CONSTRUCTING KNOWLEDGE: A PEDAGOGICAL EVALUATION OF DESIGN-BASED LEARNING.

VICTORIA JOLLEY, UNIVERSITY OF CENTRAL LANCASHIRE

Abstract

In relation to architectural education this article introduces and discusses design-based learning. It outlines key characteristics and pedagogic theories that support this style of teaching and analyses how students acquire subject specific knowledge as well as key transferable employability and life-long learning skills.

Key words

Design-based learning, problem-based learning, project-based learning, reflection, functioning knowledge, collaboration.

Introduction

Design-based learning is a teaching method that uses the design of objects, forms or spaces as projects to facilitate learning (Gomez, 2011). It is the core pedagogy of architectural education, where curriculum design aims to simulate aspects of professional practice by presenting students with design projects that are addressed in a studio-based learning environment. There are two distinct pedagogic advantages to this. Students are prepared for employment and, whether embarked on as an individual or collaborative assignment, this activity offers rich experiential learning. At UCLan, from as early as the first semester, level 4 architecture students are asked to engage in design challenges set in the studio as group work. In doing so this builds the culture of their architectural education, nurtures the studio's ambiance and reinforces its role as an arena for exchanging ideas.

Knowledge acquisition in design-based learning

Design-based learning offers many benefits to both student and tutor. Because designing is a practical process it is a form of learning-by-doing or active learning. During projects the tutor assumes the role of facilitator and the student, who is at the heart of the learning process, proactively takes ownership of their progress and can self-direct their acquisition of new knowledge and skills through the

exploration of an idea (Doppelt et al, 2008). In this respect design-based learning supports constructivist learning theories where the artificer forms an understanding of a subject or theme by critically reflecting on their first-hand experiences of it. A key supporter of this approach is Professor John Biggs (2002), an education consultant, who was influenced by the work of Tyler (1949). Tyler believed that 'learning takes place through the active behaviour of the student: it is what he does that he learns, not what the teacher does' (p.1). Biggs also uses problem-based learning, a form of design-based learning, as an example of constructive alignment (aligned teaching), where the teacher ensures the learning environment, methods and outcomes support one another to enable the learner to meet curriculum objectives and construct new knowledge through appropriate activities. This is often achieved through the creation of a diligent and thriving studio ambiance and well-structured assignment briefs, workshops and tutorials that address course validation criteria. Projects can relate to live scenarios, sometimes with real clients, and can complement research-informed or work-based learning programs.

Design-based learning can facilitate collaborative learning even when students work individually. Because students work alongside one another in the studio, they engage with each other and contribute to and feel part of a learning community, which in turn increases engagement and motivation. They learn constantly by freely discussing and exchanging ideas and by watching what each other are doing. This exposes them to a greater range of solutions and opinions than if they were working in isolation. A dynamic and vibrant atmosphere is created which rewards them with an 'unlimited opportunity for meeting among people who share an issue which, for them at the moment, is socially, intellectually and emotionally important' (Cunningham, 2005). Simultaneously students improve their communication, presentation and reflection skills and are exposed to group dynamics (Duball et al cited in Neal, 2011, p102). This view is further elaborated by Neal et al (2011) who noted that:

> when students work together in groups to solve complex and authentic problems, it can assist them in developing not only content knowledge but generic graduate attributes, such as problem solving, reasoning and communication skills. Moreover, peer learning takes place, during which

> students learn from each other while they are working together and assessing their own and each other's performance. (p.101)

Knowledge application in architectural design-based learning

In architectural education, learning-by-doing is combined with knowledge application to further intensify the learning experience. This encourages in-depth learning and a practical understanding of a subject as a result of idea exploration and reflection. The designer self-selects, retrieves and researches relevant information, theories and techniques to respond to a design challenge. Mirroring professional practice, the designer demonstrates and performs their understanding of this existing or new knowledge by creatively experimenting and applying it during the design development phases. This transforms declarative knowledge into 'functioning' knowledge (Biggs, 2002, Cunningham, 2005, Gomez, 2011) and requires the ability to combine knowledge with analytical and practical skills. Often in architectural design, data can be taken from a diverse range of sources and the ability to critically analyse, reflect, select and intellectually and creatively apply what is relevant to a project to add coherence to what might be a complicated scenario, creates multiple unique combinations and responses to the same design brief. The advantage of this is highlighted by Kowoltoski (2009), who states that 'given a specific design reference, a student may learn to identify relevant concepts and build a theoretical basis for his/her design knowledge, which can then generate new design solutions.' (p.471) Writing in reference to architectural education in his publication *Educating the Reflective Practitioner,* Schon (1991) expands this process further by stating that:

> designers put things together and bring new things into being, dealing in the process with many variables and constraints, some initially known and some discovered through designing. Almost always, designers' moves have consequences other than those intended for them. Designers juggle variables, reconcile conflicting values, and manoeuvre around constraints – a process in which, although some design products may be superior to others, there are no unique right answers. (p.42)

In architectural education the design process is as important as the final design proposal. Roberts (2007) specifically claims it is 'the students' discussion around the

problem that is the valuable learning experience rather than solving the problem itself.' Because of this it is essential that design development stages are thoroughly documented to record what has been achieved and how it has been discovered. Often sketches or models, either physical or virtual, these initiate discussions during tutorials and reviews. In simple terms the process of architectural design can be described as cyclical, comprising the following stages.

1. Define design problems and criteria in response to a brief – what am I being asked to address/ create/ solve?
2. Determine lines of inquiry – what do I need to know to inform and complete this?
3. Collate, critically analyse and select relevant information/ sources of inspiration i.e. precedent studies, knowledge from other disciplines and theories.
4. Experimentally apply knowledge, theories and techniques to explore and develop a range of options.
5. Choose preferred solution.
6. Select, develop and construct proposal.
7. Evaluate efficacy of proposal.

In architectural education this process is supplemented by tutor and peer feedback delivered through tutorials and reviews to stimulate discussion as well as individual and group reflection.

Reflection in architectural design education

The design process provides numerous opportunities for reflection for both tutor and student. Schon (1991) identifies two types of reflection: reflection-in-action and reflection-on-action. Reflection-in-action is critical thinking that changes routine procedures or outcomes. It questions our current understanding to redefine a problem and through experiment creates new or varies knowledge. Reflection-on-action is retrospective evaluation of what we have achieved which may then be used to inform future action. In a typical design cycle the designer shifts rapidly between reflecting on their actions, for example considering their past experience and feedback, to reflecting in action whilst designing as follows:

1. Reflection by student during design. The student reflects on the brief, the set of conditions and their current knowledge base to determine relevant and additional research required. Once all relevant information has been identified it is used experimentally to inform design decisions. The student then considers the results and revises the scheme as needed.

2. Reflection by student and tutor during a tutorial or review. Using drawn and verbal communication, the student reflects on and describes their design process and current preferred design options. The tutor (and possibly other students) study the proposals and reflect on their repertoire of design experience. Then student and tutor engage in a critical conversation to reframe the draft scheme if necessary. Drawing and talking are used by the tutor to develop and record their alternative options and in doing so also demonstrates their approach to designing.

3. Reflection by the student on the discussion and tutor's demonstration. The student considers the tutor's feedback and revisits the design to create a new drawing. They may also recall and imitate the tutor's design method. The student reflects on the new design relative to the previous scheme and evaluates its implications and possibilities. The process then repeats to stages 1 or 2 as appropriate.

Conclusion

Design-based learning dominates architectural education as it aims to mimic professional practice. It is an example of using modes of learning that mirror professional environments, which also have been used by other practical problem-based disciplines such as music, nursing, teaching, medicine etc to revise curriculum and pedagogy (Webseter, 2008). This approach can provide quality student experience as well as develop many key high-level transferable graduate skills. Students learn how to learn, think critically and how to work autonomously either individually or as a team member, which are essential skills for life-long learning and employment. They also gain the ability to hypothesise, test strategies and evaluate conclusions. In relation to their discipline they acquire a self-directed, in-depth, critical and practical understanding of their subject. This knowledge is dynamic and

may evolve through further investigation, having reflected on personal development plans. In relation to architectural education the design process, learning environment and mode of delivery offers many opportunities for reflection and encourages students to identify their own learning needs or desires.

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