

Evaluation Of Graduate Learning Outcomes Using Constructive Alignment in Australia

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The paper examines the manner in which to evaluate an undergraduate degree in construction management using an approach known as "Constructive Alignment". One of the most significant assessment challenges in higher education is how to authentically realize the acquisition of graduate attributes. The research discusses the methods used to renew a course in a manner that aligns with the graduate learning outcomes. This research also highlighted the need for teaching staff to be engaged with the process of constructive alignment to embed the course learning outcomes within their subjects. The paper concludes with discussion about how graduate outcomes align with professional standards, and course outcomes.

Keywords*:* Teaching Enhancement, Graduate Outcomes, Curriculum Review, Construction

Introduction

In spite of almost universal agreement on the need for graduates to possess generic skills and knowledge, the assessment of these graduate attributes remains a challenge for educators. Traditional approaches to assessment have not typically focused upon the measurement of generic graduate attributes (eg. critical thinking, teamwork, communication etc.) nor identified frameworks for assessing student progression towards work-readiness. Yet construction and built environment employers are increasingly demanding the development of employability attributes, stressing
the need for measurement of student performance against these qualities (Curtis and Lucas 2001).

The concept of curriculum integration has been talked and written about for numerous years. Hopkins (1937) described the concept of curriculum integration as a means of fostering unity between the learning process and the learner. What occurs through "integration" is the melding of the learning process with student behavior (Auchey, Mills et al. 2000) One of the most significant assessment challenges in higher education is how to authentically develop the acquisition of graduate attributes. When the assessment of attributes is developed to prepare students for the real world context or work place, it becomes even more challenging and complex.

Course reviews are an essential part of the renewal of all university programs. This paper documents the process of undertaking a review using the principles of "constructive alignment". Many internal and external processes trigger the need for such reviews, and the temptation is to simply change the aspects of the course that are perceived to problematic at the time. However, constant tinkering of courses often leads to a situation where the content and assessment process fall out of alignment with the program as a whole. The paper uses a case study approach to describe a "sandpit" course review conducted at Deakin University in Victoria, Australia and compares that to similar processes used in the United States.

'Constructive alignment' starts with the notion that the learner constructs his or her own meaning through relevant learning activities. The teacher's job is to create a teaching environment that supports the learning activities appropriate to achieving the desired outcomes (Biggs 1996). The key is that all parts in the teaching scheme, comprising; curriculum, intended learning outcomes, and assessment tasks, are aligned with each other. All are fine-tuned to the learning activities addressed in the desired Course Learning Outcomes (CLO's), and the University Graduate Outcomes (UGO's). The theory then concludes, that if all of the assessments and learning outcomes are aligned, then the student finds it difficult to escape without learning appropriately.

This process of aligning course content and assessment with high-level graduate/course outcomes is essential for discipline-based courses, like construction management. Professional institutes that accredited University construction degree courses are seeking to ensure that when a student graduates that they have met the minimum standards, and have the necessary skills and attributes to begin a career in the industry (Love, Smith et al. 2003, Mills, McLaughlin et al. 2008).

What is constructive alignment?

'Constructive alignment' has two aspects. The 'constructive' part refers to the idea that students construct meaning through relevant learning activities. That is, meaning is not something transmitted from teacher to learner, but is something learners have to create for themselves. Teaching is simply a catalyst for learning, and in the end the students learn what they do, regardless of what the teacher may have intended (Boud and Falchikow 2006).

The essential idea is to ensure that the curriculum and assessment drive the learning activities of the student. It's student-centered in that it is about what skills and attributes graduates can demonstrate on completion of the course. In a good system, all aspects of teaching and assessment are focused to support high level learning, so that all students are encouraged to use higher-order learning processes. 'Constructive alignment' (CA) is such a system; it is an approach to curriculum design that optimizes the conditions for quality learning (Treleaven and Voola 2008).

If students are to learn desired outcomes in a reasonably effective manner, then the teacher's fundamental task is to get students to engage in learning activities that are likely to result in their achieving those outcomes. It is helpful to remember that what the student does is actually more important in determining what is learned, than what the teacher says. (Shuell 1986). As Ramsden (1992) puts it, the assessment is the curriculum, as far as the students are concerned. They will learn what they think they will be assessed on, not what is in the curriculum, or even on what has been 'covered' in class (Biggs 2003) .

Instructional designers for their part have emphasized alignment between the objectives of a course and subject as being important for assessing student performance. "Constructive alignment" represents a marriage of the two approaches, constructivism being used as a framework to guide decision-making at all stages in instructional design: in developing curriculum objectives, in deciding teaching/learning activities, to assess, and formatively report student performance (Biggs, 2003).

From Aims to Outcomes

University teachers almost universally subscribe to high-level aims for the courses that they teach (Entwistle and Percy 1974). However, generalizations such as "To become a student-centered teacher, sensitive to individual student's needs", does not imply any particular teaching approach. This leaves other factors, such as; student numbers, and university administration processes, to determine the teaching and assessment methods used in each subject. Furthermore, other external events like new members of staff, or changes in university policy result in the need to adjust teaching to suit short-term imperatives.

Consequently, the mass lecture with formal examinations, continue as the default modes (Biggs 1996). Very often the need to solve short term problems drive the teaching process, this in turn creates a legacy for the next time the subject is taught. Overtime, many subjects fall out of alignment with the intended Course Learning Outcomes (CLO) and the university Graduate Learning Outcomes (GLO). Course leaders need to be aware that while short-term problems will continue, their impact is eroding the capacity of the course to deliver high quality learning outcomes. There becomes a point where a refocusing subject to the CLO's and GLO's is necessary to bring subjects back into alignment.

In designing an instructional system that supports the sort of outcomes the curriculum nominates, Cohen's (1987) idea of "constructive alignment" is that when curriculum and assessment methods are aligned, the results of instruction are massively improved; and research has shown that student achievement have been reported up to four times greater than in non-aligned instruction (Cohen 1987) .

In setting up an aligned system, the desired outcomes of the teaching should be specified in terms of both topic content, and the level of understanding. It is then important to set up an environment that maximizes the likelihood that students will engage in the activities designed to achieve the intended outcomes. Finally, the assessment tasks that should be able to show how well individual students have attained these outcomes (Nicol 2010).

Developing a framework for course review

At a time when many universities are being asked to do more with less, a challenge has been tendered which forces academics to re-evaluate new way to do business. Faculties are smaller, student populations are growing and graduate programs are being added without the benefit of added resources. This environment has created an opportunity not only to examine the program's curriculum but also to implement changes that strengthen the educational mission. New methodologies and tools are needed to accomplish this mission.

Engineering and construction courses across the Australia are developing outcome assessments for their programs that are part of the overall assessment process for their institutions. At the same time, many US universities are developing educational objectives and program objectives and outcomes for their programs to meet ABET accreditation requirements. In other words, outcomes-based criteria are being demanded from construction course in Australia, and by ABET.

Research by (Auchey, Mills et al. 2000) moved in the direction of student performance outcomes when they developed “learning outcomes template” (LOT)**.** This was used to incorporate learning outcomes into each course and provides a mechanism to discuss the competencies and skills to be included in each course syllabus and their progression through the core curriculum. The LOT is a good model to use once the learning or performance outcomes have been identified. Although the authors suggest that the mission and goals of the curriculum should be reviewed, they make no connection to the learning outcomes. Furthermore, they do not indicate how they will support the goals and objectives of the program, college, and/or institution as a whole.

The past research (Andersen, Yazdani et al. 2007) provides the basis for learning outcomes to become a part of accreditation for engineering and construction management education. This work has moved the discipline toward a model that will be able to document student learning, and at the same time, meet the expectations of their constituents. (Aldridge and Benefield 1998) have taken these concepts and integrated them with the ABET 2000 criteria and developed a planning model. This model clearly identifies the relationship between the educational and learning objectives at the program, curriculum, and the course level.

The Bachelor of Construction Management at Deakin University, Australia is participating in a Course Enhancement Process (CEP) as part of the Universities strategic plan, “LIVE the Future: Agenda 2020”. The process of course review is referred to as the “sandpit” exercise, which comprises broad ranging discussions with teaching staff to come to a collective understanding of graduate and course learning outcomes, which are expected by the University. For instance, the University strategic plan calls for opportunities to provide “a brilliant education, where students are and where they want to go” (Deakin 2012) This statement needs to be contextualized and integrated into the course in a manner consistent with expected competence of a construction management graduate (Love, Smith et al. 2003).

The study was conducted in a Construction Management program as part of a bachelor’s program offered in the School of Architecture and Built Environment at Deakin University, Victoria Australia. The industry-accredited program comprises 4 years of full-time study and leads to a degree entitled Bachelor of Construction Management (Honors) or BCM. As a large and comprehensive university in Australia, the student demographic includes both local and international students. The majority of the students undertake the program in full-time mode, and it is known that many students also work in industry while studying. The alignment process included incorporating the following Deakin University Graduate Learning Outcomes (GLO):

1. Discipline-specific knowledge and capabilities: appropriate to the level of study related to a discipline or profession.
2. Communication: using oral, written and interpersonal communication to inform, motivate and effect change.
3. Digital literacy: using technologies to find, use and disseminate information.
4. Critical thinking: evaluating information using critical and analytical thinking and judgment.
5. Problem solving: creating solutions to authentic (real world and ill-defined) problems.
6. Self-management: working and learning independently, and taking responsibility for personal actions.
7. Teamwork: working and learning with others from different disciplines and backgrounds.
8. Global citizenship: engaging ethically and productively in the professional context and with diverse communities and cultures in a global context

Course Learning Outcomes (CLO) was developed as part of the Assessment and Learning Design stage. The CLOs align with the Australian Qualifications Framework (AQF) (AQF 2013) standards as well as the standards of four industry accrediting bodies, including Australian Institute of Building, Royal Institute of Chartered Surveyors, Australian Institute of Quantity Surveyors and Chartered Institute of Building.

Results

The next part of the paper compares the learning outcomes of the Australian university with similar outcomes developed for programs in the United States.

Table 1
Comparison of learning outcome in Australia and United States

Learning Outcomes for Construction Management in Australia	**Learning Outcomes-ABET Criterion 2, USA**
Theory	
Demonstrate knowledge of construction management theory, principles and concepts.	Students will develop the ability to solve civil engineering problems by applying fundamental knowledge of mathematics, science, and engineering;
Application of Theory	
Integrate and appropriately apply construction management in: Construction Technology, Law, Management, and Economics	Students will develop the ability to formulate and solve civil engineering problems in planning, design, construction, and operations of systems, components, or processes that meet specific performance, cost, time, safety, and quality
Environmental Context and Culture	
Integrate contextual factors that impact on construction management including; sustainability, professional practice, regulations, code and standards, social and cultural factors	Students will obtain the broad education necessary to understand the impact of the civil engineering solutions in a global, societal, and environmental context consistent with the principles of sustainable development;
Research and Experimentation	
Acquire and apply research skills to initiate and formulate research questions and contribute to new knowledge, based on current research directions	Students will develop the ability to design and conduct experiments and analyze and interpret data within the various civil engineering specialty disciplines;
Communication	
Communicate effectively in a range of contexts, to a range of stakeholders, using oral, written, graphical and interpersonal communication.	Students will develop the ability to function and communicate effectively, both individually and within multidisciplinary teams;
Utilize a range of digital technologies and information sources to discover, select, analyze,	

use, evaluate, and disseminate both technical and non-technical information	
Critical Thinking & Life Long Learning	
Use critical and analytical thinking and judgment to identify, evaluate and apply appropriate principals and procedures in: Construction Technology, Law, Management, Economics	
Use advanced cognitive skills to analyze, generate and recommend solutions to complex problems	Students will experience an academic environment that facilitates and encourages life-long learning and retention.
Ethical and Reflective Practice	
Demonstrate self-management through professional and ethical conduct and reflective practice.	Students will develop a solid understanding of professional and ethical responsibilities;

The comparisons above show (Table 1) strong similarities to each other, which validates the course learning outcomes utilized in Australia. The next section of the paper is to compare the process of developing course performance outcomes. Deakin University uses a 4-step process of course enhancement, known as the "Sandpit" review. This comprises: (1) Evidence Portfolio, (2) Development of Course-wide learning outcomes (CLO's), (3) Redesigning Learning Environments, and (4) Evaluation of changes.

Table 2

Processes for developing course wide learning outcomes

"Sandpit" Course Review Process, Deakin University, Australia	**Flow chart for developing course performance outcomes, Anderson et al (2007)**	**Flow process for implementing the LOT, Auchey et al 2000**
1. Evidence Portfolio	1. Identify content	1. Establish curriculum
	2. Assign content to a course	
	3. Write content goal statements	2. Examine existing course content
		3. Check horizontal integration 4. Check vertical integration 5. Check prerequisites 6 Adjust prerequisites
2. Course-wide Learning Outcomes	4. Write outcome related course goals/objectives	7. Develop and refine syllabus based on Learning Outcomes
3. Redesign Learning Environments	5. Write course Learning Outcomes	
	6. Identify Assessment measures	8. Prepare lesson plans based on syllabus Unit Learning Outcomes
4. Evaluation of Changes	7. Evaluate	9. Perform External evaluations

Evidence Portfolio

A Course Evidence Portfolio was assembled as part of the initial scoping for the Bachelor of Construction Management (BCM) review process. This identified areas of strength and areas for enhancement. The evidence portfolio comprises a desktop audit of Unit Guides, already in the university's systems, which identify existing; contact time, learning outcomes, and assessment requirements. The process of identifying the Units/subjects that represent the essential components of the course can sometime be an issue if other courses are nested within the program.

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This process assumes that the existing program of study is already meeting the requirements of the market. The American procedures by Anderson et al (2007) and Auchey et al (2000), have may more steps and assume that the course is being developed for the first time, or significantly re-written for new or emerging markets. The additional steps used in the Auchey LOT’s also address the need to compare both vertical alignment (ie. Alignment within a discipline like estimating practice) and horizontal alignment. This horizontal alignment refers to the level of instruction within a course, ie. 1st year, 2nd year, final year. This approach infers that the level of instruction has an impact on the manner in which particular subjects/units are taught.

Course-wide learning outcomes

This step comprises the identification of graduate/university learning outcomes, as well as discipline specific learning outcomes. The CLO’s are typically matched with the requirements of the Australian Qualifications Framework (AQF). In this case the, 4-year Bachelor’s degree with Honors is matched to meet the requirements of AQF level 8. The Deakin process is based on a series of studies that have been undertaken at a national level, related to the AQF and to the Course Learning Outcomes for Construction Management, which were developed by the Office of Learning and Teaching (Newton 2009). In this respect the Deakin approach was to contextualize the CLO’s based on existing nationally agreed standards for the construction management education.

In addition, the professional associations that accredit the construction courses (AIB, AIQS) have also engaged on dialogue on incorporating the Course Learning Outcomes for Construction Management into their accreditation processes. To some extent the above processes inform the CLO’s, but they are invariably generic, and need to be reinterpreted for each degree program. For instance, the guidelines used by Anderson et al (2007) and Auchey et al (2000) superficially describe this phase as “Write outcome related course goals/objectives” (Anderson et al 2007). In reality this process needs to be more circumspect and relies on more expansive thinking process, but it is not obvious from the literature if that was the case.

Redesigning Learning Environments

This step involves a process of re-imagining the learning and assessments to better align the assessment with the newly developed CLO’s. A workshop was held for the course team to align Unit Learning Outcomes (ULO’s) and unit assessments, and to redesign learning, delivery and assessment materials. Deakin University does provide some level of support from it’s teaching and learning experts, but the major component of the task relies on individual subject teachers to develop the unit assessments.

This phase of the review is particularly important as it represents what the student actually does within the course. As Biggs (2003) puts it students “will learn what they think they will be assessed on, not what is in the curriculum, or even on what has been 'covered' in class”. It is at this point that the generic course outcomes (CLO’s) are implemented as ULO’s within particular subject/unit, and individual assessments within the weekly teaching.

All of the course review processes (See Table 2) gloss over the significance of this stage, and describe the processes in mechanistic terms. It has been the experience of the authors that it is difficult for some individual teachers to embrace CLO’s within their own subjects/units, as they tend to be focused on their own subject area, and not on the course as a whole.

Evaluation of changes

This step attempts to validate the change between the existing course and the new, checking for overlaps or gaps. Finally, it identifies and lessons learned for any Course Enhancement processes that may occur at the University in the future. The 4-step process leads to the development of a matrix that matches the GLO’s with the CLO’s. The matrix then attempts to tease out the implications for the course that would follow from the attributes.

It is beyond the scope of the paper to raise the many and varied issues that have come out of the review. However, one of the issues that surfaced was part of a subject related to planning and scheduling. The GLO of Digital Literacy was supposed to apply to the subject because it was expected that students would be developing software skills in computerized scheduling. This appeared not to be the case; instead students were taught to schedule using hand calculations from first principles, like arrow on node diagrams.

It became obvious that students had an unsophisticated understanding of the scheduling software, other than what they learned through self-instruction. It was discovered that the degree program as a whole, did not teach computerized scheduling in any formal manner; instead students picked up the skills on their own as they progressed through the program. This meant that students spend large amounts of time on simple scheduling tasks, without learning the higher-level management skills required. Consequently, the curriculum has been revised to accelerate their learning using program simulations and case studies. This approach utilizes the more advanced capabilities of the software, and leads to a better understanding of the management issues associated with construction scheduling.

The process of constructive alignment is a helpful for undertaking course reviews, because it emphasizes the importance of the higher level attributes that students need to attain upon graduation. This issue is very easily lost when courses are taught because individual teachers are often indifferent to requirements that are beyond their subject areas. The processes used in both the USA and Australia (See Table 2) is very similar and all contains the essential ingredients for implementing structured programs for the developing competent graduates.

Discussions and Conclusions

The principle of "constructive alignment" evolved with the decision to use a GLO's and CLO's to inform learning activities and assessment process within each taught unit. This forces teachers to reflect on what they wanted from the unit/subject, and how they thought they going to get it, which in turn puts pressure on the lecturer to provide appropriate teaching activities to help them do so. In this way, all components in the system become aligned to the high level objectives of course and meet the university Graduate Learning Outcomes.

The 'alignment' approach refers to what the lecturer does, which is to set up an environment that supports the learning activities appropriate to achieving the desired learning outcomes. The key is that the components of the teaching, especially the teaching methods used and the assessment tasks are aligned with the learning activities. The student is in a sense 'trapped', and finds it difficult to progress without learning what he or she was intended to learn.

This approach is also very useful for disciplined-based courses, like construction management, that lead directly into a career in industry. Four professional institutes, which have certain requirements for graduates, accredit the BCM program at Deakin University. Part of the challenge for senior academics has been to align the various accreditation requirements with the university and course learning outcomes, in a way that is consistent with good outcomes for students.

It is also clear that the process of course review is itself an important issue. Each of the three processes that have been examined in Table 2 has a slightly different emphasis. For instance, the Deakin "sandpit" review relies on the fact that the existing course is fundamentally right for its circumstances, and only needs to be realigned to for a better emphasis on CLO's. However, others, who instead, emphasize that it is important to re-evaluate the course outcomes, before proceeding to the next step, did not reflect this approach in the processes.

Good lecturers are expected to be clear about what they want students to learn and what students should have to do in order to demonstrate that they have learned at the appropriate level. The weakness in all the course review processes maybe how the generic course level outcomes, are re-imagined to become subject level outcomes.

The philosophies of constructive alignment provide a good framework for systematically operationalizing these issues, in a way that is consistent with the development of competent graduates. The paper highlights the benefits of this approach in terms of practicality, efficiency, and the disciplinary embedding of attributes. In particular it emphasizes the mindset that needs to be cultured in lecturing staff so that their teaching decisions are formed by the process of focused integrated alignment.

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