

Intended outcomes

Design Project

Tutors: Andrew Agapiou and Fiona Bradley

The focus of the Design Project will be the interrelationship between Architecture and Structural Engineering. Students will be expected to develop an architectural idea from concept through to detailed design and be able to situate their project within the contemporary discourse on architecture.

Semester 2

Project: Water Taxi Station

Introduction

Glasgow plans to move its Transport Museum from Kelvin Hall to Yorkhill Quay, where the Kelvin meets the Clyde. This will hopefully regenerate this part of the Clyde side and create opportunities for local residents as well as provide an exciting new tourist attraction. A good transport link will be an essential part of the project.

This design project will concentrate on the new transport provision and will involve the design of a Water Taxi Station to transport people across the Clyde to and from the new museum and its environs. The design will involve the provision of plans, sections, elevations and details sufficient to demonstrate the student's understanding of structure and how a small building is constructed as well as issues of context, function and materiality.

The site is steeped in Glasgow lore and offers an abundance of narratives from which the building can emerge, taking stories told on the river as its point of departure.

Project Introduction and Site Analysis

Weeks 1 - 2

Formulation of an initial brief, study of architectural precedents, site analysis including the history of the site (political and economical), views and approaches, scheme design options, ground conditions and relationship to the river. Research Information from recent 4th Year project will be provided.

Scheme Design

Weeks 3 - 5

Scheme development to document a full understanding of spatial organisation and use, relationship to site and environs, construction, integration of services, landscaping, the visual impact of the building (on site and context), the architectural language used and materiality. (Scale: plans and elevations 1:100, sections 1:50)

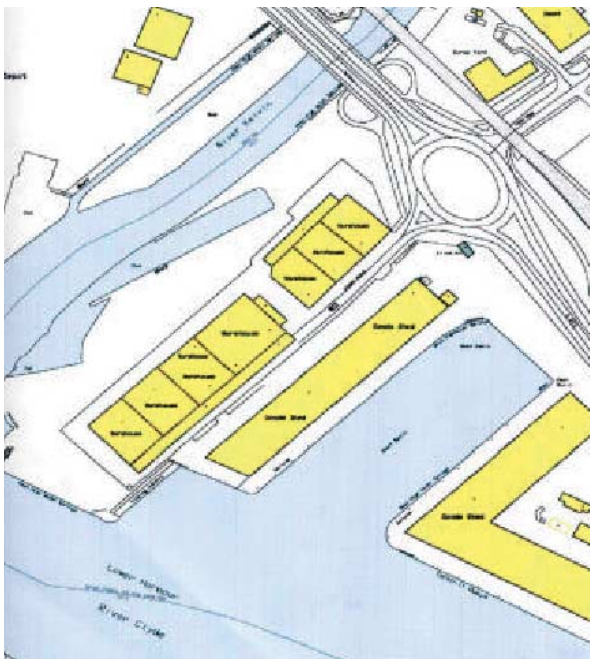
Students will be able to:

- Develop and communicate the quality of architectural strategies and propositions.
- Develop and communicate a comprehensive proposal for the building
- Develop and communicate their structural strategy and choice of materials

Scheme Design Review

Week 6

An interim review of the project will be carried out prior to the commencement of detailed design. Venue and appropriate timetable slot to be agreed.



Detailed Design

Week 7 - 11

Documentation of the physical properties of the scheme, construction details, materials, finishes, colors and textures and details that define the character of the building. Student to produce sufficient construction details and sections to define the building construction. i.e. foundation design, wall and column details, floor construction, beam details, roof details, external wall section, stair detail where applicable. (scale 1:20/1:5)

Students will be able to:

- Develop and communicate the quality of the relationship of the constituent parts of the architectural design.
- Develop and communicate the materiality and construction of the building

Students will:

- Document investigations of the relationship among structure, construction and environment related to the overall architectural strategy.
- Document investigations of the relationship between light, color and materials related to the overall architectural development.

Tutorials

A series of tutorials will be run throughout the semester to cover the elements of detailed design to be covered in the final submission.

Week 1: Introduction and Site Context

Week 2: Structural frame strategies – concrete, steel, load-bearing masonry or timber. Taxi pier strategies.

Week 3: Types of floor construction

Week 4: Types of roof construction

Week 5: Topographical relationship and foundation solutions

Week 6: Review

Week 7: Façade and materiality

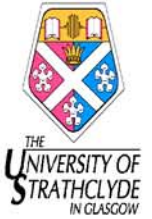
Week 8 – 11: Miscellaneous Details

Submission Date: Monday 7th April 2003 – 4pm.

Integrating Problem-Based Learning within a Traditional Teaching Environment

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Introduction

This poster presents the experience of introducing Problem-based Learning (PBL) into a building technology subject within a traditional Architecture course structure at Strathclyde University. It outlines issues which are involved including the benefits which may be gained and the problems which may be encountered.

Problem-based learning is introduced and compared with other more traditional forms of teaching. It is argued that one advantage of PBL is that it provides a mechanism for severing the reliance on the teacher's knowledge base and empowers students to teach themselves.

PBL may be utilised not only within entire degree courses which follow PBL structures, but also within traditional degree structures. The structural problems which may be encountered in this instance are outlined, and then a case study is used to highlight experience of similar issues.

The case study presented is from a primarily problem-based construction technology subject within a traditionally structured Architecture degree course. The subject is outlined and the students' perspectives of a design project exercise is presented.

Problem-based Learning

Wood (1985) divided teaching methods into three different categories;

Teachers-based;
Text or media-based and
Problem-based.

Teacher-based programmes

Woods describes teachers-based programmes as 'the teacher selects the knowledge, creates the learning environment, develops and uses the evaluation materials, presents knowledge and the problems, and provides a personal image of a professional'

Media-based learning

The second form of learning makes use of extensively documented material presented holistically. Distance education is a good example of this, whereby the full curriculum is established and documented at the commencement of the programme, and students then work at their own pace through the programme. Woods describes media-based learning as 'the teacher selects the knowledge and the sequencing and may provide self-test and evaluation material'

Problem-based learning

PBL is fundamentally different from teacher-based and media-based approaches in that it requires the use of a problem as a primary teaching mechanism. Wood argues 'a learning situation is presented before any knowledge is given. Then once the knowledge is acquired, it is then applied to the problem'.

It is important to realise that any particular programme will not be wholly within one category, and that shades of grey exist across an entire course, within individual subject or units, and within specific problems.

The following table summarises learning responsibilities within Woods three different teaching methods, and examines different aspects of learning within each.

Table of Learning Responsibility

Elements of learning	Teacher based	Media-based	Problem-based
Provision of the learning environment & teaching materials	Prepared and presented by the teacher	Prepared and presented by the teacher	Learning situation presented by teacher; learning materials selected by student
Timing of delivery/when	Determined by the teacher	Student	Student
Timing of delivery/when	After presentation of teaching material	Presented at environment-but can depend on progress	Before presentation of teaching material
Learning responsibility	Teacher	Students	Student - self learning
Professional usage	Teacher presents professional usage	More difficult	Clearly absent
Assessment	Set and assessed by teacher	May include self-assessment	Self-assessment
Costs	Teacher	Student	Student

It is easy to see the relevance of traditional methods to those areas where rules, procedures, formulae etc, are applicable. Thus, for mathematics, engineering and contract administration, the attraction of a traditional programme is significant. It can also be seen that the reliance on the teacher's knowledge base is less critical - as it is easily supplemented by standard references and guides.

It is within the professional degrees such as Architecture, to name a few, that the limitations of the traditional approach have been recognised. In order to enable students to learn the professional discipline, an alternative method is used to sever the reliance between teacher's knowledge base and the students need to learn it. Rather the student is empowered to seek the answers from a wider range of resources (including the teachers) and is guided in that learning process by a series of problems instead of a structured curriculum along academic discipline lines. This is the Problem-Based Learning (PBL) approach.

In order to subvert academic disciplines to the solving of problems, it would be necessary to devolve academic teaching within a course into a problem-centric approach. Courses would need to be designed across the board as problem-centric, and problems would need to be determined which ensure that all of the traditional academic points are learnt by the student as they use the necessary material to solve problems.

How then does PBL work when applied within particular subjects within a course which teaches a traditional teacher-based programme centred about academic disciplines?

PBL within traditional programmes

It can be seen from the discussion above that within disciplines which are systemic and experience based, such as construction technology, there is always a need for an approach which is not reliant on the particular knowledge base of the teacher. 'Educationalists are often inadequately equipped to provide much of the useful knowledge and skills needed by practitioners' (Stratton, 1985). So it is understandable that there has been a move to include elements of PBL within traditional courses without changing the underlying structure of the programme.

However, the introduction of PBL within a traditional framework is associated with structural problems. PBL is not implemented throughout the entire course. The academic content of the course remains primarily taught through traditional teacher-based mechanisms. The PBL subject exists in an inappropriate environment may be subject to the following risks:

1. Students suffer loss of direction because they are used to structured and guided programmes where the learning environment and teaching methods are provided by the teacher
2. Students fail to make adequate progress as they are used to the teacher setting sequencing and timing
3. Students resent the "workload" because they have to seek out answers - whereas they are used to being provided with the information in a structured form
4. The "good" students thrive on the self-learning challenge, the poor students expect information to be taught and therefore fail to achieve
5. The students may feel that any lack of their achievement is the fault of the teacher (through lack of teaching) because the responsibility for the quality of the learning is normally the teachers rather than the students
6. Standardised student evaluations receive low results due to the students sense of alienation with the subject and the assessment procedures being designed for teacher-based programmes
7. Problem-solving becomes subject-specific and narrow due to time and resource constraints

Case study

Building Technology & Environment 3A

The subject Building Technology and Environment (BTE) 3A was revised in 2002 to adopt what was developed to be a problem-based approach. Run over two 10-week terms and with a cohort of 73 Architecture students, this programme appeared extremely successful but not without problems, which were exposed during student appraisal.

The subject examines the world of contemporary architecture and architectural icons to demonstrate how designers use their knowledge of materials, structure and construction techniques to create high quality buildings, particularly at detail level. It is the third and final class that forms the technology and structure component of the Building Technology and Environment course. The teaching staff had backgrounds in Building Construction (1), Structural Engineering (1) and Architectural Design (2).

At the conclusion of the subject the students should:

- be able to examine examples of contemporary architecture and to explain the underlying scientific principles and their application; and
- be able to demonstrate the role of technology at all levels in the design process

The bulk of the students are BSc Architectural studies students, however, some BEng Building Design Engineering students also take the subject. The Architecture and Engineering students will have completed the first two years of their course prior to the start of BTE3A.

While the subject utilises problem-based learning, it also includes formal lectures which are assessed by examination at the end of the first term. The remaining 50% of the assessment is in 3 stages, based on a design project. All assessment is compulsory. The focus of the project is to examine the inter-relationship between Architecture and Structural Engineering. Students are expected to develop an architectural idea from concept through to detailed design and able to situate their work within contemporary discourse within architecture.

Water Taxi Station design

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Yorkhill Quay, Glasgow



Aerial view of Transport Museum site

The site is steeped in Glasgow lore and offers an abundance of narratives from which buildings can emerge, taking stories told of the river as its point of departure.

Stage One - Site Analysis & precedent study

We asked students to formulate an initial brief, study architectural precedents, undertake a site analysis including the history of the site (political and economic), views and approaches, scheme design options, ground conditions and relationships to the River. Research information from recent 4th year projects were provided to the students. Students were given 2 weeks to complete the site analysis and precedent study

Stage Two - Scheme Design

The students were asked to develop a scheme for the water taxi station. This required students to document their understanding of the spatial organization and use of the building, relationship to site and environs, construction, integration of services, landscaping, scheme design options, visual impact of the building (on site and context), the architectural language and materiality. Students were required to produce plans and elevations to 1:100 scale and sections to 1:50 scale by week 5. An interim review of the scheme design was then undertaken, involving part-time architecture tutors. Students were assessed on the quality of their architectural strategies and propositions, and structural strategies adopted.

Stage Three - Detailed design

The students were required to produce detail designs of their scheme to 1:5 & 1:20 scale. This involved documenting the physical properties of the scheme, construction details, materials, finishes, colours and textures and details that define the character of the building. Students were also asked to produce sufficient construction details and sections to define the building construction, i.e. foundation design, wall and column details, floor construction, beam details, roof details, external wall section, and stair detail where applicable.

The students' solutions

Question time

At the end of the introductory session the students went away with the problem and returned 3 days later with questions. Most of the students had between 3 - 4 questions prepared. A sample of typical questions is presented below:

- Can sustainable building materials be used?
- What sort of amenities would need to be incorporated into the water taxi station?
- What was the tidal range of the Clyde river?

It may seem that whilst some questions appear superficial it was apparent that the students had given some thought to problems most likely to occur in the design of a water-side development within a designated inner city regeneration area. An interesting aspect of the problem was how to get passengers up and down from the quayside into the taxi in the safest and most efficient way possible?

How they approached the problem

The class was sub-divided into 5 groups by the subject co-ordinator and each group was allocated a tutor. Many of the students reverted to previous design studio projects and lecture notes to solve the problem. This was anticipated as we had indicated study coverage areas in the introductory session for this purpose. Brainstorming was utilized by many students in resolving the issues. Other students gave some individual thought and then carried out a brainstorming exercise within their group. It was decided that two-hour, weekly studio sessions would be required to allow students to consult their tutors and teaching staff with individual questions on their proposals. Students found this time slot valuable particularly during the detailed design stage.

The students' perspective

A questionnaire was devised to solicit feedback related to the design project. Analysis of the results which are mainly qualitative in nature are set out below.

How was PBL different from past learning?

In answering this question we were hoping that the students would consider if there was a difference between the PBL approach and more typical assignments that have been given in other subjects. They were asked to note any specific areas where differences may lie, for example, in the amount of research that they undertook in their approach to the water taxi station design exercise.

The students reported less book-type research and more use of previous learning, they noted that the PBL approach was more practical and realistic. Some indicated they could find no definite answer to a variety of problems (perhaps they were unable to focus the scope) and this may have been the cause of frustration to some of the students, given the structure of previous related subjects contained within the undergraduate programme. They felt that the PBL approach required them to research in more depth.

Fewer reported that the PBL approach required the same amount of effort but applied it differently as the work required the analysis of the situation in real life. Some considered there to be no specific topic, rather that PBL approach encompassed a group of topics with the students being forced to decide the scope.

Summary and conclusions

The subject received positive comments. There was a high degree of interest from both staff and students involved in the water taxi design exercise. However, there was some polarization of the students performance into strongly and weakly performing students with few occupying the middle ground. General comments about the subject included that it was the one of the most interesting and challenging experienced during the undergraduate programme and the design project was seen as being extremely valuable. The workload was considered excessive, as many of the students were also working on studio-based projects at the same time, but was accepted as being a necessary evil by most students.

Problem-based Learning is a valuable teaching method for teaching a subject where the knowledge base of the teacher is otherwise critical, and where an holistic approach to problem solving can be applied. However, while it can be successfully implemented, PBL sits uncomfortably within a traditional of teacher-based programme.

If PBL is to be utilized, then there are a number of issues which must be addressed. These primarily revolve around empowering the students toward self-learning and providing an environment in which they are able to assume responsibility for their own learning without suffering alienation.