



Coláiste na Tríonóide, Baile Átha Cliath
Trinity College Dublin

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ACADEMIC PRACTICE AND E^LARNING: RESOURCES

Enhancing Assessment and Feedback in the Natural Sciences.

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Summary

This pamphlet aims to introduce assessment and feedback approaches that will enable academics to embed a greater variety of graduate attributes into their teaching and learning practices. This resource outlines theory that underpins the development of module content and appropriate assessment and feedback methodologies and provides examples of teaching and learning practice that are used in the School of Natural Sciences.

Introduction to this resource

The expectations and demands of students in higher education have changed dramatically over the past number of years. There has been a divergence in the perception of a university academic as a purveyor and transmitter of knowledge, grounded in the Humboldtian tradition of scholarship, where the acquisition of new information is the goal of education, to a more market driven approach which fosters competition for funds, student numbers and reputation and which places greater emphasis on the links between higher education and industry (Fanghanel, 2012). Consequently, the consideration of graduate attributes that are required to enhance prospective employment has altered the mission of many higher education institutes to focus on graduate competencies rather than just the pursuit of knowledge, in order to up-skill the population and develop a lifelong approach to learning (Pokorny and Warren, 2016). Trinity College Dublin is no exception in this regard, and through the development of the Trinity Education Project a resource toolkit has been developed that can be used to review and renew the curriculum taught and the way in

which material is delivered and assessed. This resource paper has been developed through attendance and engagement with a module entitled “Assessment and feedback in higher education”, developed and delivered by Dr Ciara O’Farrell, Dr Cicely Roche and Dr Michael Wride from the Trinity College Dublin, Centre for Academic Practice and eLearning (CAPSL). The focus of this resource is to review and discuss the role of module design and appropriate assessment and feedback techniques to enhance the attributes of graduates from the Trinity College Dublin, School of Natural Sciences.

The development and assessment of graduate attributes in higher education

University graduates accumulate a diverse collection of attributes during their time in higher education, these are reflected in the direct assessment of academic excellence (e.g. grades), but also include less tangible skills such as the ability to communicate effectively and the development of an appropriate work ethic (Norwood and Henneberry, 2006). Collectively however, these graduate attributes represent the core learning outcomes of higher education and have been defined by Bowden et al., (2000) as:

“The qualities, skills and understanding a university community agrees its students should develop during their time with the institution. These attributes include but go beyond the disciplinary expertise or technical knowledge that has traditionally formed the core of most university courses. They are qualities that also prepare graduates as agents of social good in an unknown future”.

The role of university educators is fundamental to the development of graduate attributes, and the perception of these attributes has a significant influence on the discipline specific implementation of teaching and learning strategies (Green et al. 2009; Hughes and Barry, 2010). However, it is widely recognised that the assessment of graduate attributes is complicated and can be more problematic at the institutional rather than discipline level as some attributes can be considered 'wicked competencies' that are difficult to assess using traditional techniques (Knight and Page, 2007).



Figure 1. The expected attributes of graduates from Trinity College Dublin developed through the Trinity Education Project.

When we consider the many facets of the attributes embedded within graduates of Trinity College Dublin (Figure 1), the ability to think independently and communicate effectively are relatively easy to assess using conventional summative assessment techniques. It is more difficult however to assess the varying ability of students to behave responsibly and to deal with ambiguity for example. For graduate attributes to be successfully implemented a clear and coherent assessment framework for all attributes is required (Ipperciel and ElAtia, 2014).

Module development, delivery and appropriate assessment and feedback techniques

In order to embed graduate attributes into the teaching program, the use of constructive alignment in program or module design will facilitate students to achieve the learning outcomes that reflect the required educational expectations, in addition to both intellectual and behavioural competencies (Treleaven and Voola, 2008).

Constructive alignment as described by Biggs (1999) has two distinct aspects. The constructive part focuses on the development of meaning by the students facilitated by the teacher through relevant activities that promote active, student-led learning and the engagement of course content across several levels which facilitates deep-learning (Donnelly and Fitzmaurice, 2005). The alignment aspect relates to the role of the teacher in the learning activities, ensuring that the learning environment supports the desired outcomes. In this perspective, Hunt and Chalmers (2012) suggest that the university academic should move away from acting as the 'sage in the stage' to become the 'meddler in the middle'. Where the curriculum, learning outcomes, methods used and assessment criteria are all aligned, the students will find it difficult not to achieve the required learning outcomes, and as such will develop a broader compliment of graduate attributes.



Figure 2. The perspective of the National forum for the enhancement of teaching and learning in higher education on assessment and feedback.

The assessment of learning in higher education is multifaceted and needs to address both the outcomes of learning in addition to the process of learning (Brown and Race, 2010). This concept is highlighted in Figure 2, developed by the national forum for the enhancement of teaching and learning in higher education, which indicates the role of assessment of, for and as learning. This highlights how both summative and formative assessment approaches allow for the demonstration of learning, how feedback enhances the process of teaching and learning and how students can engage in self-regulation of their learning. Where these three aspects combine, the highest level of student learning can be achieved.

However, it is important to consider the volume of assessment that might be undertaken by students across a moderatorship, as students often perceive that they are being over-assessed (Wang et al., 2013). Students then become excessively strategic in their approach to assessment, engaging more in the high-stakes tasks that carry a mark and will directly contribute to their degree (Figure 2). In this situation the students invest a disproportionate amount of

time in the summative assessments, and miss out on the more formative aspects which will enable them to develop key skills in self-regulated learning and to reflect on their thinking, motivation and behavioural practice (Nicol and Macfarlane-Dick, 2006). In order to address this issue, greater consideration needs to be given to how assessment approaches are aligned both within a module and across a moderatorship programme, in addition to providing a more coherent overview of the assessment activities to the students such that they have a better understanding of the relevance of their educational experience (McLaughlin and Simpson, 2004).

As detailed in Figure 2, there are a variety of assessment approaches that align across the summative/formative, high/low stakes and teacher- or student-led continuum. These range from conventional assessments such as essays, laboratory reports or multiple choice questions, but extend to self-reflection assignments and self/peer assessments. The latter approaches have significant utility in providing an opportunity to assess the more wicked aspects of graduate attributes. Inherent in this process however is the need to provide feedback such that the students can utilise this information to enhance their approach to learning, and also to develop the skills to critically evaluate their own work and the work of others.

Feedback is often one aspect of many undergraduate courses that the students are least satisfied with, and as described by Nicol et al., (2013), needs to be addressed by enhancing the level of detail, clarity and structure provided, in addition to ensuring that it is given in a timely manner. These concepts are developed further by Gibbs (2010) and Race (2010) who argue that the evaluation of

learning can be improved by designing assessments that will engage students in the topic rather than increasing anxiety, develop student ownership of the need to learn by aligning the learning outcomes with evidence of achievement, utilise timetabled contact hours to engage students in the learning process, ensure timely feedback from both lecturers and peers and to ensure that the feedback is not only returned but that the students act upon it.

Examples of assessment and feedback approaches in Natural Sciences

Detailed below are a few examples of approaches used in the delivery, assessment and feedback of material taught on the undergraduate Plant Science and Environmental Science moderatorships.

Mind-mapping

In order to help students focus on the learning, at the start of each lecture a mind-mapping exercise is undertaken, whereby the students are asked to recall the content and key issues raised in the previous lecture. This process is facilitated by the students with guidance and feedback on the thought process/structure being given by the lecturer in real-time. Following this a photograph of the mind-map is uploaded to Blackboard so that the students can reflect and critically assess their level of comprehension around a particular topic.

Science communication and peer assessment

The Ecology, Evolution and the Environment School Seminar Series introduces students to a range of scientific topics that are often outside the core content of the moderatorship on which they are studying. The students are given an additional tutorial on the topic of science communication and are then assessed on their ability to communicate the seminar topics by writing short summaries in the form of blog posts. The students individually submit their work to Blackboard and then, working in pairs, provide critical peer assessment on their partner's submission. The feedback is also submitted to Blackboard for review and feedback by the lecturer. Following this, the students utilise the peer feedback provided to write a second blog post, on an alternative topic to their first submission, which is then assessed.

Tutorial engagement and presentation skills

Senior Sophister students are asked to discuss the 'hot-topics' in plant science with regards to the role that plants play in addressing questions of global importance. Following this they summarise the topics and distribute these between members of the class. Working in small groups, they research a particular topic and then give a PowerPoint presentation to the rest of the class. The assessment criteria for the presentation include the critical analysis of the content, structure/organisation, delivery, creativity and ability to answer questions on the topic. Each group in turn are expected to lead the questions and to provide feedback on the presentation, for which additional marks are given. At the end of the session, guided by the lecturer, the students discuss the feedback

received and how this might be implemented into future presentation assignments.

Enquiry on the utilisation of feedback

Students are assessed using conventional, summative assessment techniques such as laboratory reports and extended essays. These are submitted to Blackboard and the assignments are returned in annotated form and with a summary feedback statement. The students are then asked to reflect on this feedback after which they are invited to a one-to-one session where they present their thoughts on the assignment, the feedback returned and are asked to identify how they might implement alternative practices in future assignments.

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