CO-ORDINATING ASSESSMENT ACROSS A PROGRAMME

Adam Gibson[1*], Rebecca Yerworth[1], Pilar Garcia Souto[1], Jennifer Griffiths[2], Gwyneth Hughes[3]

[1] Dept Medical Physics and Biomedical Engineering, UCL, London, WC1E 6BT
[2] Arena Centre for Research-Based Education, UCL, London, WC1E 7HB
[3] Institute of Education, UCL, London, WC1H 0AL

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**Correspondence to: Adam Gibson, Department of Medical Physics and Biomedical Engineering, University College London, UK. E-mail: adam.gibson@ucl.ac.uk*

Abstract: Assessment within a degree programme is critical for providing summative grades and formative feedback on specific pieces of work. Incorporating different forms of assessment into a programme provides students with opportunities to develop a wide range of skills beyond core disciplinary knowledge. Examples include research-based assessment, outward facing assessments aimed at different audiences, and authentic assessment linked to professional workplace practice. The opportunity to develop relevant professional skills is particularly important in an accredited engineering programme.

The modular approach to programme development, prevalent in the UK, where different modules are often developed autonomously and assessed independently can make it difficult to introduce broader, creative assessment practices and can lead to heavy reliance on one method. For example, all module organisers might feel that their module is best assessed through written reports. Even if this is the most appropriate assessment mechanism for each individual module, we postulate that over the programme as a whole, students might learn more if they are required to submit a range of different types of outputs. By spreading this assessment portfolio across modules, we can develop and test a wider range of skills even while reducing the total assessment load.

We will give examples from a programme that uses a combination of traditional assessments, authentic workplace-like assessments, research-based assessments, and assessment for different audiences. The paper examines the individual module compromises which may need to be made if assessment is to be seen holistically, to create programme-wide balance to maximise student development.

1. INTRODUCTION

Assessment is, of course, a vital part of any Higher Education degree programme as it provides evidence of learning progress for students and staff and provides evidence and rigour for the final degree classification. However, staff, students, institutions and external bodies may differ in how they prioritise different aspects of assessment as well as feedback, to which it is intimately linked. The disconnect between staff and students' perceptions of good quality assessment and feedback

is well documented (Pazio, 2016) and is reflected in the persistently lower scores in this section of the UK's National Student Survey (NSS, 2017; Price et al., 2011).

In degree programmes organised around modules, assessment tends to be directly linked to the modules, with the advantages that the syllabus is well defined, and teaching and assessment are closely linked. However, there are potential disadvantages including an increased tendency towards overassessment, increased challenges of providing good, cumulative, ipsative feedback (Hughes, 2011) and a reduced emphasis on the holistic cross-disciplinary learning that can provide a framework for students to make connections across the entirety of their discipline (Harland et al., 2015).

Assessment is one of the strongest influences on how students spend their time (Gibbs and Simpson, 2005). Students quickly work out efficient study strategies, such as strategic revision focussed on doing sufficient to "pass the exam" (Gibbs, 1999; Stobart, 2008). Well-chosen coursework can help to mitigate this and can enhance student engagement, improve the quality of learning, and provide a better long-term predictor of learning than exams. Moreover, careful design of coursework can influence students to spend their time more productively and appropriately, can encourage deeper learning and can reinforce a wide range of skills that are relevant to the workplace (Gibbs and Simpson, 2005).

It has been argued that the narrow focus on traditional concepts of assessment, typically using coursework to provide formative feedback and an exam to give a summative grade (Richardson, 2015), means that broader potential benefits of assessment can be lost (Boud and Falchikov, 2006). We argue that this limited vision of assessment is exacerbated in a modular system and that by taking a broad view of assessment across a programme as a whole, additional benefits can be realised that enhance learning while improving student satisfaction and employability.

Programme-wide assessment, especially as a reaction to perceived concerns of modular degrees, has been researched and discussed in depth (Jessop et al., 2012). In this paper, we review different roles that can be provided by a broad range of assessment practises, and consider the benefits of each. We identify factors to consider when co-ordinating coursework across a programme and conclude with a case study that describes a programme with co-ordinated coursework. We particularly emphasise opportunities for practising professional skills, designing coursework to actively support holistic learning, and the advantages of being able to exploit a range of different assessment types.

2. ROLE OF ASSESSMENT

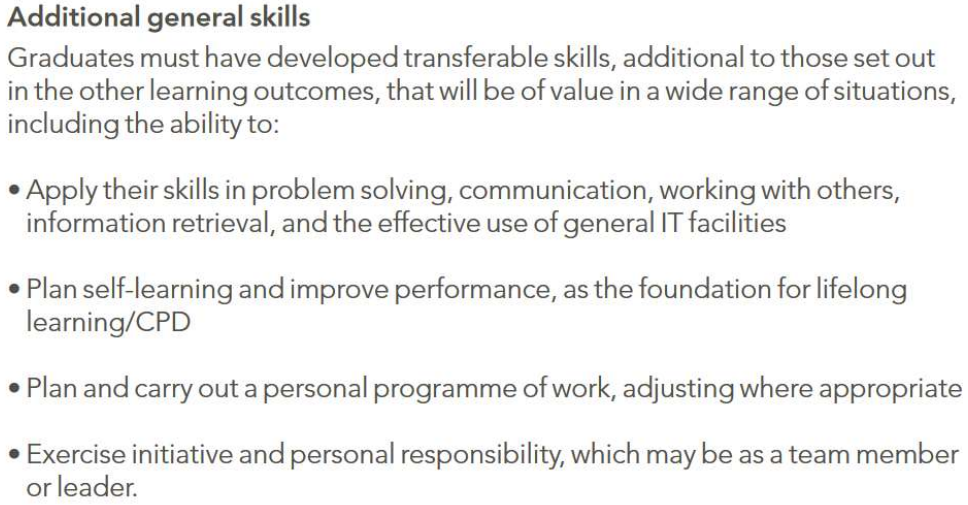
2.1 Assessment for learning

The traditional understanding of assessment, which is to provide formative feedback and summative grading, is well researched and well accepted (Hattie and Timperley, 2007), being incorporated into the education strategies of higher education institutes. However, these aims are associated with identifying the extent to which material has been learnt elsewhere, but often do not themselves directly assist with learning or assimilating new knowledge or skills.

An alternate approach is to consider assessment as part of the learning process (Assessment Reform Group, 1999; Stobart, 2008). One method, known as Assessment for Learning, considers assessment to be a tool which should be used to enhance learning. This approach extends existing formative and summative assessment to provide effective feedback to students and adjust teaching

according to students' understanding, but goes beyond this by actively involving students in their own learning, recognising the role of assessment in motivation, and the importance of autonomous learning. Assessment for Learning is accepted as a successful strategy which leads to improved learning. A number of resources encourage its use in primary and secondary school though methods such as open-ended questioning, encouraging self-reflection and ensuring that feedback provides advice on how students can improve their work.

When applied to the Higher Education setting, Assessment for Learning is an example of an assessment practice which can be introduced in a relatively straightforward manner into an existing module. The knowledge and skills which are learnt through this process may not be captured by the usual knowledge-based learning outcomes for a particular module; instead students might learn broader skills such as self-reflection, and personal motivation. Such skills are increasingly required by professional bodies which accredit degrees, as shown in the extract of the skills that are required for a UK accredited Engineering degree in Figure 1 (Engineering Council, 2014).



Additional general skills

Graduates must have developed transferable skills, additional to those set out in the other learning outcomes, that will be of value in a wide range of situations, including the ability to:

- Apply their skills in problem solving, communication, working with others, information retrieval, and the effective use of general IT facilities
- Plan self-learning and improve performance, as the foundation for lifelong learning/CPD
- Plan and carry out a personal programme of work, adjusting where appropriate
- Exercise initiative and personal responsibility, which may be as a team member or leader.

Figure 1: Additional general skills required for a BEng degree if it is to be meet UK Engineering Council accreditation

2.2 Constructive Alignment

The principle of Constructive Alignment recognises the value of assessment as a method of learning rather than just grading (Biggs and Tang, 2011). It combines the principles of *constructive learning* in which learners actively build their own knowledge by creating connections with their previous experiences to form an integrated whole and *alignment* in which the learning and assessment activities are intentionally designed to relate to the learning outcomes of the task being studied. While constructive alignment can be applied at a module level, it becomes much more powerful when learning and assessment can be coordinated across an entire programme, as the links between topics which can be lost in a modular programme, are explicitly emphasised. Constructive alignment is an essential component of for assessment for learning as student learning can be compromised if alignment is not present.

2.3 Individual and group coursework

A good example of using assessment to engender the learning of skills is in teamwork. This is an area where employers have frequently reported that graduates are weak, although recent data suggest that this is now improving (Institution of Engineering Technology, 2016).

Group-based assignments have advantages over individual assessments, such as allowing for more open-ended work which enhances deeper learning. They also open up the opportunity to learn professional and transferable skills such as teamwork, leadership, project management, and giving and receiving peer feedback. These professional skills can be hard to address with individual coursework. On the other hand, providing robust, individual summative grades is challenging in group work, and high quality learning can compromise the quality of the assessment. Some institutions base entire programmes around group-based and problem-based learning (Donner and Bickley, 1993). However, a softer approach, where assessment is coordinated at a programme-level, can allow for a mix of coursework approaches including individual, pair, peer-group and mixed-group activities which would not be possible at a module level.

2.4 Authentic and research-based assessment

Research-based education encourages students and staff to form a unified learning community, emphasises the unique characteristics of disciplines and can empower students to develop their own learning depending on their interests (Fung, 2017). Extending the concept of research-based education to assessment can open up new, more realistic assessment methods which might be directly linked to academic research (poster presentations, critical analysis of a paper, podium presentations or capstone research projects and dissertations). These are examples of authentic assessment, where the mode of assessment is itself practice for real-world tasks which a graduate might encounter in academic employment. More broadly, authentic assessment might include interviews, role plays, videos or podcasts, writing websites, making objects and similar, open ended, reflective, collaborative tasks that develop skills which are relevant to employment and build upon students' prior experience.

Unlike traditional exams and worksheets, these broader assessment practices are not valuable solely for assessment. They can also provide opportunities for students to practice skills and assimilate new ideas – they are part of the learning process rather than merely assessment. By fully exploiting these concepts, assessments can feel more real, but also more valuable, increasing motivation for both students and staff. By using the same task to learn, practise, develop and assess a skill, overassessment can be minimised and the relevance of a particular piece of knowledge to the broader discipline is emphasised (Yerworth et al., 2017). This becomes particularly valuable when skills learnt in different modules can be brought together to solve a single realistic task.

2.5 Assessment for different audiences

One elegant way to enhance students' communication skills is to require them to communicate to different audiences. Understanding one's audience is a high level communication skill that can be difficult to develop when writing reports or giving presentations to university staff and students. Alternative methods of assessment, such as writing a website for an interested non-expert, explaining concepts to school children, writing a user manual for a client or speaking to experts from a different field can extend students' ability to communicate to a broad audience and provide them with experience which can be attractive to future employers. As before, if this replaces traditional assessment, it can simultaneously enhance engagement and reduce overassessment.

3. CO-ORDINATING ASSESSMENT ACROSS A PROGRAMME

3.1 Building knowledge

A modular degree, with well-defined learning outcomes, should be structured so as to build on previous learning. Co-ordinating assessment can then enforce the understanding of progressively more challenging concepts while maintaining a coherent structure to knowledge. Particular co-ordination may be required if the modules are shared between degree programmes to ensure that prerequisites are met. It is relatively straightforward to develop and assess technical, subject-specific learning outcomes.

3.2 Consolidating skills

If skills can be taught, practiced, consolidated and assessed across modules, they can be generalised. Problem solving, communication and team work, for example, are all much broader than a single module and by requiring such skills to be demonstrated repeatedly, students can be encouraged to see them as general principles rather than linking them to specific topics. Moreover, by devolving the learning to multiple modules in different years, these skills can be developed with the intention that students will be able to understand and apply them holistically throughout their work.

3.3 Minimising overassessment

Overassessment is a frequent complaint from students and staff. It is claimed that it can result in superficial learning, poor quality feedback, disengagement by students and resentment by staff (Galvez-Bravo, 2016). Overassessment can manifest as an emphasis on summative over formative feedback, repeated assessment of the same material, a reluctance by students to tackle extension work which may be unassessed, and a tendency for student to see their degree as a series of disconnected fixed pieces to be engaged with and then moved on from rather than a holistic body of knowledge. The modular system may make this more likely, but by co-ordinating assessment at a programme level, some of these problems can be mitigated. For example, a “heat map” of assessment listing submission dates can encourage staff to reduce and spread out tasks.

3.4 Tools for coordinating assessment across a programme

A project called ‘Transforming the Experience of Students Through Assessment (TESTA)’ was carried out between 2009-12 (Jessop et al., 2012). TESTA collected data on assessment from staff and students and provided evidence which led to changes in programme assessment in the institutions studied. Subsequently, it has been used with more than 100 programmes in over 40 universities.

4. CASE STUDY

Some of the concepts described above have been introduced into a new programme in Biomedical Engineering which is part of UCL Engineering’s Integrated Engineering Programme (Bains et al., 2015). This is a framework in which generic engineering skills are taught in an authentic, cross-disciplinary manner with an emphasis on professional skills and real-world experience.

The Biomedical Engineering programme has more than twelve open-ended, authentic, group-based practical assessments spread across the four years. This allows generic and professional skills to be taught, developed and assessed with increasing depth throughout the programme

(Garcia Souto et al., 2017). General engineering skills (such as those listed in Figure 1) are taught in tutorials and workshops but assessed through practical work that also tests core disciplinary knowledge. This reduces the assessment load while emphasising the relevance of the skills which can otherwise feel remote to students. Some specific examples where changes to assessment have been made following programme-level review are given below:

- Contract and patent law is taught formally and was initially assessed explicitly immediately following the workshop where it was taught. Feedback from students suggested that they didn't recognise the relevance of the subject to engineering. We therefore chose to assess it as part of a later week-long exercise where groups of students produce a business case for commercialisation of real medical device research. They pitch the business case to a panel of experts in an example of authentic, external-facing, group-based assessment which tests communication skills alongside legal issues closely integrated with the understanding of technology and critical evaluation of information.
- Students produce many written reports over the programme, but to extend the challenge of advanced writing skills, they are required to write a collaborative website for an external audience of interested laypeople, and an instruction manual for a disabled client. Neither of these exercises is necessarily the best way to assess the particular task which students were set – traditional written reports might have been more appropriate – but following programme-level review, it was decided that requiring a broader range of written work developed skills which justified any reduction in the quality of the assessment in these specific areas.
- A lack of programme level co-ordination in the early stages of development meant that students were being asked to write two literature reviews. The technical learning objectives were very different, but the skills being developed were the same. One of these was removed to reduce overassessment.
- The natural way to assess substantial practical assignments is often by presentation. We have intentionally found alternative methods of assessment such as interviews.
- Accreditation was found to be a useful process which formalised the co-ordination of teaching and assessment across the programme. A matrix linking learning outcomes to modules was required for the accrediting body and this was used to identify areas which were over- or under-assessed and modifications were made in response to this.

We are currently considering how we can best co-ordinate feedback across the programme. Best practice would be to provide ipsative feedback on students' improvement since previous assessments (Hughes, 2011), which we have introduced with formative lab notebook assessments across three modules and technical drawing which is progressively taught across 3 years. A further intermediate step will be to produce feedback guidance or criteria which are used across the programme.

These approaches allow skills such as advanced communication, group work, leadership and project management to be developed and assessed within the footprint of tasks which would be completed and assessed in any case, so without adding to the assessment load of students and staff. Staff can be more engaged when they are encouraged and supported to develop ambitious teaching and assessment activities, while students report being more comfortable when embarking upon final-year research projects or summer internships, because they already have experience of drawing on the whole of their learning to identify and tackle problems, and of the critical thinking, problem-solving and project management skills which are necessary.

5. CONCLUSION

Assessment is frequently criticised for encouraging students to focus on summatively assessed tasks at the expense of a broader understanding of the subject. We propose that a successful strategy which can motivate students to learn more widely is to carefully coordinate assessment at programme rather than module level, as supported by TESTA (Jessop et al., 2012). Indeed, there is compelling evidence that an uncoordinated modular system can reduce self-regulation and motivation (Harland et al., 2015).

Although the concept of learning styles is to a large extent discredited, it is still the case that some students report that they prefer some types of exercises over others (Pashler et al., 2008) and there is evidence that certain types of assessment might disadvantage certain students according to gender, nationality and educational background (Hazel et al., 1997; Rasooli et al., 2018). Distributing a range of assessment types throughout a programme, such that they build in complexity and challenge, may make the programme more equitable for a broad student cohort.

There are challenges to co-ordinating assessment across a programme, such as the administrative requirements that are imposed by a modular structure. Pedagogical challenges include concerns of academic autonomy: an academic tasked with teaching a specific topic in a particular module, might feel that their material is best assessed using a particular coursework task. This might conflict with the optimal design of the programme as a whole so there might be times when the requirements of the module contradict with those of the programme, requiring careful planning and negotiation.

In principle, programme-level co-ordination allows for student progress to be tracked across modules and years, so that their strengths and weaknesses can be identified and the effect of feedback on their performance can be tracked. However, in practise, this is difficult due to the number of members of staff involved, and arguably, having a broad range of assessment types may make this harder. We are looking into introducing tracking of individual students, which ultimately could lead to differentiated assessment for different students.

We believe that the benefits of co-ordinating assessment across a programme outweigh the disadvantages and that tools such as TESTA provide evidence and support for this. The opportunity to create a learning community in which each individual constructs their own portfolio of knowledge using a broad range of assessment tasks as part of the learning process is compelling.

6. REFERENCES

Assessment Reform Group (1999). Assessment for learning: Beyond the black box.

Bains, S., Mitchell, J.E., Nyamapfene, A., and Tilley, E. (2015). Work in progress: Multi-displinary curriculum review of engineering education. UCL's Integrated Engineering Programme. In 2015 IEEE Global Engineering Education Conference (EDUCON), pp. 844–846.

Biggs, J.B., and Tang, C. (2011). Teaching for Quality Learning at University: What the Student Does (McGraw-Hill Education (UK)).

Boud, D., and Falchikov, N. (2006). Aligning assessment with long-term learning. Assess. Eval. High. Educ. *31*, 399–413.

Donner, R.S., and Bickley, H. (1993). Problem-based learning in American medical education: an overview. Bull. Med. Libr. Assoc. *81*, 294–298.

Engineering Council (2014). The Accreditation of Higher Education Programmes. UK Standard for Professional Engineering Competence. Third Edition.

Fung, D. (2017). A connected curriculum for higher education (UCL Press).

Galvez-Bravo, L. (2016). Overassessment in higher education: does less mean more? Innov. Pract. *10*, 93–102.

Garcia Souto, P., Gibson, A., Hughes, G., Cottenden, A., and Yerworth, R. (2017). Improving students' critical thinking and communication skills. In 45th SEFI Conference, (Azores, Portugal)

Gibbs, G. (1999). Using assessment strategically to change the way students learn. In S. Brown & A. Glasner (Eds) Assessment Matters in Higher Education, (Society for Research into Higher Education), p.

Gibbs, G., and Simpson, C. (2005). Conditions Under Which Assessment Supports Students' Learning. Learn. Teach. High. Educ. *1*, 3–31.

Harland, T., McLean, A., Wass, R., Miller, E., and Sim, K.N. (2015). An assessment arms race and its fallout: high-stakes grading and the case for slow scholarship. Assess. Eval. High. Educ. *40*, 528–541.

Hattie, J., and Timperley, H. (2007). The Power of Feedback. Rev. Educ. Res. *77*, 81–112.

Hazel, E., Logan, P., and Gallagher, P. (1997). Equitable assessment of students in physics: importance of gender and language background. Int. J. Sci. Educ. *19*, 381–392.

Hughes, G. (2011). Towards a personal best: a case for introducing ipsative assessment in higher education. Stud. High. Educ. *36*, 353–367.

Institution of Engineering Technology (2016). Skills and demand in industry.

Jessop, T., El Hakim, Y., Gibbs, G., Hyland, P., Reavey, D., and Scott, I. (2012). NTFS Project Final Report: TESTA (2009-12).

NSS (2017). National Student Survey results 2017.

Pashler, H., McDaniel, M., Rohrer, D., and Bjork, R. (2008). Learning Styles: Concepts and Evidence. Psychol. Sci. Public Interest *9*, 105–119.

Pazio, M. (2016). The discrepancies between staff and students' perceptions of feedback and assessment practices – analysis of TESTA data from one HE institution | Practitioner Research in Higher Education. Pract. Res. High. Educ. *10*, 91–108.

Price, M., Carroll, J., O'Donovan, B., and Rust, C. (2011). If I was going there I wouldn't start from here: a critical commentary on current assessment practice. Assess. Eval. High. Educ. *36*, 479–492.

Rasooli, A., Zandi, H., and DeLuca, C. (2018). Re-conceptualizing classroom assessment fairness: A systematic meta-ethnography of assessment literature and beyond. Stud. Educ. Eval. *56*, 164–181.

Richardson, J.T.E. (2015). Coursework versus examinations in end-of-module assessment: a literature review. Assess. Eval. High. Educ. *40*, 439–455.

Stobart, G. (2008). Testing Times: The uses and abuses of assessment. Test. Times Uses Abus. Assess. 1–218.

Yerworth, R., Gibson, A., Griffiths, J., and Garcia Souto, P. (2017). Contextualising the teaching and assessment of Engineering skills. In 45th SEFI Conference, (Azores, Portugal).