

# **KEEP YOUR STUDENTS IN THE DARK – DON'T LET ASSESSMENT SUPPRESS CREATIVITY**

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## **ABSTRACT**

Project based learning is a valuable tool in the teaching of engineering design. For example undertaking a design and make project can aid the development of subject knowledge whilst demonstrating meaning in subject specific higher skills. Where innovative assessment within project based learning can offer enhanced learning is through the ability to assess the progress of learning in addition to outcomes.

Traditional approaches to assessment utilise formative assessment to provide feedback to the student and summative assessment as a measure of the product.

Two aspects of this traditional approach reduce the potential for creative thinking; the desire of the learners to meet the perceived objectives of the lecturer, and, the inability of the learner to ignore their experiences and observations of their wider environment. These aspects reduce creativity and risk taking.

This paper will describe how integration of an assessment for learning (AfL) approach has utilised both formative and summative assessment of the learning process to support creativity within the design process.

During the project the student is guided through an exploration of the knowledge required to support a questioning of the final task before that task is revealed and the final objective outlined. In the way a formative dialogue may take place which gives the learner a confidence and freedom to innovate.

This approach is seen as student centred, valid, reliable and affordable whilst also promoting creativity and problem solving.

*Keywords: assessment creativity, project based learning, assessment for learning*

## **1 INTRODUCTION**

Design serves a fundamental role within an engineering degree programme as defined within the QAA revised Subject Benchmark Statement[1] states;

“Design.....involves significant technical and intellectual challenges and can be used to integrate all engineering understanding, knowledge and skills to the solution of real problems”.

It goes on to state that graduates need to use creativity to establish innovative solutions, therefore it is appropriate to consider if traditional approaches to the teaching of engineering design meet all of these criteria. Or more specifically do current approaches to assessment enable the design activity to contribute to these key learning objectives? Particularly as research on students response to assessment suggests that in defining

assessment tasks the teacher is giving students a clear direction about what they should learn and how they should go about it[2].

Constructive alignment of learning activities appropriate to the curriculum objectives[3] enables deeper learning so it may also be appropriate to consider how assessment may also form a part of these learning activities rather than just an adjunct required to take a measurement upon which to base an academic qualification.

So what is it that we need to do to enable assessment for learning within design to support both deeper learning and facilitate the use of creativity to reach innovative solutions?

At Northumbria AfL draws upon these six conditions

1. an emphasis on authenticity and complexity in the content and methods of assessment rather than reproduction of knowledge and reductive measurement
2. using high-stakes summative assessment rigorously but sparingly rather than as the main driver for learning
3. offering students extensive opportunities to engage in the kinds of tasks that develop and demonstrate their learning, thus building their confidence and capabilities before they are summatively assessed
4. providing an environment that is rich in feedback derived from formal mechanisms e.g. tutor comments on assignments, student self-review logs
5. providing an environment that is rich in informal feedback, e.g. peer review of draft writing, collaborative project work, which provides students with a continuous flow of feedback on 'how they are doing'
6. developing students' abilities to direct their own learning, evaluate their own progress and attainments and support the learning of others

## **2 ENGINEERING DESIGN, CREATIVE SKILLS AND LEARNING**

Design is about finding creative and innovative solutions through the application of technical understanding and problem solving skills. But how do creative skills fit within learning? The expectations of employers place such skills to the fore, looking for graduates with 'the ability to master something difficult' but conclude that 'there is some debate over the role of universities in developing such skills'[4]. This criticism may be justified as design tasks have been seen to be constrained and focussed upon the reinforcing of the acquisition of knowledge[5].

This paper suggests that by moving beyond a preoccupation with outcomes based assessment, where learning is predicted and driven by definition of the assessed tasks, towards assessment of how the learning is happening. In this way creativity and innovation will be enabled, the student will not be able to strive to meet the teachers expectations - they will start in the dark but make their way out into the light.

The fundamental concept is to use a dialogue between teacher and student, or commonly for design teaching a group of students, to build confidence in the ability to engage with their learning and deepen their understanding.

Creativity requires situations and spaces, the context is set by the teacher through definition of the task, or in this case initially parts of the task, and the resource both physical and cognitive will enable inquiry and enable students to value their own ability therefore they will be freer to be creative and test their abilities.

The levels of understanding as outcomes of learning, table 1, as defined by Entwistle[6] allow a straightforward appreciation of how a developmental dialogue, with feed forward formative comment, which takes place during the early stages of the project can support the development of higher level skills.

Table 1 Levels of understanding as outcomes of learning[6]

Mentioning	Incoherent bits of information without any obvious structure
Describing	Brief descriptions of topics derived mainly from material provided
Relating	Outline, personal explanations lacking detail or supporting argument
Explaining	Relevant evidence used to develop structured, independent arguments
Conceiving	Individual conceptions of topics developed through reflection

Defining four stages of a project; preparation, incubation, illustration and verification Lewis[7] identifies the first, preparation, as being the stage at which the teacher has the most influence, enabling the student to extend their ‘database’ of intellectual resources.

### 3 A NEW STRUCTURE FOR DESIGN PROJECTS

This new structure which sets out to enable deeper learning, creativity and innovation whilst giving significant opportunity for forward feeding feedback and reducing the students focus on summative assessment. Project based learning is frequently used within the teaching of engineering design, this method is ideally suited to the widely used ‘design and make’ project. This can be illustrated by an example generic teaching plan (time intervals are not necessarily uniform, especially between sessions 3 and 4).

Session 1

- Preparation with the students; form the groups, set out how the project will be run, outlining the use of the formative/feed forward templates whilst stressing the need to retain all paperwork as this forms the main component of the ‘final report’.
- Activity; define the first foundation defining step.

Session 2

- Students complete the first template which records their findings of the first foundation defining step.
- Students and tutor review the template, reflecting upon the first foundation defining step, agreeing and recording summary outcomes on the template as guidance for subsequent activity.
- The tutor defines the next formative step which is also recorded on the template.

Session 3

- This is a repeat of the previous step, recording the previous outcomes and defining the next step, taking care not to present solutions but if direct guidance is required this is presented as options, a procedure which is repeated for each foundation stage as required.
- After the predetermined number of ‘knowledge building’ foundation stages the final project objectives are revealed to the students and they are reminded of the summative assessment requirements (as described below)

Session 4

- Students present project outcomes, receive final formative feedback from tutor and complete their short reflective report and portfolio of developmental evidence for summative assessment.

### 4 ASSESSMENT STRATEGY

This approach to incorporating AfL within project based learning applied to the teaching of engineering design aims to move both the teacher’s and the students’ assessment burden from the final stages of the project to be more evenly distributed over the course of the project as a dialogue for learning.

The formative feedback is forward focussed and sets out to support deeper learning[8] by;

- Monitoring understanding and addressing any problems
- Monitoring and developing specific knowledge and generic skills
- Monitoring and enhancing the quality of work produced

Fundamental to the redistribution of the assessment burden is, in part, supported by the use of the templates (pre-printed forms upon which progress, reflection and tutor comments can be recorded) at each stage of the dialogue. This is to facilitate feedback and also to overcome some of the perceived shortcomings of the traditional use of a summative final project/design report.

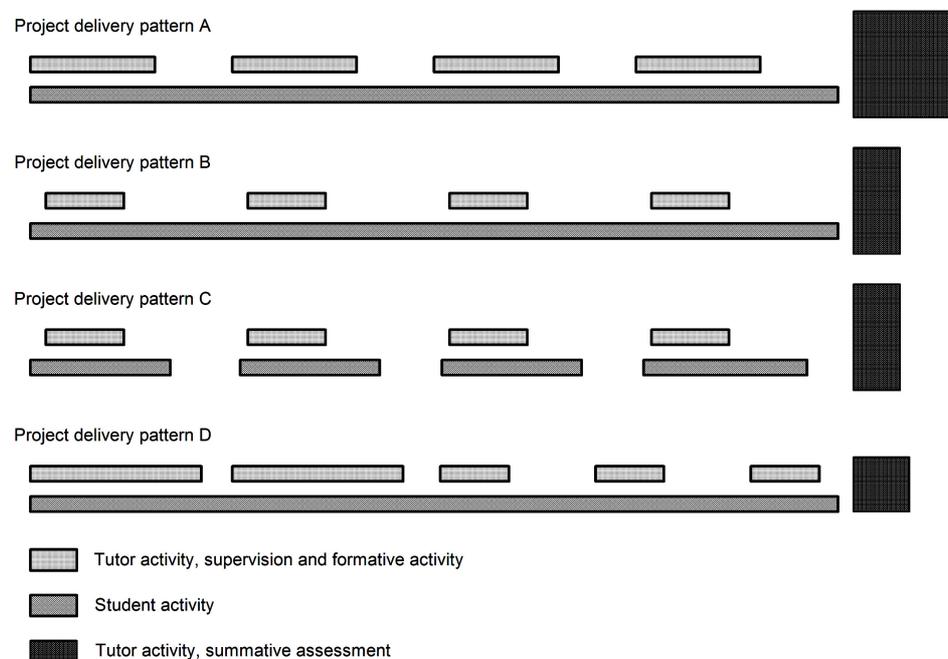


Figure 1. Characteristic project delivery patterns

In Figure 1 an idealised delivery pattern for project based learning is represented in pattern A where tutor and student activity, both formative and summative, is shown as progressing from left to right. When staff time is under pressure and the number of groups supervised increases there is a tendency to attempt to reach this idealised pattern but supervision and formative activity is reduced and a pattern of the form of pattern B is the outcome. As the dialogue between tutor and student declines it is possible that the engagement with the project by the student will reflect the reduced tutor engagement and pattern C may be the outcome.

The approach to project based learning described in this paper is believed to support the tutor student dialogue whilst being represented by delivery pattern D. Here there is a focus on the process of the design project through the formative dialogue and a reduction in the burden to both the student and the tutor of the 'final report' employed by the traditional summative assessment with an almost exclusive focus upon the project outcomes.

In addition to the use of the formative templates to complement the 'face to face' tutor feedback sessions the students are made aware that the summative assessment is fundamentally founded upon evidence of their active involvement a structured design process evidence of problem solving and decision making which has occurred during the period of the project. This is a departure from the approach that the students may be familiar with for projects work, and there is an initial reluctance to trust that drafts, copies of planning sessions, developmental sketches etc. are what is being requested for the following reasons;

- they are a record produced at the time, therefore reflect decision making based upon the evidence available at the time,
- all concepts and ideas put forward should be represented, - a complete record the pace of progress is shown and also any learning from mistakes etc. is recorded,
- a planned structure is encouraged - sketches and drawings must be shown to predate trials or prototypes to remove the tendency to 'knock something up and draw it later',
- this material will be generated during the course of the project - so why increase the burden on the student by asking for a summary which would actually contain less material of interest?

The final assessment will meet the graduate attributes given by Oehlers, such as; competence in critical and independent thinking, ability to effectively synthesise information and ideas, ability to apply an integrative or systems approach to solving engineering problems if it is a record of the process which avoids any of the issues which arise when student activity is driven by the perceived requirements of traditional outcome based assessment.

## **5 CONCLUSIONS**

This suggested structure for project based learning employed for engineering design activity has been employed during both the early and also latter stages of undergraduate programmes. It is also a suitable technique for short projects of only a few hours in addition to projects run over a number of weeks a feature which allows a preparatory trial run before embarking on a longer exercise - an approach which gives student confidence in project based learning.

So is it that the students should be kept in the dark? It is suggested that this is certainly the case if otherwise they were to only focus upon the end of the tunnel and rust towards the light without and knowledge of what there may be to cause them to trip.

It may be more appropriate to suggest that the approach outlines here is based upon the concept of showing and discussing aspects of the whole landscape with the students before they are told the destination of their journey. Can a design project become an enlightening magical mystery tour?

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