THE DESIGN APPROACH AND ACTIVITY-LED LEARNING

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ABSTRACT
Two approaches to design and engineering pedagogy have been developed at Coventry University. They are the Design Approach which is being applied in the Industrial Design Department and Activity-Led Learning which is being applied across Faculty of Engineering and Computing. They have much in common, including the emphasis on communities of learners and the preparation for entry to professional practice through contact with real life projects. The Design Approach involves an emphasis on project based activity. At the core of being able to engage in designerly thinking, balancing creative and evaluative thinking is a dual processing match of linear and simultaneous processes as a conversation between these two modes of thought. Design students achieving this match must confront and travel through a key threshold which we have labelled the 'toleration of design uncertainty'. Activity-Led Learning is an approach to education based on providing stimulating activity that engages and enthuses students and creates challenge, relevance, integration, professional awareness and variety. An activity is a project, problem, scenario, case-study, enquiry, research question (or similar) in a class-room, in a laboratory, at work, or in any other educational context. Activities will often cross subject boundaries, as activities within professional practice do. Many involve design project work, particularly those for the Faculty's Architecture course. In this area there are significant similarities to the Design Approach. The purpose of this paper is to compare and contrast these approaches.

Keywords: Design approach, activity-led learning, real life projects

1 INTRODUCTION

The Centre of Excellence for Product and Automotive Design (CEPAD) is one of Coventry University's three HEFCE-funded centres of excellence for teaching and learning. It has implemented a five-year plan to reinforce existing teaching excellence within the Industrial Design Department of Coventry School of Art and Design (CSAD) and reflect upon its practices to inform future design education. The project pursued a number of themes such as the exploration of design education in the context of the design community of practice, the internationalisation of design education, threshold concepts in design education and the exploration of visual and spatial creativity through digital technologies. A particular emphasis has been the Design Approach to pedagogy.

The Faculty of Engineering and Computing at Coventry University is large and multi-disciplinary. Encompassed within the Faculty are departments of Mathematics, Statistics and Engineering Science; Mechanical and Automotive Engineering; The Built Environment; Engineering and Knowledge Management; and Computing and the Digital Environment. The Faculty wishes to develop and enhance the student learning experience to promote student retention, engagement, and achievement. The ambition to improve the learner experience is underpinned by a learning and teaching vision to build a community of learners, through employer and profession focussed activity led education. This teaching and learning vision characterises the Activity-Led Learning experience the Faculty wants its students to have. It also recognises that the learning experience is supported in a number of different ways and through a number of different 'agencies' including registry, academic, professional and technical functions. The Faculty's planned £50 million new building design is being informed by this vision and the need to further integrate service functions to support the student experience.

Two approaches to pedagogy are being promoted strongly by two separate academic groupings at the same university. The approaches appear to have much in common but also some significant differences. The aim of this paper is to compare the Design Approach and Activity-Led Learning in order to identify how history, motivation, professional context and academic reflection can influence the development and definition of particular approaches to pedagogy. Examples of implementation can be found in cited references.

2 THE DESIGN APPROACH

There is a long tradition of teaching design through design practice. Students who wish to become proficient as designers spend a significant proportion of their time tackling design problems. Alongside support studies the student experience is of progressively more complex design exercises, often culminating in projects which mimic real world designing. The end goal is often seen as that of achieving a level of capability sufficient for students to function as designers in the real world. This ambition could be seen as their having the goal of becoming part of the community of design practitioners. Their education serves to provide them with a passport to enter this community.

A community of practice is typically a group of professionally qualified people in the same discipline all of whom negotiate with and participate in a mutually understood discourse. This discourse is both explicit and, very often, tacit and the signs of membership are usually unmistakable [1,2,3].

If the notion of design education as providing a passport to enter the community of professionals is to be acted on then it is essential that design professionals be engaged in the process. For Coventry's scheme this is achieved through a number of arrangements.

- A high proportion of the staff has come directly from professional practice. Currently about 65% have come from an industrial background, the majority from the transport industry.
- There is industry involvement in the delivery of the programme. In a 4 year scheme, typically there is industry related project work from year 2 onwards.
- Students have the opportunity to experience professional placements and internships. This happens usually in year 3 and often involves work outside the UK.
- CEPAD engages in client-funded design work and applied research such as the design of the Benero car, and the design and development of Microcab.

These are effective mechanisms for ensuring the professional relevance and industry orientation of the courses of study and that within the programme work is presented to a high level of professional polish. Typically students leave their studies with portfolios of work whose presentation standard matches well the work of the industry design studios. That aspect of the portfolio's function in providing a passport to practice is being met quite proficiently.

Feedback from our industry colleagues is that the element most needed in such portfolios, the excitement or 'wow' factor, is also the most difficult to achieve. Clearly professional competence in presentation is not sufficient on its own. There needs to be a complementary engagement with developing creative design thinking capability.

The contention in the Design Approach is that in order to function effectively as designers they must engage in the designerly way of knowing. At the core of doing this is the ability to engage with design thinking, including tackling vague problems, thinking in a constructive and solution-focused way, and homing in on concrete propositions. In so doing, they typically employ an object language, often in the form of drawings or other visual models. This is a core capability which is shared across different types of designer. In the practice based approach to design education we suggest that the intention could be seen as one of combining the generic designerly thinking with the domain related specialised knowledge, to produce a level of overall capability sufficient to gain entry to the relevant community of design practice.

In the 'Designerly Way of Knowing' [4], Cross characterises design as an activity involving tackling 'ill-defined' problems through a 'solution-led' problem-solving approach. Cross notes that the designer's attention oscillates between the problem and its solution, in an appositional search for a matching problem-solution pair, rather than a propositional argument from problem to solution. This picture of the thinking processes involved in designing corresponds with the classic analysis-synthesis description of the design process. It is clear that for anything other than very simple mental operations, both halves of the brain are involved, as has been shown in EEG maps of cerebral activity during experimental tasks. It would seem that the two processing modes are typically employed at the same time and interactively, and that a more complete understanding of any particular problem arises from the matching of initially separate simultaneous mental operations. The 'dual processing' strategy employed by designers involves a 'conversation' taking place between these two modes [5]. The result of this 'conversation', in what Tovey describes as an 'incubation period', enables a designer to arrive at a ‘solution’ [9]. However, qualitative data from a longitudinal study carried out by CEPAD into identifying *threshold concepts* in design with a cohort of industrial design students from entry (2005) to graduation (2009) showed that some students, presented with typical ‘wicked’ design problems [6] may get stuck in this ‘conversation’. Often students are trying to satisfy what they think tutors want rather than deploying their creative abilities and those who do not get beyond this can remain stranded in what Meyer and Land describe as a ‘liminal state’, while they struggle for understanding [7]. As reported in Osmond et al [8], a threshold concept also features other characteristics: it is *transformative* in that it involves a personal and a conceptual change; *irreversible* in that it will not be easily forgotten; *integrative* in that it allows hitherto unrelated knowledge to ‘slot into place’, and *troublesome* in that it ‘appears counter-intuitive, alien…or seemingly incoherent’. For students who are ‘stuck’, in order to move beyond a liminal state they need to experience a transformation to navigate this uncertainty, and to develop the confidence to challenge design conventions, produce solutions and innovative designs. However from the study it became clear that once students accept that each time they approach a design brief they will experience this uncertainty then they are able to use the tools and methods inculcated within their programme to harness their thoughts and ideas and begin designing. In essence, the research identified a threshold concept, which CEPAD has labelled as ‘the toleration of design uncertainty’, defined as ‘…the moment when a student recognises that the uncertainty present when approaching a design brief is an <u>essential</u>, but at the same time <u>routine</u>, part of the design process’.

From this analysis the notion of providing a safe ‘creative space’ in which the students could experiment emerged. Indeed it was considered that this was a key change and that the design programme should be revised to incorporate both scheduled time and physical space to allow it to happen [9,10]. For those embarking on practice based design education where they will spend much time tackling design problems, these shared capabilities are part of the core competency which they need to master. The designerly way of knowing involves a solution focused creativity in which there is a match of holistic and evaluative processes. In the conversation between these two modes the design uncertainty threshold is engaged as an essential but routine process. Whereas industry engagement is productive in inculcating professional level presentation skills, the achievement of effective designerly thinking could be facilitated by a re-organisation of the design teaching programme. Following a longitudinal study such an arrangement based on the analysis-synthesis grouping and devised to both encourage creative processes, and accommodate the uncertainty threshold, is being trialed. The early signs for its success from both students and industry are encouraging.

3 ACTIVITY-LED LEARNING

In the large and multi-disciplinary Faculty of Engineering and Computing at Coventry University many of the courses within its departments have their origins in sandwich courses delivered in the 1960s when the institution was founded. This contact and involvement with industry gave input into the course content and formation with the sandwich period providing the opportunity for the student to apply their knowledge to ‘real situations’ and obtain experience of working in the industrial environment.

However both in Coventry and across the sector the sandwich element has declined over the years and there have developed strong opinions that graduates, certainly in engineering, were no longer ‘fit for purpose’ [11]. A conclusion drawn from both the industrial and educational inputs was that more experience in applying theoretical understanding to real problems was needed. Clearly the education of graduates requires closer links with industry to provide and help deliver the real problems referred to and, by implication, students who are highly motivated and engaged better with their courses [12].

These issues have been addressed across the sector in the UK and other countries most notably in the USA, UK and Australia, and in Denmark. Pedagogies adopted have included Problem-Based Learning [student led acquisition of knowledge] and Project-Based Learning [staff led application of knowledge] and these are discussed in detail by Mills and Treagust [13]. They conclude that a weakness of Problem-Based Learning is that the knowledge requirement is driven by the student which may result in knowledge gaps whereas *Project*-Based Learning, although more prescriptive, is more relevant to the hierarchical nature of engineering knowledge and to the industrial situation, and a mixed mode which also includes elements of the ‘chalk and talk’ pedagogy may be the best way to satisfy industry and graduate needs. No one solution will fit all courses in all countries due to the local industry requirements, available resources in terms of facilities and staff, and their willingness to be a part of the change process needed to implement the new approach.

In Coventry the Faculty wishes to develop and enhance the student learning experience to promote student retention, engagement, and achievement. Underpinning this ambition to enhance the student learning experience is the recognition that learning is more likely to be effective when students are active participants in the learning process [14]. That is, the learning experience is more likely to have significant positive gains for the learner if they are active rather than passive recipients within it. As McCowan and Knapper [15] point out:

> *Learning in a passive system has a much greater tendency to be both superficial and quickly forgotten. Active involvement in learning helps the student to develop the skills of self learning while at the same time contributing to a deeper, longer lasting knowledge of the theoretical material…..[and] …it is almost the only effective way to develop professional skills and to realise the integration of material from different sources.*

Thus the faculty's ambition to improve the learner experience is underpinned by a learning and teaching vision to build a community of learners, through employer and profession focused activity-led education. A significant motivation for defining and refreshing the Faculty's learning and teaching strategy is that in 2012 the Faculty will move into a new £50 million building. The design of the building has been heavily influenced by the desire to create learning spaces that support and promote the strategy. As Dunn et al. [16] claim, 'the combination of pedagogic vision and building design will provide for an exciting and radical learning space in a technological faculty'. At Coventry the pedagogy adopted is termed Activity Led Learning (ALL) described as [17]:

A pedagogic approach in which the activity is the focal point of the learning experience and the tutor acts as a facilitator. Activity-Led Learning requires a self-directed inquiry or research-like process in which the individual learner, or team of learners, seek and apply relevant knowledge, skilful practices, understanding and resources (personal and physical) relevant to the activity domain to achieve appropriate learning outcome(s) or intention(s). To be appropriate, the learning outcomes or intentions must be consistent with the aims, outcomes and intentions of the programme of study with which the student is engaged.

The beginnings of ALL at Coventry can be traced back to 1989 when a new course in Automotive Engineering Design was to be introduced. This was taken as an opportunity to rethink the formation of engineers with an aim of developing engineering design skills which are inseparable from the professional skills associated with engineering practice, as discussed by Griffiths [18, 19]. The course, which was studio based after a conventional 'chalk and talk' year one, was accredited by the IMechE for CEng, led to highly motivated students with a 90% progression after year 1, and resulted in 90% graduate employment with industry requesting students from this course for sandwich placements and employment. From the point of view of the University there was a cost in providing a dedicated space for the studio activity, and a requirement for staff to change their methods of teaching.

Further impetus to this area of development was provided when in 2005 the Formula Student project of designing, constructing and competing with a single seater race car [20] was integrated into the BEng Motorsport Engineering [19]. The project brought project planning, costing, technical design with engineering science, team working, student motivation and the application of understanding through doing. Student reaction was summed up in comments such as "helpful staff; working as a team; ability to gain experience; fantastic platform to learn from; enables us to apply what we learn within a real project". Other perceived benefits were an increase of the integration of academic and support staff focusing on the student learning experience, students taking a greater responsibility for their learning, peer learning and an opportunity to reflect on career aspirations.

Examples of recent implementation of Activity-Led Learning are described in references [17], [21] and [22].

4 DISCUSSION AND CONCLUSIONS

Clearly the Design Approach and Activity Led Learning have much in common. This is not unexpected as the practice and industry orientation for their activties are part of the history and identity of Coventry University, and something it shares with many other technical and vocationally orientated institutions. Furthermore there are close links between the Faculty of Engineering and Computing and the School of Art and Design, particularly between Mechanical and Automotive Engineering, and Industrial Design.

In each approach there is an intention to ensure the active and effective involvement of industry and relevant professionals in the education process. The mechanisms and arrangements for doing this are very similar, involving as they do such things as industry engagement in practical activity and project work. Whereas in the Design Approach this is explicitly perceived as relating to the notion of preparing students for entry to the community of professional practice, in the Activity-Led Learning approach there is a similar but implicit notion. Indeed it is regarded as both fundamental and self-evident, and as such not remarkable. What is more explicitly stated in ALL is that a community of learners should be developed as an overt intention to facilitate an appropriate pedagogic dynamic. This is not an identified ambition of the Design Approach but is an assumed intention, recognized as a desirable characteristic of a studio culture.

The origins of ALL in Automotive Engineering Design lead to an expectation that it will have things in common with the Design Approach, and it has. The Faculty is large and multidisciplinary, and it contains a wide range of courses and programmes. Of these its Architecture course in the Department of the Built Environment probably has most in common with the Transport and Product Design Programme in the Industrial Design Department, in Art and Design. It has a large component of studio based design practice and a commitment to design projects which increase in scale and complexity as the course progresses. Indeed it is clear from discussion with its tutors that students on the course have a similar experience of the design uncertainty threshold, and that one of the intentions in the studio context is to create an environment in which students can deal with it successfully. The similarities with the operation of the studio culture in Industrial Design appear to be quite considerable.

There are some differences in the motivation for the definition of the terms. Certainly the definition of both the Design Approach and Activity-Led Learning resulted from attempts to make sense of existing practice and to highlight effective practice, but in Activity-Led Learning there were additional sources of motivation. One was to identify a strategy to guide the design of the new building, and another was to spread this approach to education to areas of the Faculty in which it has traditionally been less pronounced. This latter aim is being achieved by highlighting the importance of Activity-Led Learning in the Faculty, and to some extent imposing minimum expectations for its introduction in courses where it is less developed. So there are two main differences. One is that the term 'Activity-Led Learning' is used to characterise educational approaches across a wider range of academic disciplines than the term 'the Design Approach'. The other is that while both terms represent an attempt to make sense of existing practice, 'Activity-Led Learning' has an addition function – to promote change. Overall it is clear that the two approaches can happily co-exist with the Design Approach's being located in the broader context which Activity-Led Learning provides.

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