelor's degree, engineering diploma, and engineering technology diploma programs. Since it began offering certification in 2016, ETAC has approved 159 engineering diploma programs, delivered by 14 IHLs in Malaysia, and 50 engineering technology degree programs. Accreditation serves to guarantee that graduates meet the standards established by BEM for engineering technologists. Each assessment offered must be in line with the intended learning objective, and the teaching context must be created so that students may master the learning outcome (Biggs, 2012).

The essential tenet of constructive alignment, according to Biggs (1999), is that an effective teaching system will match its methods of instruction and evaluation with the objectives-stated learning activities so that each element of the system will support the right kind of student learning. In their study, Zhang et al. (2022) found that using a constructive alignment template can greatly increase students' learning effectiveness, offering theoretical and practical references for teaching and learning in scientific courses. Constructive alignment is a term used in the field of Outcome-Based Education (OBE) to describe the design and delivery of education programs. The concept of constructive alignment refers to the alignment of learning outcomes, assessment practices, and teaching methods, with the goal of ensuring that the students are able to achieve the desired learning outcomes.

The basic idea behind constructive alignment is that the educational process should be designed in a way that helps students to attain specific learning outcomes through a combination of instruction, practice, and feedback. To achieve this, teachers and educators must carefully design learning activities and assessments that align with the stated outcomes and provide students with the necessary opportunities to practice and demonstrate their understanding of the material. In practice, constructive alignment involves the following steps:

i. Identifying the desired learning outcomes: This is the first and most important step in the process of constructive alignment. Educators must first determine what they want students to learn, and then translate those outcomes into clear and measurable statements.

ii. Aligning instruction and assessment: Once the learning outcomes have been identified, the next step is to align the instructional methods and assessment practices with those outcomes. This means that the educational activities and assessments should be designed in such a way that they help students achieve the desired outcomes.

© 2023 Politeknik Ungku Omar | All rights reserved.

iii. Using formative assessment: Formative assessment is an ongoing process of evaluation that helps educators to monitor student progress and adjust instruction as needed. In the context of constructive alignment, formative assessment provides opportunities for students to receive feedback and adjust their learning strategies.

iv. Providing opportunities for practice and application: Constructive alignment also involves providing students with opportunities to practice and apply what they have learned in real-world contexts. This helps to reinforce their understanding of the material and enhances the transfer of learning from the classroom to real-life situations.
In conclusion, constructive alignment is a crucial component of Outcome-Based

Education, as it helps to ensure that students are able to attain the desired learning outcomes in an efficient and effective manner. By aligning learning outcomes, assessment practices, and teaching methods, educators can create educational experiences that are tailored to the needs of their students and help them achieve their full potential.

Program Learning Outcome (PLO) refers to the knowledge, skills, and attitudes that students are expected to attain as a result of completing a particular program of study (Biggs & Tang, 2011). PLOs are used to define the expected outcomes of an educational program and provide a clear and measurable framework for assessing student performance. According to Biggs and Tang (2011), PLOs are "statements that describe what students are expected to know and be able to do at the end of a program of study". PLOs are typically developed at the program level and provide a roadmap for the design and delivery of educational programs. PLOs are an important component of Outcome-Based Education (OBE) and are used to align educational programs with the needs and expectations of students, employers, and other stakeholders. By defining clear and measurable PLOs, educators can ensure that their programs are relevant, effective, and meet the needs of their students. Constructive alignment in teaching and learning become vital in OBE curriculum whereby the implementation of OBE must be aligned with 12 Program Learning Outcome (PLO), Course Learning Outcome (CLO) and type of assessment produced. Whilst, all 12 PLOs mapping with SP (Problem Solving) and SK (Knowledge Profiles) also been developed to eased the process of identifying the best SP and SK according to the depth of assessment and requirement by each PLO. However, there were some issue highlighted by previous researchers regarding constructive alignment in OBE curriculum and the mismatch between assessment and program learning outcome as shown in Table 1.

© 2023 Politeknik Ungku Omar | All rights reserved.

Table 1: Issue in developing constructive alignment

Issue	Previous Studies
The importance of learning outcomes	Biggs, (1999); Adam, (2006); Biggs and Tang, (2007); Ali, (2019); Romero, M., & Kalmpourtzis, G. (2020); Noor Al-Huda & Khoo (2013); Rathy et al, (2020); Thian et al. (2018)
Learning outcome mismatch with tasks given	Alfauzan & Tarchouna (2017); Romero & Kalmpourtzis (2020).
A misalignment of learning outcome with teaching and learning approaches	Alfauzan & Tarchouna (2017) ; Abatihun, (2020); Sun & Lee (2020)
Assessment tasks are inadequately distributed to assess the intended knowledge and ability of students expressed in the learning objective	Genon & Torres (2020); Alfauzan & Tarchouna (2017); Abatihun, (2020); Zhang et. Al. (2022);
Constructive alignment was designed to promotes students' deep learning approach	Hailikari, et. al., (2021); Zhang et. Al. (2022); Jasmin, et al. (2018); Stamov Roßnagel, et al. (2021)
Challenge in establishing an OBE system	Gunarathne et al., (2019); Reich et al., (2019); Spady & Marshall, (1991)

Aligning assessment with learning outcomes is an important aspect of ensuring that students are effectively learning what they need to know in a course or program. However, this can be a complex and challenging process, and there are a number of issues that can arise when attempting to align assessment with learning outcomes. One issue is the lack of clear and well-defined learning outcomes. If learning outcomes are not clearly defined and communicated to both instructors and students, it can be difficult to develop assessments that effectively measure these outcomes. Additionally, if learning outcomes are not well defined, it can be difficult to determine what students should be able to know and do by the end of a course or program. Another issue is the lack of alignment between the assessment methods used and the learning outcomes being assessed. For example, if a learning outcome focuses on critical thinking skills, but the assessment only measures factual recall, it may not accurately assess student mastery of the learning outcome. A third issue is the lack of integration between assessment and instruction. In order to effectively align assessment with learning outcomes, it is important that assessments are integrated into the instructional process and used to inform and improve teaching and learning. Finally, there is often a lack of ongoing assessment improvement and revision. In order to effectively align assessment with learning outcomes, it is important to continuously evaluate and improve the assessments used, in order to ensure that they are accurately and effectively measuring student learning.

A recent study by Marzano and Pickering (2017) highlights these and other challenges in aligning assessment with learning outcomes, and provides recommendations for overcoming these challenges. The authors suggest that to effectively align assessment with learning outcomes, it is important to establish a clear and well-defined set of learning outcomes, to align assessment methods with these outcomes, to integrate assessment into the instructional process, and to continuously evaluate and improve assessments. Hence, every program developed by IHL must have a Program Education Outcome to determine the graduate has mastered all knowledge and skills required. The program also needs to be formulated based on the 12 learning outcome

© 2023 Politeknik Ungku Omar | All rights reserved.

programs (PLO) listed by the Sydney Accord. The Sydney Accord is an international agreement between engineering accreditation bodies that was established in 2001. It provides a framework for the recognition of engineering qualifications across different countries, and is aimed at promoting the mobility of engineers and facilitating their international recognition.

The Sydney Accord is one of the five mutual recognition agreements developed by the International Engineering Alliance (IEA), and it is specifically focused on the recognition of engineering qualifications in the field of electrical and electronic engineering. The Accord sets standards for engineering education and accreditation, and provides a mechanism for the mutual recognition of engineering qualifications between countries that are signatories to the Accord. The main objectives of the Sydney Accord are to:

i. Promote the mobility of engineers between countries
ii. Facilitate the international recognition of engineering qualifications
iii. Encourage the harmonization of engineering education and accreditation standards
iv. Ensure the quality and comparability of engineering education programs

To become a signatory to the Sydney Accord, an engineering accreditation body must meet certain criteria and demonstrate that it has the necessary systems and processes in place to ensure the quality and comparability of its engineering education programs. Once a country becomes a signatory, its engineering qualifications are recognized by other signatory countries, making it easier for engineers to work and study abroad. The Sydney Accord has been widely adopted by engineering accreditation bodies around the world, and is considered an important step towards promoting the mobility and recognition of engineers in a global context. By providing a common framework for the recognition of engineering qualifications, the Accord helps to ensure that engineers have the skills and knowledge they need to meet the challenges of an increasingly interconnected world. Engineering technology graduates need to master the 12 PLOs. The intended PLO is as follows (Figure 1).

© 2023 Politeknik Ungku Omar | All rights reserved.

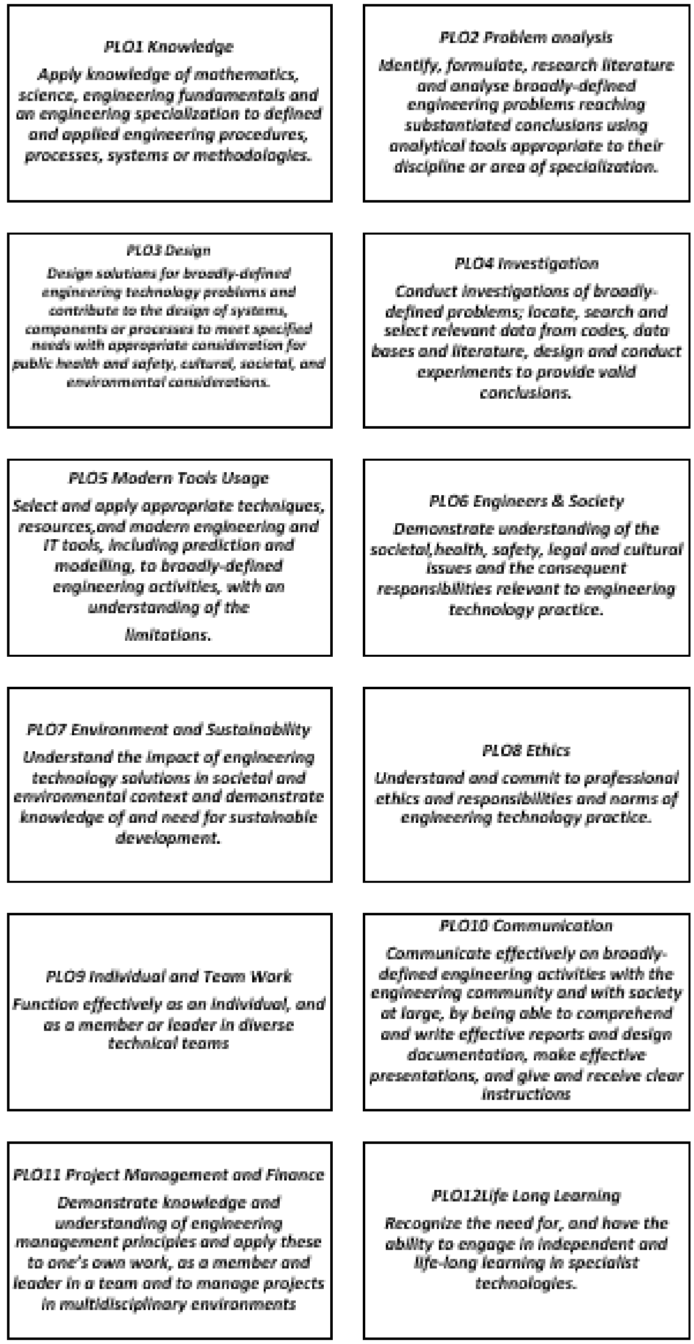

Figure 1: Program Learning Outcome

(Source: Engineering Technology Programme Accreditation Standard 2019)

© 2023 Politeknik Ungku Omar | All rights reserved.

Whilst, Figure 2 shows how constructive alignment in curriculum whereby all rubrics and assessment given to students reflected back to PEO.

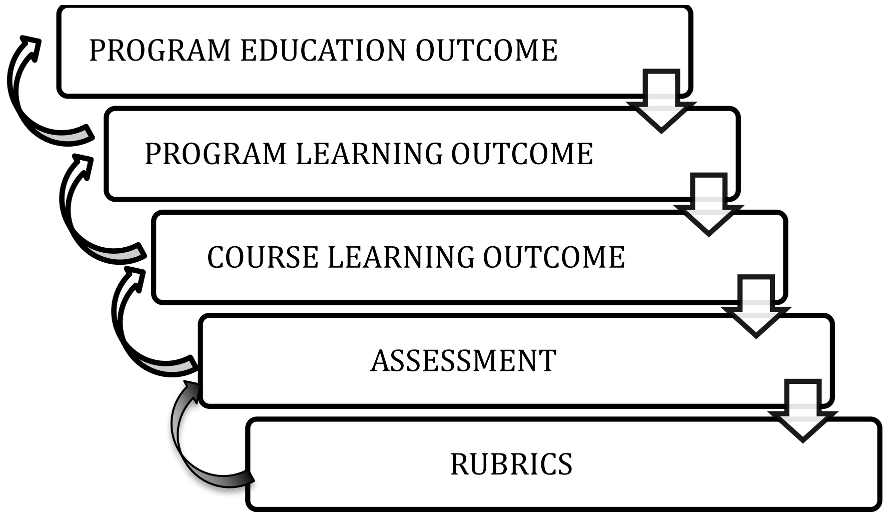

Figure 2: Constructive Alignment in Curriculum

Each program contained courses that will be offered to students. Each course offered must have a course learning outcome (CLO) for students to master. The planned CLO should be mapped with 12 PLOs designed under ETAC standard. Each CLO needs to be assessed to determine the graduate's achievement. Past studies have found that assessment needs to be done constructively aligned with CLO and PLO. PLO needs to map with knowledge profile (SK/DK) and problem solving (SP/DP). Table 2 shows 8 Knowledge Profile (SK/DK), 7 Problem Solving (SP/DP) & 5 Engineering Activities (NA/TA).

Table 2 Knowledge Profile (SK/DK), Problem Solving (SP/DP) & Engineering Activities (NA/TA)

Knowledge Profile (SK/DK)	**Problem Solving (SP/DP).**	**Engineering Activities (NA/TA)**
SK1-Natural sciences	SP1-Depth of knowledge required	TA1-Range of resources
SK2-Mathematics	SP2-Range of conflicting requirements	TA2-Level of interactions
SK3-Engineering fundamentals	SP3-Depth of analysis required	TA3-Innovation
SK4-Specialist Knowledge	SP4-Familiarity of issues	TA4-Consequences to society and the environment
SK5-Engineering Design	SP5-Extent of applicable codes	TA5-Familiarity of issues
SK6-Engineering Practice	SP6-Extent of stakeholder involvement & conflicting requirements	-
SK7-Comprehension	SP7-Interdependence	-
SK9-Research literature	-	-

© 2023 Politeknik Ungku Omar | All rights reserved.

Therefore, this paper aims to develop constructive alignment guideline in preparing assessment for technology program in assisting of rubric developing process that in line with learning outcome. All 12 PLOs under ETAC with knowledge profile (SK/DK) and problem solving (SP/DP) were mapped in order to create assessment rubrics for every PLOs.

2. Method

This study employs a qualitative methodology and document analysis. Comparative to quantitative research, qualitative studies use distinct types of data. Documents analysis is a widely used qualitative research method that involves the systematic examination and interpretation of written, visual, or audio material. This method can be used to gather data on a wide range of topics, including organizational processes, policies, and practices; cultural norms and beliefs; and historical events. According to Morse (1994), "document analysis is a social research method for studying written and printed texts that are relevant to the researcher's research questions. Morse goes on to explain that document analysis can involve the examination of a range of materials, including books, reports, memos, letters, journals, manuscripts, newspaper articles, government reports, organizational records, personal papers, audio-visual materials, and electronic data. In conducting document analysis, researchers often follow a systematic process, including: (1) selecting the documents to be analysed, (2) coding and categorizing the data, (3) identifying patterns and themes within the data, and (4) interpreting the findings in relation to the research questions. One of the strengths of document analysis is that it allows researchers to access a rich source of historical and contemporary data that may not be available through other methods, such as interviews or observation. Document analysis can also be less time-consuming and less expensive than other qualitative research methods, as the materials being analysed are often readily available and do not require the researcher to actively engage with participants. In conclusion, document analysis is a valuable qualitative research method that provides researchers with access to a rich source of data for understanding complex social and cultural phenomena.

A range of sources, including observations, interviews, and results from printed materials, can be used to gather data (Patton, 1990). Meanwhile, observations, interviews, and document analysis were the methods employed to collect data (Kamarul Azmi, 2012). Document analysis is a type of qualitative research in which the researcher interprets materials to give context and meaning to a topic under review (Bowen, 2009). Document analysis is a small part of the process of gathering information from written or spoken texts in order to conduct research. Information pertinent to the study's goals was gathered using this manner. Document sources inclusive of curriculum, syllabus, guidelines, circulars, minutes of meetings and many more. In this study, the documents analyzed are the curriculum documents of the Engineering Technology Program, Program Structure, ETAC standards as well as previous studies related to course assessment. Prior to conducting the analysis, O'Leary (2014) emphasized several steps in the planning process to be considered, including creating a list of texts to examine, addressing any linguistic or cultural barriers in accessing the texts, acknowledging and overcoming personal biases, acquiring relevant research skills, implementing strategies to maintain credibility, being aware of the desired data, and addressing ethical considerations. Figure 3 shows the research framework for this study.

© 2023 Politeknik Ungku Omar | All rights reserved.

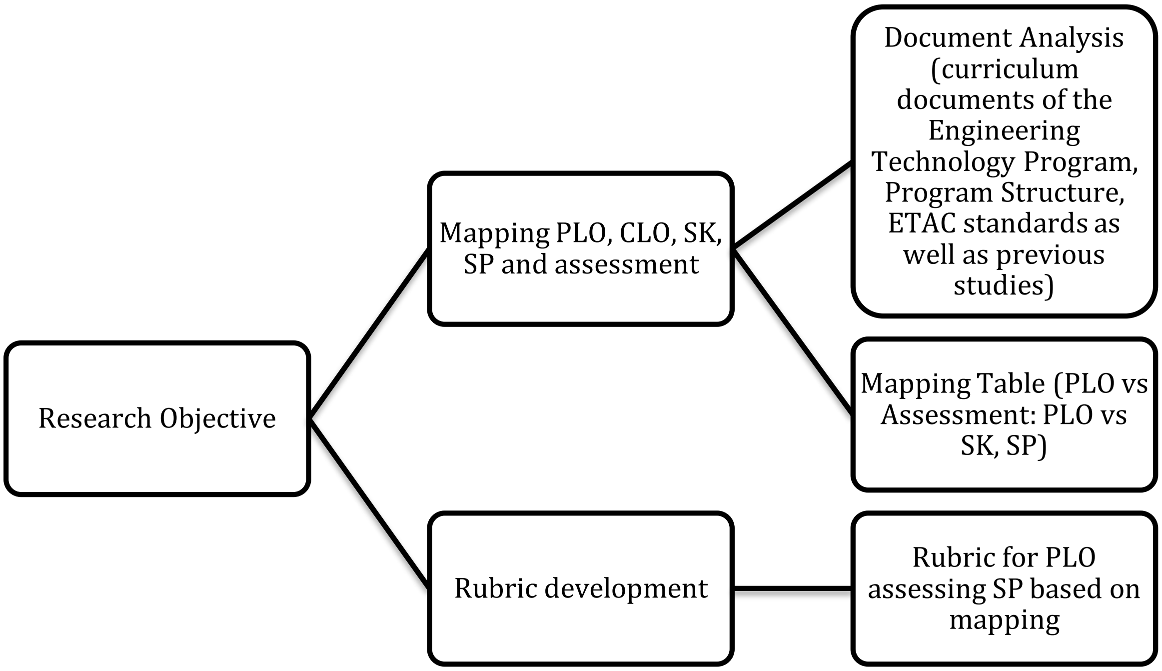

Figure 3: Research Framework

3. Result

The following section presents the results of a study that aimed to develop constructive alignment guideline in preparing assessment for technology program in assisting of rubric developing process that in line with learning outcome. After conducting a thorough review of existing literature and best practices in technology program assessment and rubric development, a draft assessment guideline was developed as it provided a clear and structured approach to aligning assessment practices with learning outcomes. Based on the analysis, the assessment constructive alignment guideline was refined and finalized. The final guideline consisted of five key components: (1) program learning outcome (PLO) identification and type of assessments, (2) PLO mapping with SP (Problem Solving) and SK (Knowledge Profiles), (3) PLO mapping with TA (Engineering Activities), (4) summary of PLOs, SPs and SKs Mapping, and (5) rubrics. Table 3 shows all 12 PLO and type of assessment suitable to assess the student competency in term of problem-solving skills and knowledge acquisition for each PLO. As for example, for PLO 1 (Knowledge), student attainment can be assessed using test, quiz and final examination whilst PLO5 (Modern Tools) can be assessed using Mini Project, Lab Report, Project Presentation and Capstone Project. Assessment is very important in determining student achievement as well as a key indicator of curriculum success. The developed curriculum should be able to be thought by the teaching staff and able to achieve the learning objectives by execution of assessment given to students.

Table 4 shows all 12 PLOs mapping with SP (Problem Solving) and SK (Knowledge Profiles). Each PLO has its owned mapping toward SP and SK according to the depth of assessment and requirement by each PLO. For example, PLO 1 (Knowledge) were mapped with 3 SP namely SP1, SP2 and SP3. PLO1 also were mapped with SP1, SP4 and SP5. Therefore, lecturers will have an

© 2023 Politeknik Ungku Omar | All rights reserved.

option to choose the best mapped for their assessments. Later all assessment created by lecturers will aligned with this mapping to ensure all PLOs were measured correctly.

Table 3: PLO Vs Assessment

No	***Program learning Outcome***	**SK/TA**	**SP**	**ASSESSMENT**
1	**PO1 -Engineering Knowledge**	SK1-SK4	SP1 and some or all of SP2 to SP7:	TEST, EXAM , QUIZ
2	**PO2 – Problem Analysis**	SK1-SK4	SP1 and some or all of SP2 to SP7:	TEST, EXAM, QUIZ, CASE STUDY, TUTORIAL
3	**PO3 -Design/Development of Solutions**	SK5	SP1 and some or all of SP2 to SP7:	TEST, EXAM, QUIZ, CASE STUDY, MINI PROJECT, CAPTONE PROJECT
4	**PO4 -Investigation**	SK8	SP1 and some or all of SP2 to SP7:	CASE STUDY, MINI PROJECT, LAB REPORT, SITE VISIT
5	**PO5 – Modern Tool Usage**	SK6	SP1 and some or all of SP2 to SP7:	MINI PROJECT, LAB REPORT, PROJECT PRESENTATION, CAPTONE PROJECT
6	**PO6 – The Engineer and Society**	SK7	SP1 and some or all of SP2 to SP7:	CASE STUDY, MINI PROJECT, SITE VISIT, PRESENTATION, APPRAISAL, REFLECTIVE JURNAL, CAPTONE PROJECT
7	**PO7 -Environment and Sustainability**	SK7	SP1 and some or all of SP2 to SP7	CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT
8	**PO8 – Ethics**	SK7		CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT
9	**PO9 - Individual and Team work**			CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT
10	**PO10 - Communication**	TA1-TA5 (ANY 1 OR MORE)		CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT
11	PO11 - Project Management and Finance			CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL. PRESENTATION, CAPTONE PROJECT
12	PO12 - Lifelong learning			CASE STUDY, MINI PROJECT, SITE VISIT, APPRAISAL, REFLECTIVE JURNAL, PRESENTATION, CAPTONE PROJECT

© 2023 Politeknik Ungku Omar | All rights reserved.

Table 4: PLO vs SK and SP

PO	**SP1**								**SP2**	**SP3**	**SP4**	**SP5**	**SP6**	**SP7**	**Assessment**
	SK1	**SK2**	**SK3**	**SK4**	**SK5**	**SK6**	**SK7**	**SK8**							
PO1 -Engineering Knowledge	X	X	X	X					X	X					DIRECT FORMATIVE SUMMATIVE (SEM 1-3)
PO1 -Engineering Knowledge	X	X	X	X							X	X			DIRECT FORMATIVE SUMMATIVE (SEM 4-5)
PO1 -Engineering Knowledge	X	X	X	X									X	X	DIRECT FORMATIVE SUMMATIVE (SEM 6-8)
PO2 – Problem Analysis	X	X	X	X					X	X					DIRECT FORMATIVE SUMMATIVE (SEM 1-3)
PO2 – Problem Analysis	X	X	X	X							X	X			DIRECT FORMATIVE SUMMATIVE (SEM 4-5)
PO2 – Problem Analysis	X	X	X	X									X	X	DIRECT FORMATIVE SUMMATIVE (SEM 6-8)
PO3 -Design/Development of Solutions	X	X	X	X	X						X	X			DIRECT FORMATIVE SUMMATIVE
PO4 -Investigation				X				X				X	X		DIRECT FORMATIVE SUMMATIVE
PO5 – Modern Tool Usage				X		X					X	X			DIRECT FORMATIVE SUMMATIVE
PO6 – The Engineer and Society						X	X						X	X	DIRECT FORMATIVE SUMMATIVE
PO7 -Environment and Sustainability				X			X		X	X					DIRECT FORMATIVE SUMMATIVE
PO8 – Ethics							X								DIRECT FORMATIVE SUMMATIVE

© 2023 Politeknik Ungku Omar | All rights reserved.

Table 5 show mapping of PLO without SP/SK but has engineering activities (TA). Out of 4 PLOs, only PLO10 has TA as shown in table 4. Whilst, Figure 4 show the summary of PLOs, SPs and SKs Mapping to ease lecturer understanding on selecting the perfect match in developing assessment and rubrics.

Table 5: PLO vs TA

PO	**TA1**	**TA2**	**TA3**	**TA4**	**TA5**	
PO9 - Individual and Team work						
PO10 - Communication	X	X	X	X	X	Written Report, prototype, drawing, modelling Verbal Presentation, viva *Rubric need to be design according to TA1-TA5 depend on type of assessment taken.*
PO11 - Project Management and Finance						
PO12 - Lifelong learning						

© 2023 Politeknik Ungku Omar | All rights reserved.

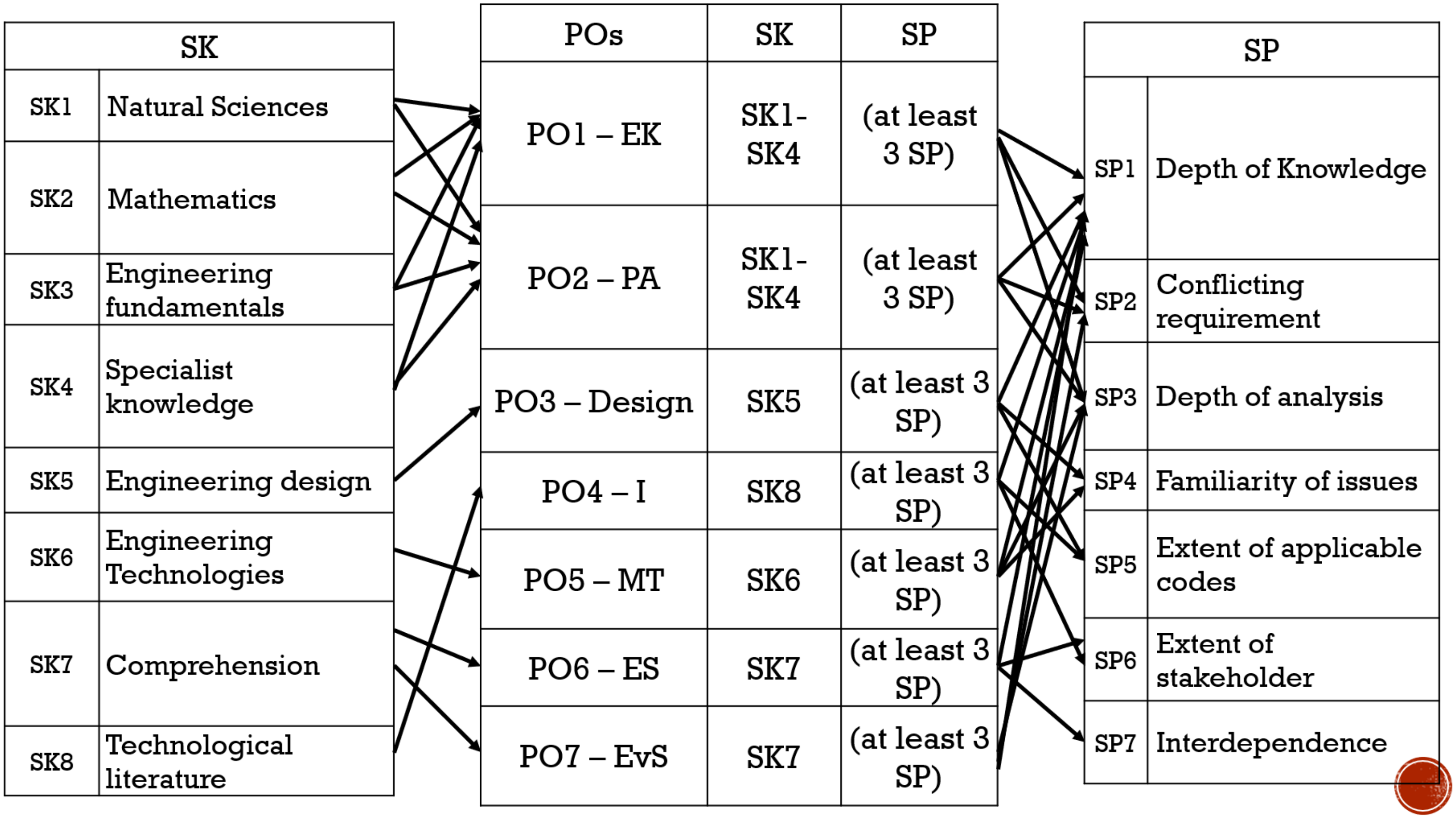

Figure 4: Summary of PLOs, SPs and SKs Mapping

© 2023 Politeknik Ungku Omar | All rights reserved.

Table 6 show scoring rubric for the intended PLO to assess a case study for designated course. Case study under this designated course were mapped with PLO5. Therefore, according to Table 4 and Table 6, PLO5 were mapped with SP1, SP4 and SP5. Keep also in mind that PLO5 was compulsory mapped with SK6 (engineering technologies). Using the same method, rubrics for all PLOs has been developed and implemented for all courses for technology program. Therefore, each rubric was match with assessment given to student whereby each assessment tally with the intended course learning outcome. Whilst, the CLO was mapped with designated PLO and the PLO was mapped with PEO, meaning that the constructive alignment for the intended learning outcome was achieved.

Table 6: Example of Rubric for PLO5

PO5

SP	Characteristic	Rubrics Design KNOWLEDGE	Task	1	2	3	4	5
SP1	Depth of Knowledge	Analyze the problem using specified knowledge profile	Task 2-3	Ability to Identify a building and analysis the building services system issue and problem.				
				Student able to analyze the problem using 1 specified knowledge profile	Student able to analyze the problem using 2 specified knowledge profile with some elaboration	Student able to analyze the problem using 3 specified knowledge profile with acceptable elaboration	Student able to analyze the problem using 3 specified knowledge profile with good elaboration	Student able to analyze the problem using 3 specified knowledge profile with excellent elaboration
		Evaluate the problem under such circumstance towards providing an effective solution		Ability to Evaluate the building servises system problem under such circumstance towards providing an effective solution				
				Evaluate 1 circumstance only	Evaluate 2 circumstances with acceptable justification	Evaluate 3 circumstances with acceptable justification	Evaluate 3 circumstances with with good justification	Evaluate >3 circumstances with with good justification
SP4	Familiarity of issues	Differentiate the infrequently encountered issues in problem solving	Task 4-5	Ability to Differentiate the infrequently encountered issues regarding building services system in problem solving				
				Compare the basis.	Compare and differentiate 2 issues	Differentiate 2 issues and propose	3	>3

© 2023 Politeknik Ungku Omar | All rights reserved.

SP	Characteristic	Rubrics Design KNOWLEDGE	Task	1	2	3	4	5
		Select formulae/procedures to resolve the infrequently encountered issues		Ability to Select formulae/procedures to resolve the infrequently encountered issues of building services using latest technology				
				Select an approach to resolve.	Select 2 approaches to resolve	Select 2 approaches to resolve and justify	3	>3
SP5	Extent of applicable codes	Develop solution using standards and codes of practice for professional engineering	Task 6-7	Ability to Develop solution using standards and codes of practice for professional engineering and **assemble 3D** (SK6) model simulation of selected housing plan to accommodate the problem arise				
				Use at least 1	Use at least 2	Use at least 2 and include practicing guide	3	>3
		Justify professional engineering experiences to resolve the problem solving		Ability to Justify professional engineering experiences to resolve the problem solving in the making of 3D model simulation				
				Justify using at least 1 experience	Justify using at least 2 experiences	Justify using 2 experiences and select at least 1	3	>3

© 2023 Politeknik Ungku Omar | All rights reserved.

4. Conclusions

This study has developed constructive alignment guideline in preparing assessment for technology program in assisting of rubric developing process that in line with learning outcome. This research applied qualitative approach for data collection using document analysis. All data were gathered through public records such as ongoing records of an organization's activities, policy manuals, ETAC guideline, strategic plans, and previous studies. The finding from all information gathered enable to produce 1) guideline for 12 PLOs and type of assessment suitable to assess the student competency in term of problem-solving skills and knowledge acquisition for each PLO, 2) guideline for 12 PLOs mapping with SP (Problem Solving) and SK (Knowledge Profiles) whereby each PLO has its owned mapping toward SP and SK according to the depth of assessment and requirement by each PLO, 3) a mapping of PLO without SP/SK but has engineering activities (TA), and 4) scoring rubric for all the intended PLOs to assess an assessment for designated course. All of this assessment guideline was developed to ensure the constructive alignment of each designated course are achieved by following the guided template.

Constructive alignment plays a crucial role in student assessment as it provides a framework for designing and implementing assessment practices that are aligned with the learning outcomes. In the context of constructive alignment, assessment is not just a measure of student performance, but also an integral part of the learning process. When assessments are aligned with the learning outcomes, they help students to focus on the most important concepts and skills, and provide them with feedback on their progress. This, in turn, enables students to adjust their learning strategies and improve their overall performance. In order to align assessments with the learning outcomes, the following steps are typically followed:

i. Defining clear and measurable assessment criteria: The assessment criteria should be based on the learning outcomes and should reflect the key knowledge, skills, and attitudes that students are expected to attain.
ii. Designing assessments that are relevant and authentic: Assessments should be designed in a way that is relevant to real-world situations and allows students to demonstrate their understanding of the material in an authentic context.
iii. Providing opportunities for formative assessment: Formative assessment provides students with feedback on their performance and allows them to adjust their learning strategies. In the context of constructive alignment, formative assessments should be integrated into the learning process and provide opportunities for students to demonstrate their understanding of the material.
iv. Evaluating student performance in a fair and reliable manner: The assessment process should be designed in a way that ensures fairness and reliability, and provides students with an accurate picture of their performance.

By integrating assessment into the learning process, constructive alignment helps to create a more meaningful and effective educational experience for students. It also enables educators to monitor student progress and adjust the instructional methods as needed, with the goal of ensuring that all students are able to attain the desired learning outcomes.

Effective assessments that align with constructive alignment can enhance student performance and reflect the Program Learning Outcomes (PLOs) and Course Learning Outcomes (CLOs) of the course. The mapping carried out in this study provides a clear guideline for creating improved scoring rubrics that align with the PLOs. The assessment of each PLO will be based on the mapped knowledge and skills, thereby elevating student achievement and motivating them to focus on their learning activities. This approach serves as a useful guideline for instructors to design assessments that align with the intended PLOs.

© 2023 Politeknik Ungku Omar | All rights reserved.

References

Abatihun, A. S. (2020). Learning Objective and Assessment Linkage: Its Contribution to Meaningful Students Learning. *Universal Journal of Educational Research*, 8(11), 5044-5052. DOI: 10.13189/ujer.2020.081104.

Adam, S., (2006). An introduction to learning outcomes: EUA Bologna Handbook. European University Association, Article B2.3-1.Berlin: Raabe.

Alfauzan, A. A., & Tarchouna, N. (2017). The Role of an Aligned Curriculum Design in the Achievement of Learning Outcomes. *Journal of Education and E-Learning Research*, *4*(3), 81–91. https://doi.org/10.20448/journal.509.2017.43.81.91

Ali, L. (2019). The Design of Curriculum, Assessment and Evaluation in Higher Education with Constructive Alignment. *Journal of Education and E-Learning Research*, *5*(1), 72–78. https://doi.org/10.20448/journal.509.2018.51.72.78

Biggs, J. (2012). Enhancing learning through constructive alignment. In J. R. Kirby & M. J. Lawson (Eds.), *Enhancing the quality of learning: Dispositions, instruction, and learning processes* (117–136) https://doi.org/10.1017/CBO9781139048224.009

Biggs, J., & Tang, C. (2011). Teaching for quality learning at university (4th ed.). Maidenhead, England: Open University Press.

Biggs, J.B. & C. Tang, 2007. Teaching for quality learning at university. 3rd Edn., Maidenhead: McGraw Hill Education & Open University Press.

Biggs, J.B., 1999. What the student does: Teaching for enhanced learning. Higher Education Research & Development, 18(1): 1-19.

Bowen, G. A. (2009). Document analysis as a qualitative research method. Qualitative Research Journal, 9(2), 27-40. doi:10.3316/QRJ0902027
CA: Sage Publications, Inc.Graduate Attributes and Professional Competencies. Version 3: 21 June 2013

Engineering Technology Programme Accreditation Standard 2019

Genon, L. J. D.& Torres, C. B.P.(2020).Constructive Alignment of Assessment Practices in English Language Classrooms *English Language Teaching Educational Journal*, 3(3), 211-228 .

Gunarathne, N., Senaratne, S., & Senanayake, S. (2019). Outcome-based education in accounting. *Journal of Economic and Administrative Sciences*, 36(1), 16-37. https://doi:10.1108/jeas-08-2018-0093

Hailikari, T., Virtanen, V., Vesalainen, M., & Postareff, L. (2021). Student perspectives on how different elements of constructive alignment support active learning. Active Learning in Higher Education. https://doi.org/10.1177/1469787421989160

Jasmin, L., Alexander, R., Matthias, N. & Kristin, W. (2018). When the type of assessment counteracts teaching for understanding, Learning: *Research and Practice*, 4:2, 161-179, DOI: 10.1080/23735082.2017.1285422

Kamarul Azmi, J. (2012). Metodologi Pengumpulan Data dalam Penyelidikan Kualitatitif. 1-15.

Marzano, R. J., & Pickering, D. J. (2017). Classroom assessment and grading that work. ASCD.

Morse, J. M. (1994). Designing funded qualitative research. Sage Publications, Inc.

Noor Al-Huda, A. K. & Khoo Y. Y. (2013). Outcome-Based Education: An approach for teaching and learning development. *Journal of Research, Policy & Practice of Teachers & Teacher Education*, 3(1), 26-35.

© 2023 Politeknik Ungku Omar | All rights reserved.

O'Leary, Z. (2014). The essential guide to doing your research project (2nd ed.). Thousand Oaks, CA: SAGE Publications, Inc.

Patton, M. Q. (1990). Qualitative Evaluation and Research Methods (2nd ed.). Newbury Park,

Rathy G.A., Sivasankar P & Gnanasambandhan T.G.,(2020). Developing a knowledge structure using Outcome based Education in Power Electronics Engineering, *Procedia Computer Science*,172,1026-1032.

Reich, A. Z., Collins, G. R., DeFranco, A. L., & Pieper, S. L. (2019a). A recommended closed-loop assessment of learning outcomes process for hospitality programs. *International Hospitality Review*, 33(1), 41-52. https://doi:10.1108/ihr-09-2018-0010

Romero, M., & Kalmpourtzis, G. (2020). Constructive Alignment in Game Design for Learning Activities in Higher Education. *Information*, *11*(3), 126. Retrieved from http://dx.doi.org/10.3390/info11030126

Spady, W. G., & Marshall, K. J. (1991). Beyond traditional outcome-based education. *Educational Leadership*, 49(2), 67-72.

Stamov Roßnagel, C., Lo Baido, K., & Fitzallen, N. (2021). Revisiting the relationship between constructive alignment and learning approaches: A perceived alignment perspective. *PloS one*, *16*(8), e0253949. https://doi.org/10.1371/journal.pone.0253949

Sun, P. H., & Lee, S. Y. (2020). The importance and challenges of outcome-based education – a case study in a private higher education institution. *Malaysian Journal of Learning and Instruction*, 17(2), 253-278.https://doi.org/10.32890/mjli2020.17.2.9

Thian, L. B., Ng, F. P., & Ewe, J. A. (2018). Constructive alignment of graduate capabilities: Insights from implementation at a private university in Malaysia. *Malaysian Journal of Learning and Instruction*, 15(2), 111-142.

Zhang, H., Su, S., Zeng, Y. & Lam, J.F.I.(2022). An Experimental Study on the Effectiveness of Students' Learning in Scientific Courses through Constructive Alignment-A Case Study from an MIS Course. *Education Science,* 12(338), 1-15. https:// doi.org/10.3390/educsci12050338

© 2023 Politeknik Ungku Omar | All rights reserved.