Positive perceptions and improved engineering undergraduate course design following a staff development session on constructive alignment

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Abstract

External peer evaluation on the BSc Engineering programme offered by the Faculty of Engineering of Kotelawala Defence University highlighted the requirement for successful application of "Constructive Alignment" (CA) in developing the study modules through establishing Learning Outcomes (LOs), designing Teaching Learning Activities (TLAs) and conducting Assessment Tasks (ATs). Due to lack of awareness and/ or skill on using the CA concept, staff encountered difficulty in coherently developing LOs, TLAs and ATs, experiencing further difficulties in achieving all module LOs and subsequent Programme Outcomes (POs). We wanted to explore whether training of faculty staff on "Constructive Alignment" would enhance the perception of the staff on applying the concept for effective curriculum development. Initially the concept of "Constructive Alignment" was explained with the aid of a handout and a module descriptor using the "tell-show-do" strategy during the faculty curriculum development committee meeting. A total of 30 committee members were then grouped according to their specialization. Each group was requested to revisit and ensure that the respective module descriptors were constructively aligned by making appropriate amendments. Subsequently, amended module descriptors were shared among the groups and subjected to provide feedback in order to improve further. At the end of the session, committee members were asked to submit their feedback on the task completed. It was observed that 60% of the committee members were initially not aware of Constructive Alignment. Furthermore, 90% of the members expressed positive feedback regarding the task. Further, they had gained satisfactory insights to this concept, as revealed by their feedback. On a subsequent evaluation, external examiners expressed their satisfaction on amended module descriptors. The study showed that specific training activities, such as on Constructive Alignment, can be successfully used to enhance the positive perception of staff and their effectiveness in applying it for effective curriculum development.

Background

External peer evaluation is a key aspect applied for upgrading and maintaining the quality and relevance of an academic programme. This has been given high priority by the Institution of Engineers Sri Lanka, the national apex body of the Engineering profession, by emphasizing this aspect as one of the main quality assurance procedures of fully-fledged Engineering degree programmes offered in Sri Lanka (IESL, 2019). Faculty of Engineering of the General Sir John Kotelawala Defence University (KDU) produces Engineering graduates mainly for the Sri Lankan armed forces. The BSc Engineering programme offered by KDU is subjected to external peer evaluation on a regular basis as a continuous quality improvement (CQI) strategy. During this process, the requirement of successful application of the concept Constructive Alignment (CA) was highlighted in developing the study modules through establishing Intended Learning Outcomes (ILOs), designing Teaching Learning Activities (TLAs)

and conducting Assessment Tasks (ATs). Due to lack of awareness and/ or skill on using the concept, staff encountered difficulty in coherently developing ILOs, TLAs and ATs, experiencing further difficulties in achieving all module ILOs and subsequent Programme Outcomes (POs). Hence, it was explored whether training of faculty staff on Constructive Alignment would enhance the perception of the staff in applying the concept for effective curriculum development.

The term "Constructive" emerges from the constructivist theory that learners use their activities to construct their own knowledge whereas "Alignment" is a principle in the curriculum theory that emphasises TLAs and ATs to be aligned to what is intended to be learned (Biggs & Tang, 2011). According to Biggs and Tang (2011), Constructive Alignment refers to the establishment of systematic alignment among ILOs, TLAs and ATs in an academic programme. It is further elaborated by stating that in CA, connections between ILOs, TLAs and ATs are aligned intrinsically (Biggs & Tang, 2011). Figure 1 illustrates the general framework for CA.

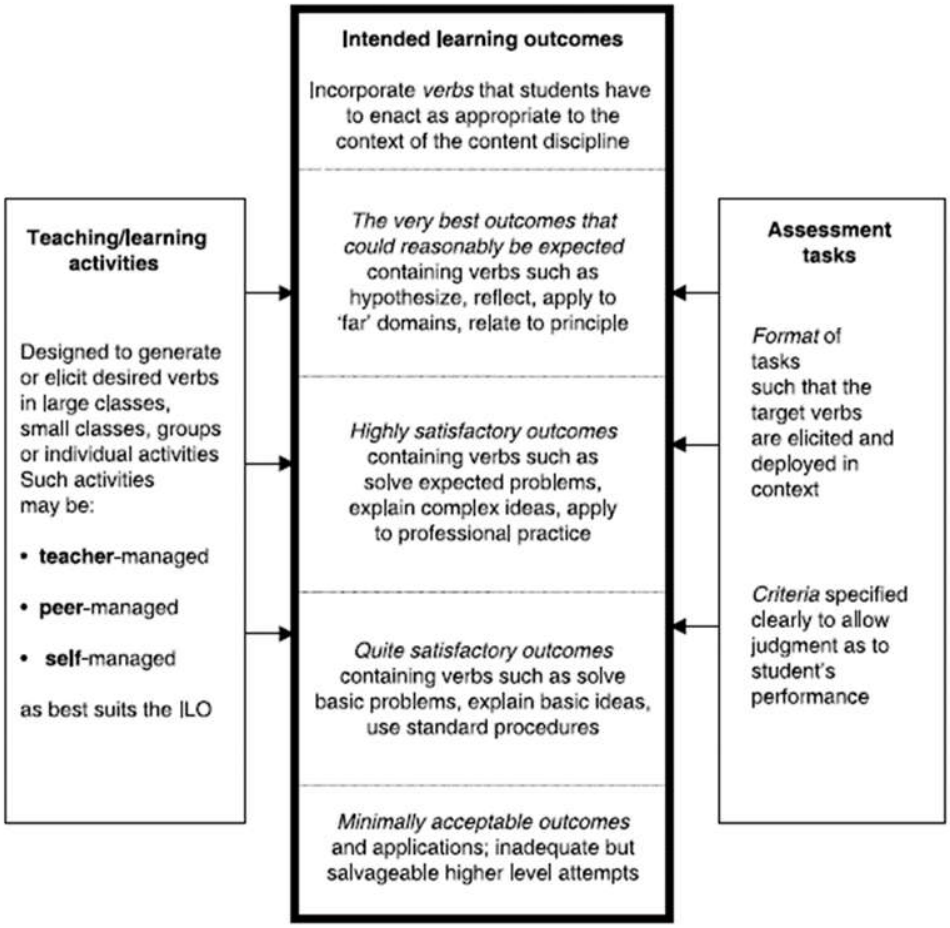

Figure 1. General framework for constructive alignment (Biggs & Tang, 2011, p. 105)

CA establishes a conceptual framework for reflecting on the following questions that need to

be answered at the key stages of teaching (Biggs & Tang, 2011): *What do I want my students to learn? What is the best way in my circumstances and within available resources of getting them to learn it? How can I know when or how well they have learned it?* CA moves one step further than most outcome-based approaches, enabling students to achieve learning outcomes more effectively (Biggs & Tang, 2011).

Methodology

In the training session, the concept of Constructive Alignment was initially explained with the aid of a handout and a sample module descriptor using the "tell-show-do" strategy during the faculty curriculum development committee meeting. A total of 30 committee members were then grouped according to their specialization as shown in Table 1.

Table 1. Grouping of committee members

Group No.	Field of Specialization	No. of committee members
1	Aeronautical/Aircraft Maintenance Engineering	04
2	Biomedical Engineering	03
3	Civil Engineering	05
4	Electrical Engineering	05
5	Electronic and Telecommunication Engineering	05
6	Marine Engineering	03
7	Mechanical/ Mechatronic Engineering	05
Total	Total	30

Figure 2. Training session in progress at Faculty curriculum revision committee meeting

First, each group was requested to revisit and ensure that the respective module descriptors were constructively aligned by making appropriate amendments. Subsequently, amended module descriptors were shared among the groups who were required to provide feedback in order to improve further. Furthermore, the process of mapping between ILOs and POs for a given module was explained to the committee in detail using a sample mapping matrix as illustrated in Table 2.

Table 2. The sample mapping matrix used to explain mapping of module LOs and POs

ILO #	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
LO1	H	M	H	M	M	M	L	L	M	M	L	M
LO2	H	M	H	M	M	M	L	L	M	M	L	M
LO3	H	M	H	M	M	M	M	M	H	H	M	M
LO4	H	M	H	M	H	M	M	M	H	H	M	M
Module	H	M	H	M	M	M	M	L	M	H	M	M

Emphasis that a LO placed on a PO was rated as: H (High), M (Moderate), L (Low) or Empty (None)

Then, the groups were requested to carry out this task and come up with relevant mapping matrices for their respective modules in the curriculum. Active discussions took place (Figure 2) and at the end of the session, participants were asked to submit feedback on aspects related to the training session using a structured 5-step Likert-scale questionnaire.

Results

The analysis of responses from the 5-step Likert-scale (soaring of responses was recorded as 1-strongly disagree to 5 - strongly agree) questionnaire is shown in Table 3.

Table 3. Analysis of questionnaire responses

#	Statement	Distribution of scores					Mean score
		1	2	3	4	5	
1	I am familiar with Bloom's taxonomy and able to set LOs with appropriate action verbs	2	5	6	9	8	3.53
2	Before attending the session, I had been aware of the concept CA	10	8	3	5	4	2.50
3	I am self-motivated to use CA for my teaching in future	2	1	0	13	14	4.20
4	I am in a position to establish a link between LOs and POs in the form of a mapping matrix	2	3	12	10	3	3.30

The analysis showed that most lecturers had been able to set LOs in their respective modules but were not aware of the concept of CA which may have hindered the quality of teaching and learning. However, they recognized the need of CA in designing curricula to facilitate deep learning. Further, they contributed to fill mapping matrix as a CQI process to check whether the programme outcomes are achieved. Responses for the three open-ended questions (Q1 - In addition to the end-semester examination, what ATs did you use in the module?; Q2 - What TLAs did you use as per ILOs?; Q3 - Which alignments did you achieve based on the concept of Constructive Alignment?) included in the questionnaire are shown in Figure 3. Although most lecturers (83%) aligned ATs with TLAs, only about one third had been able to align LOs with ATs (40%) and TLAs (33%), which determines attainment of programme outcomes.

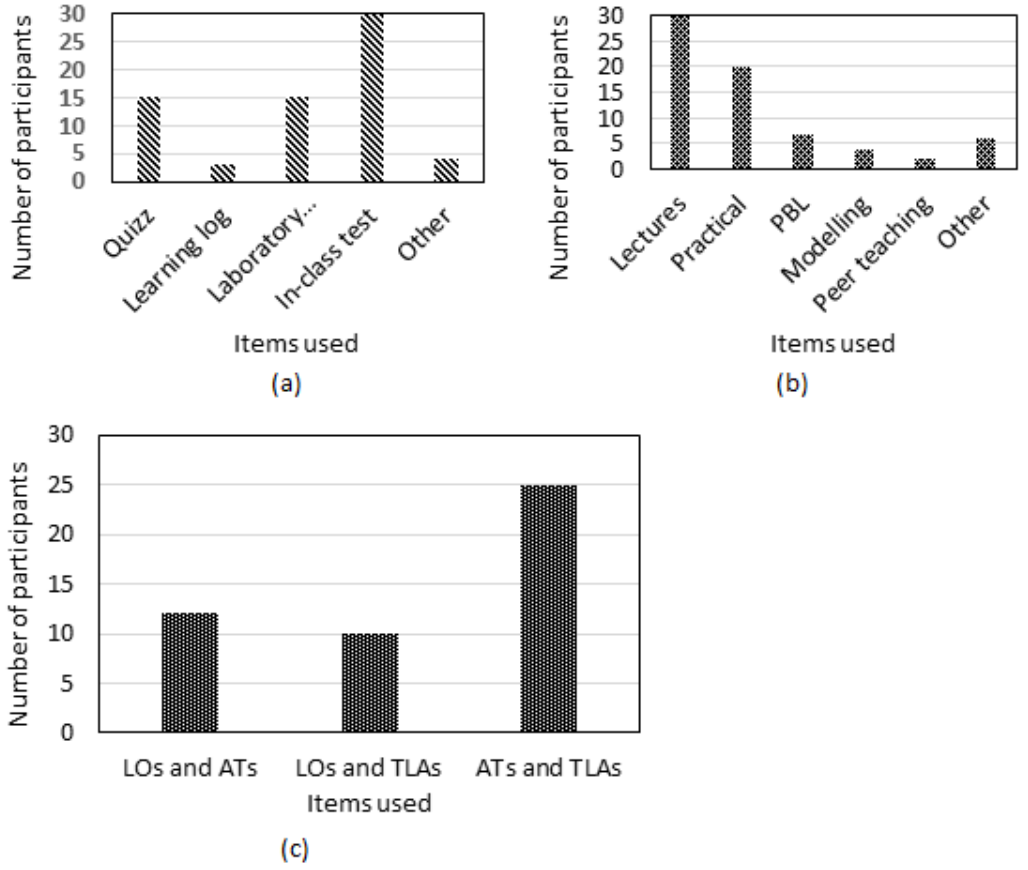

Figure 3. (a) ATs, (b) TLAs, (c) Lecturers' perceptions on the alignment among different items

Discussion and Conclusion

It was found that 60% of participants were not aware of the concept Constructive Alignment before the training session, explaining the low alignment of LOs with ATs and TLAs which, in turn, promoted conducting TLAs to meet ATs. Feedback showed participants had gained satisfactory insights into CA, with 90% becoming self-motivated to use CA in their future teaching. On a subsequent evaluation, external examiners expressed their satisfaction on amended module descriptors. The study showed that specific training activities on CA can be

successfully used to enhance positive perception of staff in applying it for effective curriculum development and to enhance better LO validation in courses.

References

Biggs, J., & Tang, C. (2011). *Teaching for Quality Learning at University; What the Student Does* (3rd ed.): McGraw-Hill/Society for Research into Higher Education & Open University Press.

IESL (2019). *Manual for recognition of four-year Engineering degrees conducted in Sri Lanka*. Colombo, Sri Lanka: Institution of Engineers Sri Lanka.