CREATIVITY IN MASS-EDUCATION CONTEXTS

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ABSTRACT
This paper discusses a learning framework (working title: 'fog framework') that has been developed in response to the challenge of teaching creative subjects in a mass-education context. The framework is an evolving one in the department of Design, Manufacture and Engineering Management (DMEM) in the Faculty of Engineering at the University of Strathclyde. The framework has been generated within the context of a level 3 undergraduate module. It is intended that the framework can be applied to any discipline in design or engineering and potentially further to any academic discipline concerned with developing creativity in a mass-education context.

Keywords: Creativity, large class sizes, learning frameworks, uncertainty, ownership, studio design projects

1. INTRODUCTION
This introduction states the *contexts* in which the framework has developed.

1.1 Departmental context
DMEM has seen a significant increase in its in take of undergraduate students over the last four years with a current departmental target of 110 students per year. This increase in students has been driven by wider economic and government in the UK that affect all Higher Education Institutions (HEIs).

1.2 Creativity context
Of particular challenge is how to teach creative design subjects within this mass-education context. Creativity is defined by the Cox Report as 'the generation of new ideas', whereas design is 'what links creativity and innovation. It shapes ideas to become practical and attractive propositions for users or customers' [1]. These issues are of particular relevance to DMEM, whose ethos is 'creating, making and managing'.

Creative design subjects are usually regarded as requiring more resources than creative written or numeric subjects. Examples of such resources being *specialist equipped space* such as design studios, technical workshops or computer labs; a *high level of contact time* between tutors and students, provided by a higher level of staffing and/or increased teaching hours; and the *materials supply* for visual communication or physical making.

1.3 Teaching context
Details of the level 3 undergraduate module in which the framework was developed (Industrial Design) are not given here as the paper wishes focuses on the generic issues of teaching creative design subjects to large class sizes. However, indicated below are

some departmental resource constraints that acted as key drivers for the development of a generic learning framework:

- DMEM does not currently have a large enough studio or workshop space to teach creative design activities to 110 students in one sitting.
- The tutor to student ratio (1:23) and the class contact time (3 hours per week) does not allow for any substantial 'one–to-one' tutor contact with the students that might exist in Small Specialist Institutes (where the ratio can be as low as 1:10).
- The department *does* have various studio and discussion spaces that can support 50-80 students, depending on the activity, and which are available outside of class time to use on a drop-in basis.

2. CREATIVITY AND QUALITY LEARNING

It is important to first justify why creativity is important to education. Proven learning frameworks relate specific types of learning activities to quality learning and these learning activities can be viewed as creativity.

Bloom's (1956) first 'Taxonomy of Educational Objectives' concerning the cognitive domain is a learning framework widely recognised and used within HEIs particularly for defining learning outcomes [2]. The use of learning outcomes is increasingly widespread, and this is especially relevant for engineering education with the recent introduction of the UK Standard for Professional Engineering Competence (UK-SPEC) which states that 'the output standards for accredited engineering programmes will encompass two different categories of learning outcomes'[3]. The highest levels of Bloom's taxonomy used for learning outcomes are synthesis and evaluation. These are cognitive activities that are commonplace in design projects and fundamental to creativity.

Biggs' work on quality learning, which is becoming widely recognised within HEIs, has a framework from which similar conclusions can be drawn [4]. The Structure of Observed Learning Outcome taxonomy shows quality learning becomes active when a student engages with qualitative cognitive activities that are concerned with theorising, hypothesising and reflecting – this in itself is a description of the activities of creativity.

Much of Biggs' discussion regarding quality learning is concerned with ideas of conceptual change and 'deep' approaches to learning. Such concepts can be interpreted as having not only cognitive resonance, but also emotional resonance. That emotions are closely related to learning is a view supported by recent research by Milton in the field of social anthropology [5]. Drawing on the work of Lazarus [6], Milton argues that 'what we learn from a situation produces an emotional response which affects how we think about that and other situations we encounter'. In other words, 'emotion engages dialectically with cognition in the process of learning' [5].

A direct association between emotions, learning and creativity can be drawn from Bloom's second 'Taxonomy of Educational Objectives', which concerns the *affective* domain [7]. This second taxonomy is much less cited in education practice, but is worth re-visiting as it is closely related to emerging research as regards emotional or experiential learning. This taxonomy shows high levels of affective learning are concerned with 'Conceptualisation of a Value' and 'Organisation of a Value System', both of which are highly creative activities.

It is clear that creativity is closely linked to quality learning. The way to teach creativity, and quality learning, would therefore be to expose students to cognitive and emotional learning scenarios. This is supported by Cowan in defining teaching as, 'the

purposeful creation of situations from which motivated learners should not be able to escape from without learning or developing' [8] and Biggs contextualises 'this is deep learning by definition' [4]. Such situations are what happen in creative design projects. When creative design projects are taught to in large class sizes, however, it is necessary to draw out the conceptual essence of what a creative design project actually *does* cognitively and emotionally and construct this as a *framework* to expose it to a wider student group.

3. UNCERTAINTY

The first framework concept is to expose students to 'uncertainty'. This exposes the students to an appropriate cognitive and emotional scenario which provokes creativity. Uncertainty becomes active when a specific aspect of a education project is designed to be uncertain. It could be in the solution outcome, the methods to be used, or the project brief. It is recommended to *not* make the learning outcomes uncertain, but to make these *clear* and *generic* to meet the requirements of accreditation for UK-SPEC [3].

Exposing students to uncertainty has additional justification beyond developing creativity. It trains students to become effective professionals. The Engineering Council supports this in the learning outcomes for the UK-SPEC, for example: 'Ability to work with technical uncertainty' and 'ability to learn new theories, concepts, methods etc in unfamiliar situations'. As design and engineering professionals work within increasingly dynamic and diverse, global market economies, they need experience of, and knowledge to work with, uncertainty.

The key issue for running any uncertain learning experience with a large class size is to manage it effectively. If it is not managed then the likely result of an uncertainty in is an overwhelming amount of questions and confusion. Gibbs and Jenkins support this in their discussions of strategies for teaching large class sizes: 'students like a clear framework within which they study. If things are too open-ended they will need more tutorial support, not less' [9]. A *framework* for managing uncertainty is also important for any education system that requires that the learning in a module be explicit. Through a framework for managing uncertainty the tutor can be explicit about the *purpose* of uncertainty but retain its qualities in the project.

3.1 Managing uncertainty

The following framework, developed by business strategy educator Eddie Obeng, is ideal for managing uncertainty [10]. Whilst designed for the management of commercial projects, it can be mapped onto education projects. The framework allows for *contextualisation* of uncertainty through defining the *type* and *scope* of the uncertainty. It is based on '*what* is to be achieved' (i.e. design/s to be produced) and '*how* it will be achieved' (i.e. method/s to be used). Once these are established, learning outcomes can be clearly defined.

Painting-by-numbers

This is a closed project. There is no learning outcome for this type of project. Students would be given a design example to work to and the method to produce the design would already be known. There is no uncertainty for the student and this type of project should be avoided in creative education.

Quest

This is a semi-closed project. The learning outcome is *methods* focused. Students are given a design example and learn methods to achieve the production of the example. This is commonly regarded as *skills* training and might involve such activities as learning freehand rendering or CAD. Generally such projects are positioned early in a design degree and uncertainty feels low for students if the tutor knows the method well. These projects can be made to be more creative when the 'quest' is highly challenging and the students have to expand the potential of methods or develop new methods.

Movie

This is a semi-open project. The learning outcome is *problem* focused. Students are given a design problem and use known methods to find a solution. Generally such projects occur later in a design degree once students are more confident with skills and methods. Uncertainty for the students does exist as the tutor does not have *an answer* to the design problem and therefore the students must invent an answer of their *own*. An important note is that the discipline context of the prescribed method/s will be closely related to the nature of the solution generated. For example, a product designer is likely to respond to a design problem with a product, whereby a service designer is likely to respond to the same problem with a service solution.

Fog

This is an open project. The learning outcome is *issues* focused. Students are presented with a new design issue that is not well understood (even by the tutor) and they must explore this issue in order to frame new problems, novel methods and design solutions. Uncertainty for the student is high. Students are unavoidably situated in a learning experience where they must activate a high level of independence and creative thinking to respond to a very open brief. Examples are responding to complex sustainability problems or addressing how to design for a social issue, such as 'crime'.

There is an emotional and cognitive balance within the above framework. Extremely 'foggy' projects can be emotionally and cognitively demanding for students, as they do not have clear methodologies or a problem to work with. It initially appears to them as an unusual education scenario and can therefore *emotionally unsettling*. 'Fog' projects demand the most responsibility and independence, and present the greatest creative challenge. By contrast, a 'painting-by-numbers' project would be emotionally uneventful and only require low levels of cognitive activity. The recommendation for creative design projects is to expose students to 'fog' projects balanced out with some 'movie' and 'quest' aspects. This makes projects highly creative but not *too* unsettling.

Uncertainty is shown within this framework to be clearly linked to issues of independence and responsibility, which leads on to the next creative learning concept of 'ownership'.

4. OWNERSHIP

'Ownership' is concerned with how much a student views the learning and the work in a project as theirs, and for them, and not the tutors, or for the tutor. It is a key concept for creativity and quality learning but importantly it is a highly effective strategy for teaching large class sizes.

Within Obeng's framework we can deduce a clear relationship between uncertainty and ownership [10]. As students are exposed to an increasingly uncertain

scenario so they must develop their own answers as there is no right answer. Thus creativity, uncertainty and ownership cooperate together as learning concepts.

Biggs supports this perspective, stating 'the learner's perspective defines what is learned, not what the teacher intends should be learned. Teaching is a matter of changing the learner's perspective, the way the learner sees the world' [4]. This is a deep student-centred approach, in which learning is focused towards student ownership. Biggs also links conceptual change and ownership: 'Much assessment practice appears not to require any conceptual change regarding learning and so students loose "ownership" of their learning'. In this statement ownership cooperates with quality learning.

The most powerful example of ownership in learning is by Gibbs and Jenkins, who conceptualise ownership as 'independence' and as one of 'two broad strategic options for replacing the conventional patterns of teaching and learning in the UK in order to cope more effectively with large classes' (the other strategy being 'control') [9]. Their independence strategy is concerned with 'characteristic methods' that are clearly associable with creativity: problem-based learning, development of student judgement, and self-assessment, and it places 'the responsibility on students to make use of a range of opportunities to suit their own needs.' This is very similar to the type of exposure a 'fog' project presents.

Thus unfolds the concept of a single learning framework that has parallel effects. A 'fog framework' (or one that has aspects of 'fogginess') can enhance creativity (through uncertainty), manage a large class size (through ownership) and create a process of quality learning (through high level cognitive activities).

5. PRACTICES: STIMULATING TEAM WAYFINDING

Important within a 'fog framework' are specific types of teaching practice. A 'fog framework' cannot use traditional forms of teaching practice such as one-way lectures (imparting information) or laboratories (application demonstrations) as these practices only engage the lower levels of Bloom's cognitive taxonomy and Biggs' SOLO taxonomy.

The teaching practices for a 'fog framework' are:

- Wayfinding talks and workshops
- The coaching of *teams*, not individuals
- Stimulating debate and discussion through *peer* learning

Wayfinding talks involve tutors presenting ideas based on *their* interpretation and knowledge of an issue. These talks are best to come from a variety of tutors (including guest speakers) to offer different views of the project issues. The talks are likely to be contextual, theoretical ideas, method concepts or case study based. Wayfinding workshops involve engaging all the students in an active learning event. They are usually a half-day event and might involve ethnographic research, debating issues, brainstorming or evaluating ideas. The tutor organises a flexible structure for the workshop, where the students have some methods to try, but the students have freedom to develop their *own* learning from the event. Such workshops should be strategically placed in the project, so that they relate to the project phase, whether this is research, concept generation or development.

The above practices are supported by Biggs as part of a quality-learning framework: 'educative conceptual change takes place when … students can work

collaboratively and in dialogue with others, both peers and teachers. Good dialogue elicits those activities that shape, elaborate and deepen understanding'. They are also supported by Gibbs and Jenkins as part of an independence strategy: 'Students can tackle more complex, more extensive and more open-ended projects if they work in groups'; 'Instead of relying on one-to-one supervision tutors need only supervise the group'.

6. CONCLUSION

The framework discussed is abstract in that it discusses a generic learning framework without raising a detailed example of the complexities of the framework in practice. This is deliberate as the key concern of this paper is a generic one. That is, that creativity, quality learning and mass-education can work together synergetically. The paper thus argues against notions that creativity is something that is only teachable on a small scale.

Creativity is now a mainstream economic concern in Western Europe and this is reflected in the Cox Report [1]. Questions for further research include: how might this generic framework be interpreted by other product development departments within and beyond Europe; how might this framework be applied to wider disciplines in engineering; and how might this framework be used within non-design and non-engineering fields.

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