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

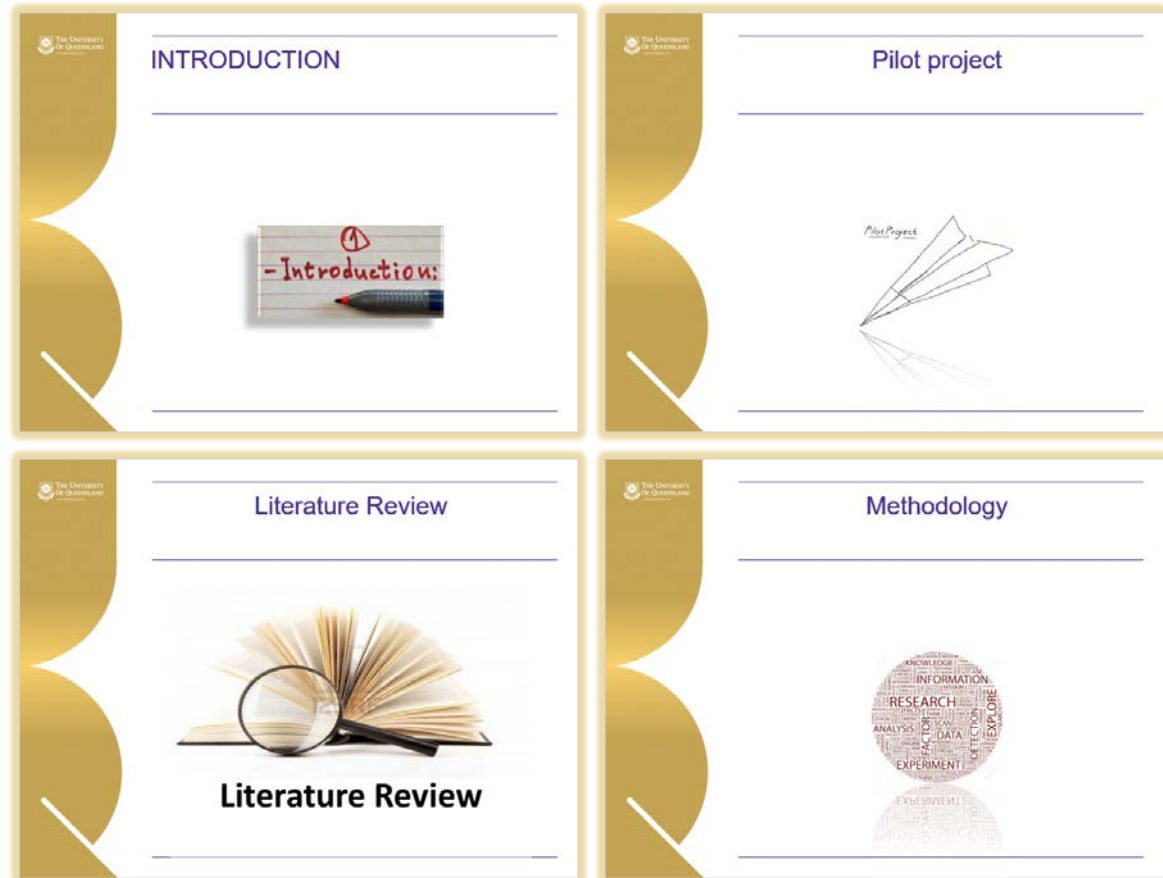
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Presentation Layout



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](#)).
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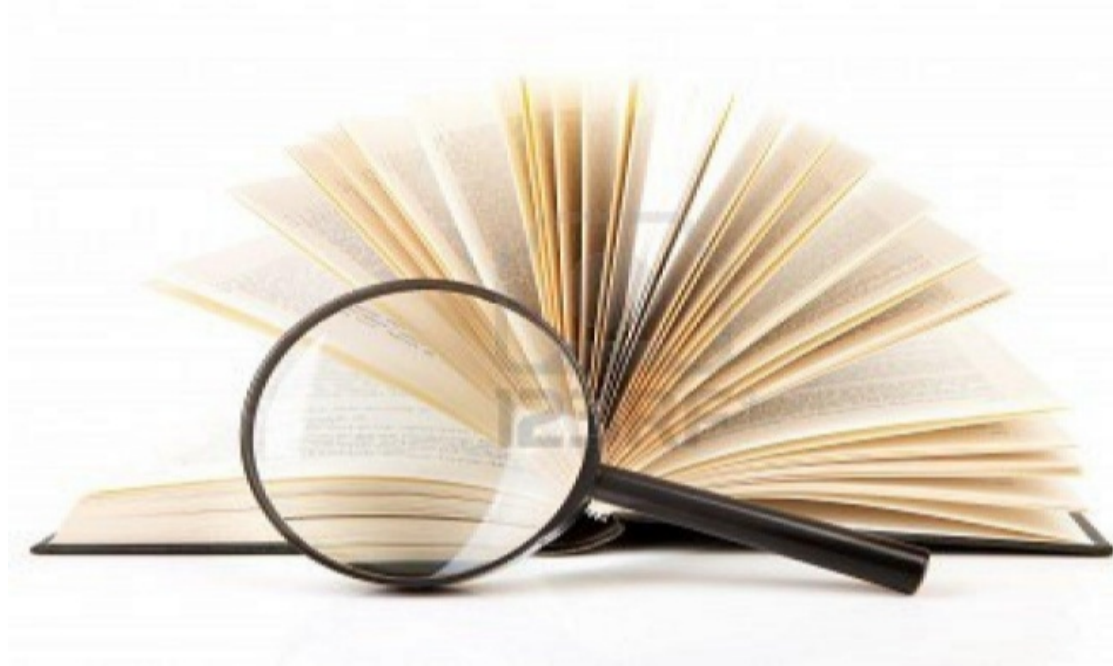
Approaches to learning -meaning

- 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?*
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Literature Review

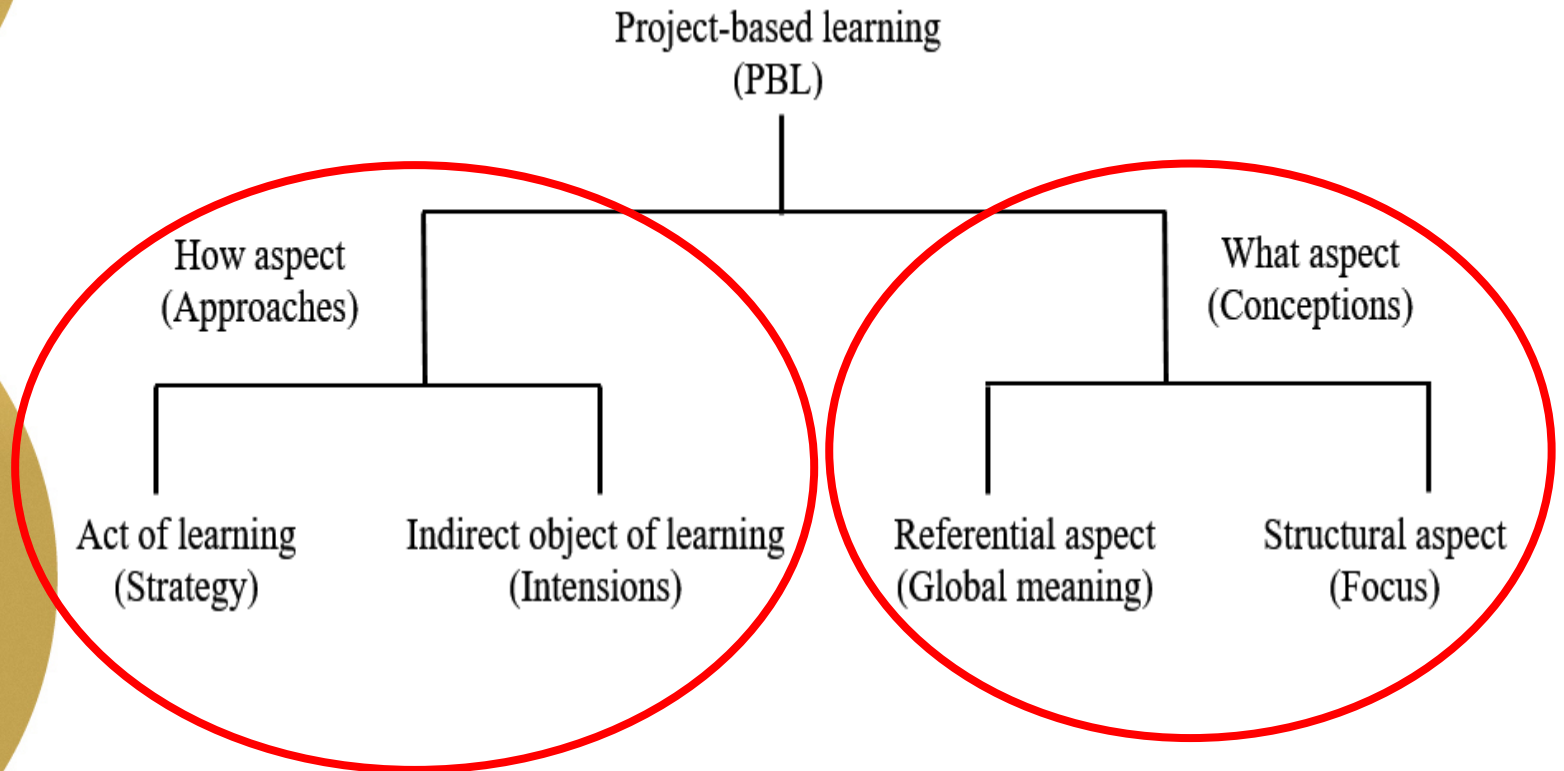


Literature Review

Literature review (Approaches)

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

Methodology – Phenomenography



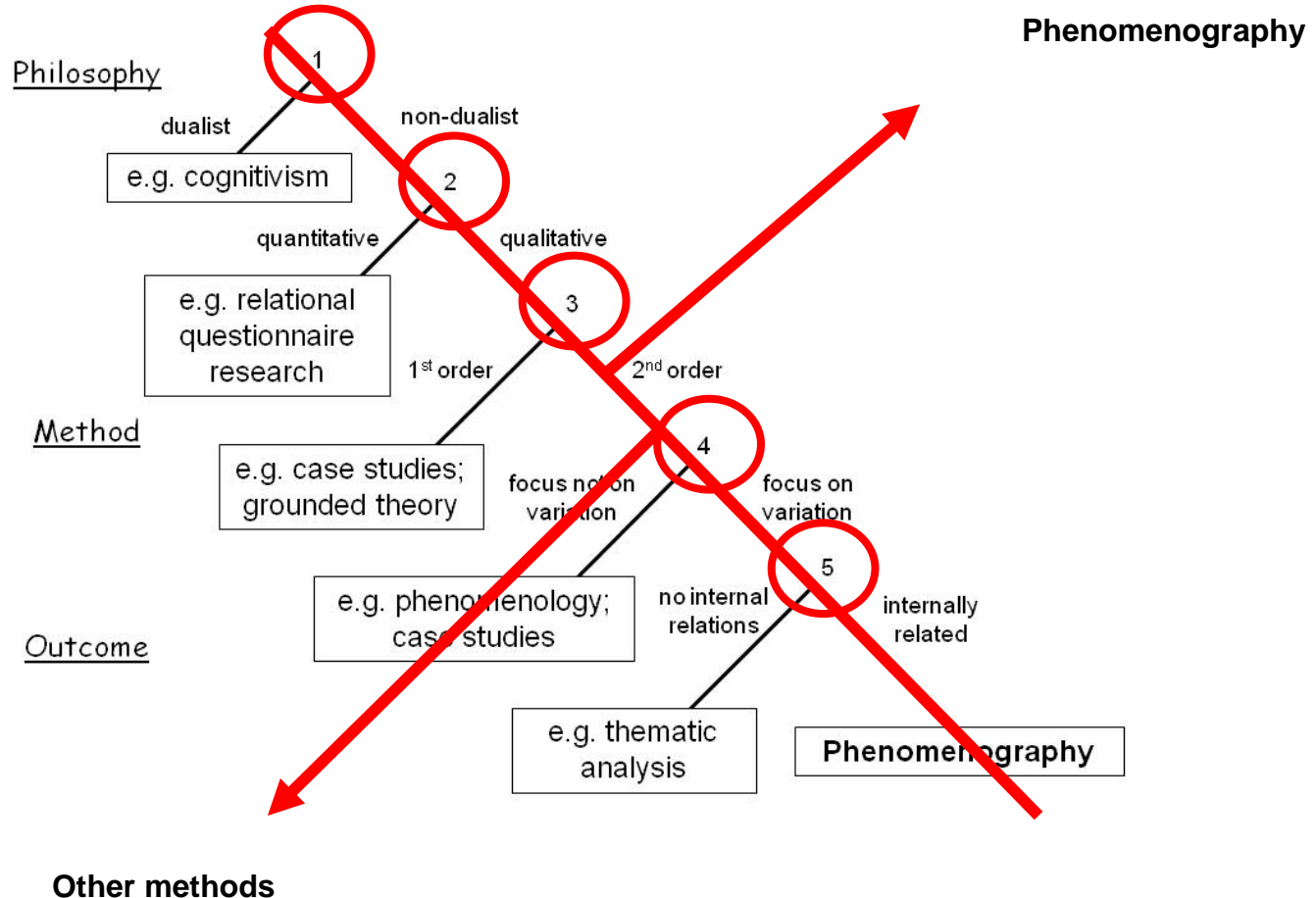
Why phenomenography ?

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.

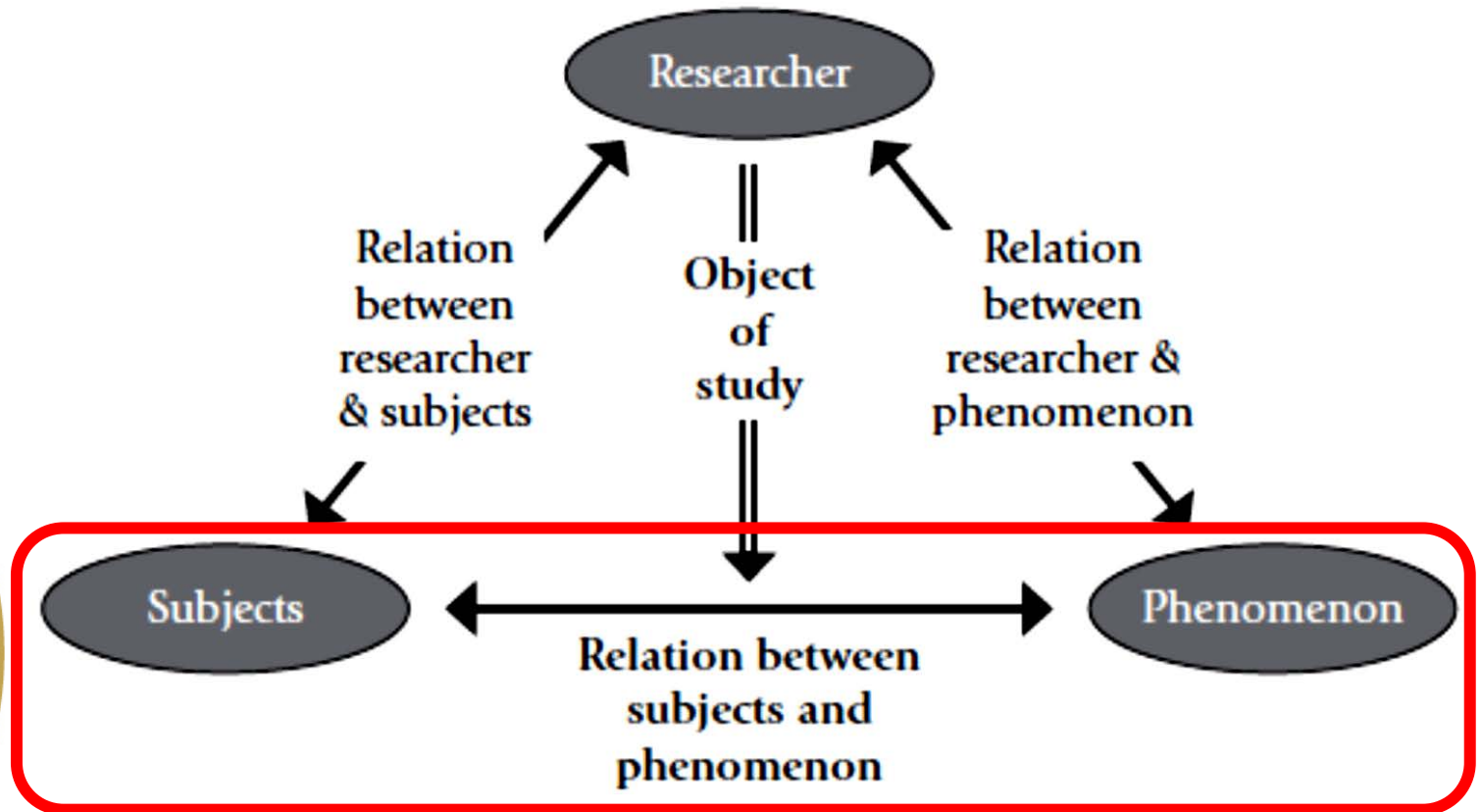
Points of Departure Between Phenomenography and Other Research Approaches

Source: (Trigwell, 2006)

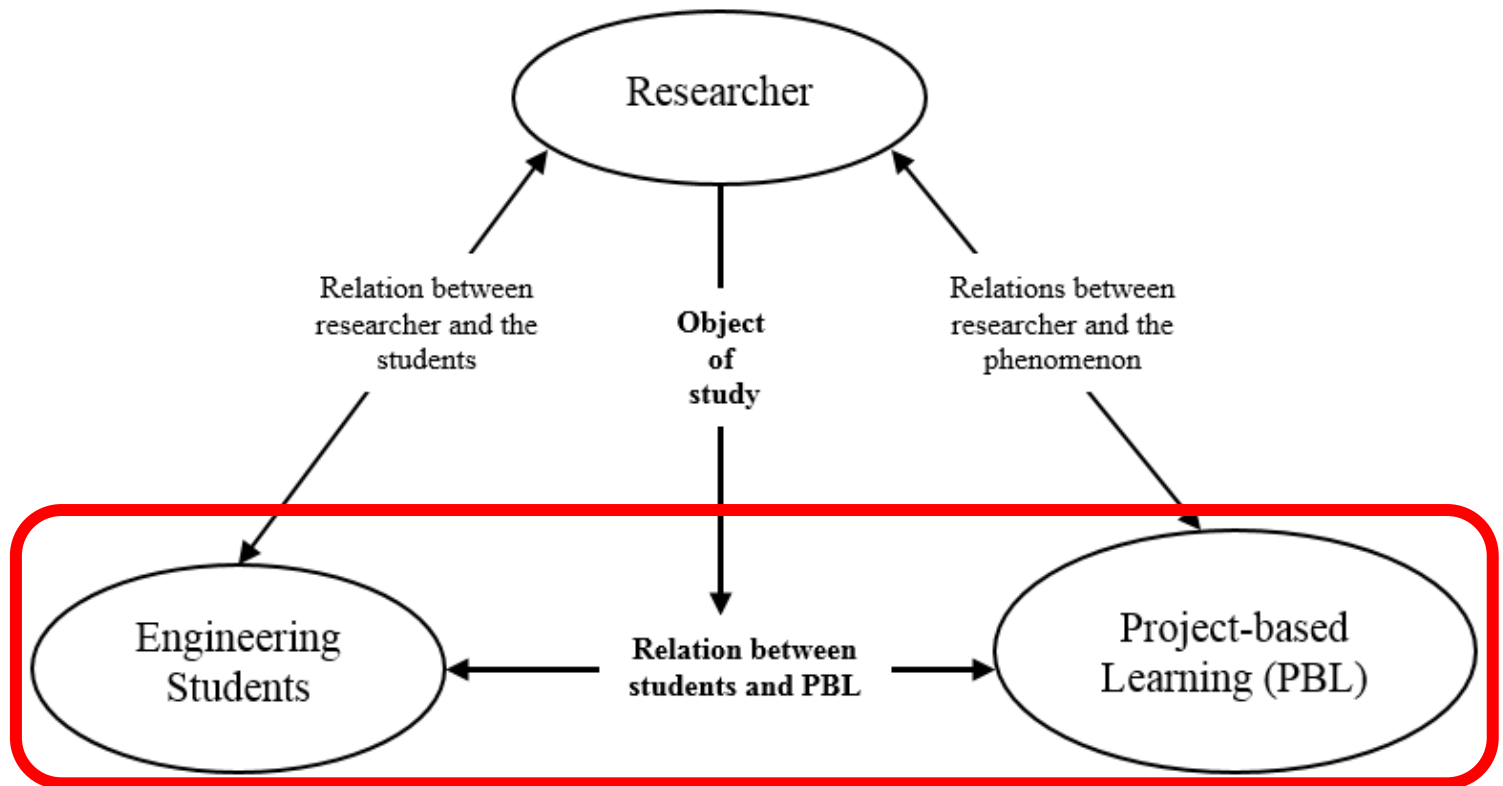


Phenomenographic relationality

J. Bowden, 2005



Relationship in this research

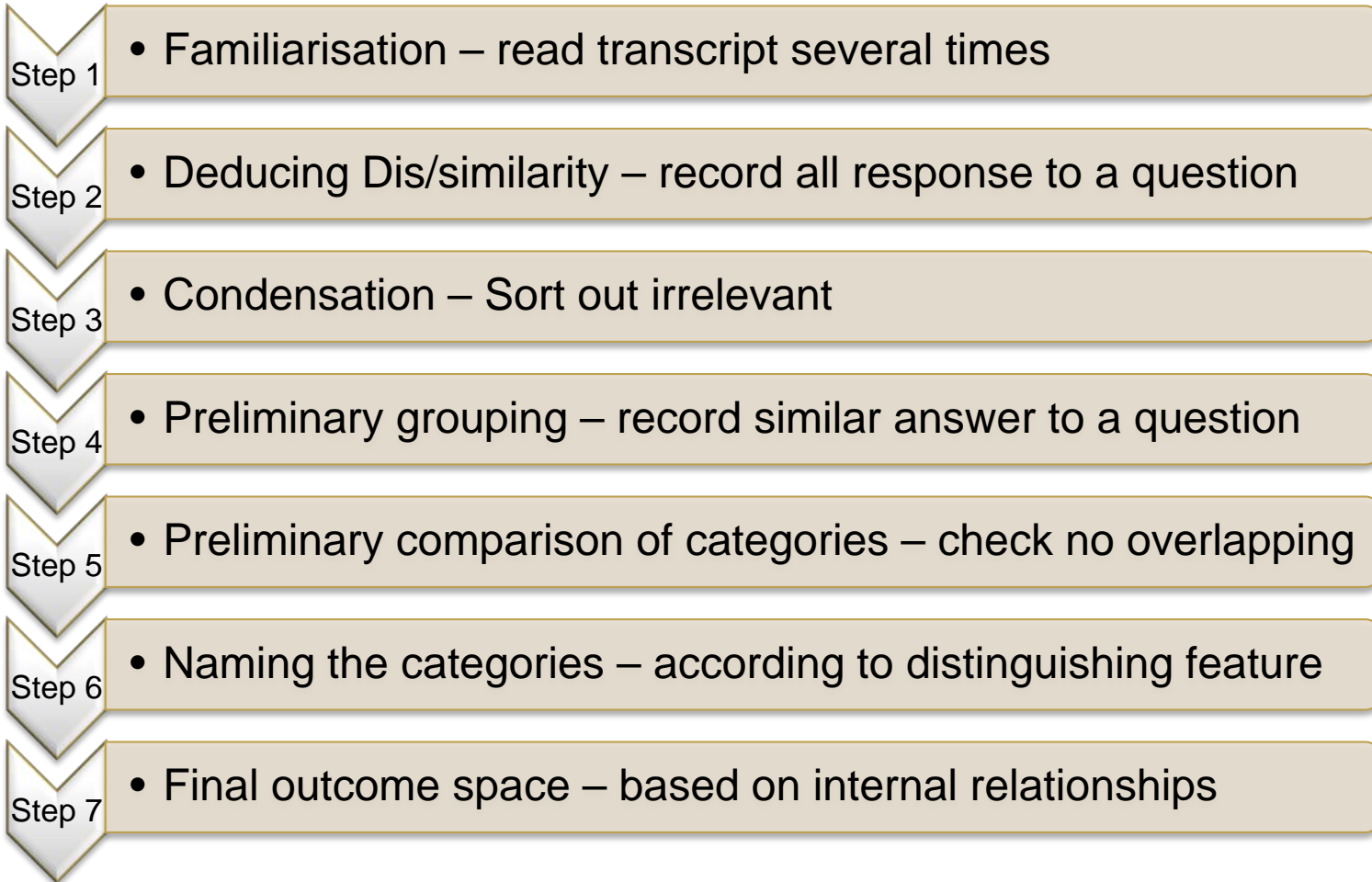


Sample in Phenomenographic study

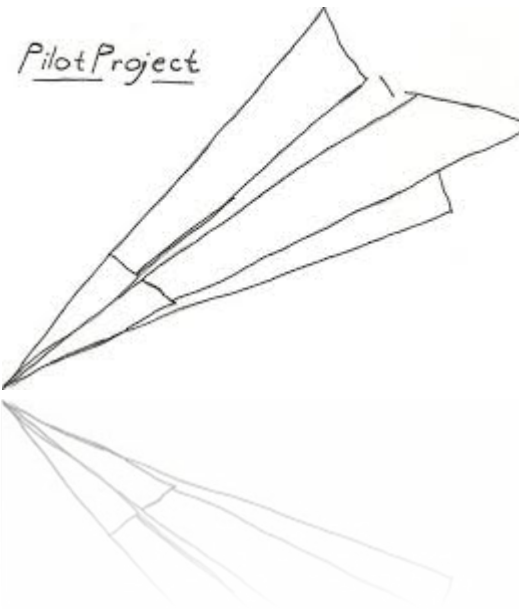
1. Recommended sample size is 15 to 20. However, a sample size of 10 is required to create a reasonable variation in the categories of descriptions. Trigwell ([2000](#))
 2. Participants must have relevant experience on the phenomenon studied
 3. Variation in sample is also recommended
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Data Analysis

([Sjöström & Dahlgren, 2002](#))



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

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

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.*
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Deep and Surface approach

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

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)

Strategy		Intention	
Focus of learning	Developing technical concepts	Developing process	Developing own conceptions
Making a product (Product focus)	A (Surface approach)		
Experimenting with projects (process focus)		B (strategic approach)	
Development of concepts (Concept focus)			C (Deep approach)

Dimension of Variations

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

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 participant

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

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Thank you

