University students’ approaches to project-based learning (PBL): An Engineering context

Mahbub Hasan
PhD Student
University of Queensland, Brisbane, Australia.
Email: m.hasan6@uq.edu.au
Presentation Layout

INTRODUCTION

Pilot project

Literature Review

Methodology
INTRODUCTION
PBL in Engineering education

- Engineering students are to deal with lots of technical concepts
- To have a clear understanding of technical concepts, project-based learning (PBL) has been widely used as a teaching strategy in engineering education (Mills & Treagust, 2003).
- “Project-based learning can be defined as an activity in which students develop an understanding of a topic or issue through some kind of involvement in an actual (or simulated) real-life problem or issue in which they have some degree of responsibility in designing their learning activities” (Morgan, 1983).
Approaches to learning -meaning

- The term ‘approaches to learning’ refers to how students go about something in a specific context.
- Researchers are interested in asking the question: ‘why should students with the same perceptions of the same courses adopt different approaches to learning?’.
Research question

1. How do engineering students approach and enact learning within a project-based learning environment?
Literature Review
## Literature review (Approaches)

<table>
<thead>
<tr>
<th>Author(s) and Date</th>
<th>Focus</th>
<th>Sample</th>
<th>Geographical context</th>
<th>Educational context</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Yang &amp; Tsai, 2010)</td>
<td>Learning through online peer assessment</td>
<td>163 college students</td>
<td>Taiwan</td>
<td>Nursing</td>
<td>To accomplish an assignment</td>
</tr>
<tr>
<td>(Trigwell, Ellis, &amp; Han, 2012)</td>
<td>Relationship between emotions approaches to learning and learning outcome</td>
<td>388 university students</td>
<td>Australia</td>
<td>First-year biology</td>
<td></td>
</tr>
<tr>
<td>(Robert A. Ellis et al., 2008)</td>
<td>Online discussion</td>
<td>110 university students</td>
<td>Australia</td>
<td>Third-year engineering</td>
<td>Online discussion</td>
</tr>
<tr>
<td>(R. A. Ellis et al., 2006)</td>
<td>Online discussion</td>
<td>105 university students</td>
<td>Australia</td>
<td>Second-year psychology</td>
<td>Online discussion</td>
</tr>
<tr>
<td>(Drew et al., 2002)</td>
<td>Approaches to fashion design project</td>
<td>21 University students</td>
<td>UK</td>
<td>Fashion design</td>
<td>Project work</td>
</tr>
</tbody>
</table>
Methodology
Methodology – Phenomenography

Project-based learning (PBL)

How aspect (Approaches)
- Act of learning (Strategy)
- Indirect object of learning (Intensions)

What aspect (Conceptions)
- Referential aspect (Global meaning)
- Structural aspect (Focus)
Why phenomenography?

Phenomenography

The research questions was related to students’ approaches to learning. As evidenced by the literature, it is clear that a phenomenographic methodology, in line with variation theory, can be adopted in the quest to answer questions of this nature.
Points of Departure Between Phenomenography and Other Research Approaches

Source: (Trigwell, 2006)
Phenomenonographic relationality

J. Bowden, 2005
Relationship in this research

- Relation between researcher and the students
- Relations between researcher and the phenomenon
- Object of study
- Relation between students and PBL
- Project-based Learning (PBL)
Sample in Phenomenographic study

1. Recommended sample size is 15 to 20. However, a sample size of 10 is required to create a reasonable variation in the categories of descriptions. Trigwell (2000)

2. Participants must have relevant experience on the phenomenon studied

3. Variation in sample is also recommended
Data Analysis
(Sjöström & Dahlgren, 2002)

Step 1 • Familiarisation – read transcript several times
Step 2 • Deducing Dis/similarity – record all response to a question
Step 3 • Condensation – Sort out irrelevant
Step 4 • Preliminary grouping – record similar answer to a question
Step 5 • Preliminary comparison of categories – check no overlapping
Step 6 • Naming the categories – according to distinguishing feature
Step 7 • Final outcome space – based on internal relationships
Pilot project
Research set up

Sample size : 4
Level of study : Masters level
Course : Enterprise Resource Planning (ERP)
Student project : ERP package for an organisation
Age range : 20s-30s

Backgrounds : Students from different engineering disciplines, such as mechanical, electrical and computer engineering were included in this study.
## Sample characteristics

<table>
<thead>
<tr>
<th>Participants</th>
<th>Current Level of study</th>
<th>Academic Background</th>
<th>Demographic background</th>
<th>Professional qualification</th>
<th>Current project</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>Master</td>
<td>Bachelor in Computer Science</td>
<td>India</td>
<td>Technical recruiter</td>
<td>ERP for a charity organisation</td>
</tr>
<tr>
<td>P2</td>
<td>Master</td>
<td>Bachelor in Electronics and Communication Engineering</td>
<td>India</td>
<td>Worked in Oil and Gas industry</td>
<td>EPR for Volvo trucks</td>
</tr>
<tr>
<td>P3</td>
<td>Master</td>
<td>Bachelor in Electrical Engineering</td>
<td>India</td>
<td>N/A</td>
<td>ERP for a charity organisation</td>
</tr>
<tr>
<td>P4</td>
<td>Master</td>
<td>Bachelor of Mechanical Engineering</td>
<td>Australia</td>
<td>Internship in Design optimisation custom body</td>
<td>ERP project</td>
</tr>
</tbody>
</table>
Data Collection

• Interview is the primary tool for data collection in phenomenographic research
• Interview type- individual, in-depth, semi-structured
• Length of interview – 40-50 minutes
• No pre-conceptions about approaches to learning –

Example question:

• *Explain how have you participated in this project? Say what actually you did rather than what you should have done.*
Deep and Surface approach

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Deep approach</th>
<th>Surface approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct object of learning (Marton &amp; Booth) or Student’s focus of learning (Dall’Alba)</td>
<td>On underlying purpose and meaning of task or learning material</td>
<td>On the task or learning material itself</td>
</tr>
<tr>
<td>Indirect object of learning (Marton &amp; Booth) or Student’s intention (Dall’Alba)</td>
<td>To understand</td>
<td>To reproduce</td>
</tr>
<tr>
<td>Act of learning (Marton &amp; Booth) or Way in which the student engages in learning (Dall’Alba)</td>
<td>Organising and integrating</td>
<td>Memorising the content of what is being learned</td>
</tr>
</tbody>
</table>

*Table 2 Aspects of approaches to learning (Sources: Marton and Booth, 1997; Dall’Alba)*
Students approaches in PBL -Findings

1. Surface approach – focus on grades
   - Do minimum to meet course requirement
   - Checking ongoing works through what’s app

2. Deep approach – focus on learning
   - Meet someone who has done this before
   - Fix someone who access your work
   - Brainstorming for understanding
   - Gathering information beyond minimum requirement
   - Good quality for future reference and to get recognition
   - Produce something non-existing
   - Meeting face to face to minimize doubts
   - Use Dropbox or OneDrive for file sharing and idea generation

3. Strategic approach – focus on both grade and learning
Students approaches in PBL - Findings

Approach A

A product-focused strategy with the intention to demonstrate technical competence

Approach B

A process-focused strategy with the intention to develop the project design process.

Approach C

A concept-focused strategy with the intention to develop own conceptions
## Intention-strategy framework

**R. Ellis, Marcus, and Taylor (2005)**

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Intention</th>
<th>Intention</th>
<th>Intention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus of learning</td>
<td>Developing technical concepts</td>
<td>Developing process</td>
<td>Developing own conceptions</td>
</tr>
<tr>
<td>Making a product (Product focus)</td>
<td>A (Surface approach)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Experimenting with projects (process focus)</td>
<td></td>
<td>B (strategic approach)</td>
<td></td>
</tr>
<tr>
<td>Development of concepts (Concept focus)</td>
<td></td>
<td></td>
<td>C (Deep approach)</td>
</tr>
</tbody>
</table>
## Dimension of Variations

<table>
<thead>
<tr>
<th></th>
<th>Approach A</th>
<th>Approach B</th>
<th>Approach C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Learning objectives</strong></td>
<td>Repetition: Memorizing and applying techniques and procedures</td>
<td>Trial and Error: Product is not the main objectives, rather the process</td>
<td>Developing concepts/ideas through research</td>
</tr>
<tr>
<td><strong>Purpose of</strong></td>
<td>Being instructed or show techniques and procedures</td>
<td>Ways of seeing things differently</td>
<td>Develop critical and conceptual thinking skills</td>
</tr>
<tr>
<td><strong>Interactions with</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>teacher/peers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Significance

**Students** – will get idea what PBL is and how should they approach

Relations between conceptions, approaches and learning outcomes will guide them

**Teachers** – will get idea about students’ approaches to PBL and redesign teaching methods

**Curriculum planners** – will get insight about students learning strategies in PBL and modify curriculum
Limitations

Small Sample size

A larger sample might represent more homogeneous views. From this small sample size, each category was drawn by the experience of at least one but usually four or more participants.

Variation in Sample

Additional approaches could be sought with a sample of students from different educational backgrounds.

Interview

Questioning was not in phenomenographic nature.

*When did you enjoy working in a project?*
References


Thank you