DEEP LEARNING: A CASE FOR GRADUATE APPRENTICESHIPS

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Abstract: Work-based learning is driven by the need to learn to do a job. For Graduate Apprenticeships (GAs), which lead to a degree and therefore degree-level roles, the structure of GA programmes needs to be more flexible and the assessment more contextualised in order for apprentices at this level to meet the wide range of needs of graduate employers and vice versa. The expectation is that success in the workplace through learning to do a job, perform a role, undertake a project etc. is driven by deep learning – the need to understand the how and why – rather than the surface learning that is part of the learn, pass, forget cycle that many learners fall into in modular programmes. Graduate Apprentices can learn in the traditional way, but also from other apprentices and other colleagues, and these forms of learning promote thinking and reflection. Traditional academic programmes deliver the same teaching and learning to every learner at the same stage of the programme and assess each learner in the same way, commonly using formal examinations as well as coursework. With work-based learning, because every job role is different, there is the opportunity to provide unique learning and assessment opportunities for each apprentice within the same degree framework. To make work-based learning degrees work, the assessment needs to be made up of activities undertaken in the workplace. Unlike the traditional assessments, these GA assessments won't be rigid but will be individually tailored to each apprentice based on both course and workplace requirements. This paper discusses how deep learning is embedded in Heriot-Watt University's Graduate Apprenticeships programmes.

Keywords: graduate apprenticeships, work-based learning, situated learning, engineering education.

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1. INTRODUCTION

Pedagogically there are a myriad of issues surrounding the use of end-point assessments and examinations such as their encouragement of short-term learning and poor work habits (Gibbs, 1981; Gibbs, 1992; Dysthe, et al., 2007). Instead, the assessments in Heriot-Watt University's (HWU's) Graduate Apprenticeship (GA) programmes encourage deeper learning and a higher level of learner autonomy and responsibility as advocated by the Quality Assurance Agency (QAA) in their quality code document (QAA, 2018).

Definitions of work-based learning (WBL) in the literature are often vague and, in some cases, contradictory (Burke, et al., 2009), here we utilise the definition of work-based learning developed by the QAA:

"Work-based learning courses and opportunities are designed and developed in partnership with employers, students and other stakeholders (where appropriate) and contain learning outcomes that are relevant to work objectives. Work-based learning consists of structured opportunities for learning and is achieved through authentic activity and is supervised in the workplace. [...] Work-based learning opportunities enable students to apply and integrate areas of subject and professional knowledge, skills and behaviours to enable them to meet course learning outcomes." (QAA, 2018)

The WBL assignments in such courses require learners to situate their learning using contextualised examples of the skills, knowledge and/or theory delivered as part of the course to demonstrate their competence against the learning outcomes, just like the apprentice tailors studied by Lave (1988) who observe that apprentices gradually participate fully in the practices of the profession over the course of their apprenticeship. Building on the process described (c.f. Stein 1998, after Lave 1997) as "way-in" and "practice", could this be described more clearly as "observe-try-practice-perfect" with the first half taking place in the classroom and the latter half in the workplace. This would definitely be described as an authentic assessment by Villarroel et al. (2018) as it meets all of their criteria:

- Realism – as the learners are in the workplace, the activities they are undertaking are indeed real as they link the theory with their work.
- Contextualisation – the learners (with the assistance of their Work-based Mentor and Personal Tutor) are recognising activities in their workplace where theory can be applied in an analytical and thoughtful way.
- Problemisation – the learner brings the theory together with the activity to solve a problem or meet a need.

This paper, we describe the assessments that have been implemented in an Engineering GA programme. By shifting the balance of assessments towards a larger contribution for the contextualised WBL over more traditional fixed assessments such as examinations we hope to encourage the learners to adopt a deeper learning mode.

2. WORK-BASED ASSESSMENT

The assessment for HWU GA courses in the BEng (Hons) Engineering: Design and Manufacture (EDM) programme is comprised of two types of assessments: class tests/assignments and WBL assignments (for which marking rubrics are available to the learners). Typically, 80% of the assessment is work-based with the remaining 20% coming from the class tests or assignments. The specific number of assessments of each type can vary in other courses within the GA programme, but the form and weighting of these are the same – work-based learning assessments accounting for a minimum of 80% and class tests making it up to 100% (some courses have no other assessments and are assessed 100% by work-based learning assessments). Chris Rust (2002) noted that the most common reason for 'Teaching, Learning and Assessment' to lose points in QAA

subject reviews was due to inconsistent assessment practices; thanks to this common assessment setup, this is not an issue for these programmes.

2.1 Work-based learning
Work-based learning assignments are done in the workplace, where possible as part of the apprentice's regular duties. Unlike the traditional Vocational Qualifications (VQ) assessments, these GA WBL assessments are not mapped against a rigid set of outcomes: there will be some defined learning outcomes, but it is up to the learner, Work-based Mentor and Personal Tutor to devise ways that the apprentice can demonstrate the required outcomes in terms of knowledge, skills and competencies to the appropriate level. Some of this assessment may be similar to VQ assessments in the sense that it amounts to "has the learner demonstrated competency in using a procedure or piece of equipment to the required standard", but many will look like traditional academic assessments contextualised to the workplace of each learner.

Both types of assessment are set up in such a way that they may be considered as both formative and summative. Maddalena Taras (2005) reflected on previous academic works and arrived at the following definitions:
- Summative assessment is a judgement which encapsulates all the evidence up to a certain point, usually in the form of a mark or grade.
- Formative assessment is the same process, but it differs in two ways: it includes feedback which defines the 'gap' between the submitted work and the required standard and indicates how this work can be improved to meet this standard; and it can include a mark/grade or not.

Prior to submission of the final work-based learning assignments for marking, the learner can receive feedback on a draft submission. This feedback will be constructive in terms of suggestions for improvement, but a mark will not be given for the draft submission; thus, this part of the assignment is Formative. Learners may then use the feedback to improve their work-based learning assignments before their final submission, which is now assessed as a Summative assessment: a mark is given based on the rubric and further feedback is given to allow the learner to improve future assessments. As Nirit Glazer stated (2014): "using both summative and formative assessments is an important mechanism for identifying potential weaknesses regarding the instructions"; the apprentices get a first try at the assessment and any misconceptions or shortfall can be addressed via the feedback.

Apprentices can sometimes find it difficult to understand the assessment criteria which is reflected through the format/method of evidence submitted. An effective way is using exemplars (samples of previous work or instructor-constructed examples) that "supports and advances students' subject knowledge" and "facilitates students' awareness of their own work and thinking" (Hawe, et al., 2019).

In order to fully contextualise the learning to their specific field specialisms of the learners' employer, the learners can choose to focus on particular areas of the course that are most relevant to their individual duties; this results in learners meeting some learning outcomes at a much deeper level than others – while the broad span of the syllabus is covered by the class tests to assure that there are no blind spots.

Deep learning is further promoted by the sustained engagement with the work-based project environment over a longer period than the more traditional semester-based projects and are more likely to last at least for the duration of the academic year (Boud & Falchikov, 2006). Layered understanding of concepts from the university level to the high-level application of a successful work-place project.

Better metrics of success also encourage deep learning. A thorough understanding of subject specialism is incentivised by the work-place apprentice as the successful project result, culminating from deep understanding of the underlying academic theory, is measured by the company and the project utility. This is lacking in the traditional UG courses where the only metric of success is traditional rubrics. Within the GA degree, both metrics are used for communicating the level of success.

2.2 Class tests
Class tests in the first two years of the GA courses in Mechanical Engineering allow learners unlimited attempts; for each attempt a different set of questions are presented. Therefore, the only way to pass the test is to understand the material (rather than remembering previous answers or copying from classmates). The multiple attempts enable the learners to learn through the assessment and transforms an otherwise static assessment into an opportunity for continuous improvement. In order to deal with the flexibility built into the work-based learning assessments, the class tests include sufficient questions to test the learner against all of the course learning outcomes. Graham Gibbs (1981) found that 'students who were made highly anxious by a test approached their study in a 'surface processing' way and made ineffective, reproductive attempts to answer the test questions'; by reducing the weight to a maximum of 20% and allowing multiple attempts, thus the threat of the 'big test' is avoided and learners can approach the assessments in a deeper, more effective learning mode.

2.3 Assessment timing
Learners must submit evidence of their fulfilment of the course learning outcomes by the end of the academic year (in July); by giving the learners all year to work on their work-based learning assessment, we create enough space to allow learners to attain what is most valued in learning whilst allowing them to exercise their right to succeed or fail. The all-year nature of the course also serves to defeat the compartmentalisation of learning (Harland, et al., 2015), which arises when courses are fully delivered and assessed within one semester with no requirement or expectation to revisit or build on that learning. It also helps apprentices to better manage their workload, think and reflect on learning outcomes, and deconstruct the barriers to learning created by the constructs of modular programmes. As multiple courses are running in parallel in this case, learners are actively encouraged to link their learning together with the learning from other courses, integrating and deepening their understanding and decompartmentalising their learning. This allows the learners to economise on their long list of required work-based evidence by matching complementary requirements into a smaller number of activities, which in turn facilitates a deeper approach to learning as students forge stronger links between different parts of the course theory (Biggs & Tang, 2011; Rust, 2002).

2.4 Challenges

Apart from all the obvious benefits that work-based assessment affords for the learner, it does not come without its issues. The learner, helped by their line manager, work-based mentor, and personal tutor, must work to identify suitable activities in order to create suitable evidence: this can be quite challenging and can sometimes cause issues due to mismatches between what employers' value and what is required by the university for assessment (Angrove, et al., 2021). The coronavirus pandemic has caused serious issues for learners, with some being placed on furlough, and others having to work from home. To address this, a number of simulated activities and scenarios were created that the learners could work through and contextualise to their workplaces.

Each learner will produce unique evidence for their work-based learning assessments based on the available activities of their workplace, the selection of which requires learners to develop the skills of meta-cognition in order to recognise and learn from these activities (Brodie & Irving, 2007). The development of these meta-cognition skills can be difficult for the learners to achieve. In order to design a suitable work-place activity to form their evidence around the learner demonstrates what is required from the course and the assessment, the learner has multiple opportunities prior to the deadline at the end of the year to discuss this with the course leader and any gaps, shortfall or misconceptions can be identified and corrected.

3. CONCLUSION

Overall, it is clear how these assessments relate to the course learning outcomes: the class tests assess all areas of the course at a low level – can the learners solve stated problems by applying the course theory – while the work-based learning assessments allow the learners free reign to apply a subset of the course theory at a much deeper level in the context of their workplace. In other words, they achieve all of the learning outcomes at least once and then reinforce that by providing evidence of them actually using their learning in a live work activity.

Feedback is provided first on a draft submission and then again on the final marked assignment which serves to correct any misconceptions and plug any gaps that may exist. The assessment in this course avoids the trap that other courses can fall into where the assessment and not the curriculum defines the learning (Biggs & Tang, 2011). As each course contains at least one work-based assessment, this provides multiple opportunities and practice for the learners in receiving, interpreting, reviewing and acting on feedback, as suggested by Carless & Boud (2018).

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