

# A COMPARISON OF PROJECT-BASED LEARNING (PBL) VERSUS PRESCRIPTIVE LEARNING FOR LABORATORY ACTIVITIES IN INDUSTRIAL ELECTRONICS

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## PROBLEM STATEMENT

- Students **enjoy the hands-on part of electronics**
- Students **appear to lose interest and enthusiasm** in learning electronics in their progression in the program
- Is this a **reflection on the teaching methods** used in the program?

## RESEARCH QUESTIONS

**Primary:**

- Do students' **academic achievement** improve using the experiential learning method of PBL for laboratory activities?
- Do students' **attitudes** towards learning electronics improve using the experiential learning method of PBL for laboratory activities?

**Secondary:**

- What are the effects on students' **intrinsic motivation** when using PBL for laboratory activities?
- What are students' **perceptions** when using PBL for laboratory activities?
- What are the effects on students' **learning style** when using PBL for laboratory activities?

## CONCEPTUAL FRAMEWORK

The following theoretical concepts guided this research study:

- Project-based learning (PBL): (Mills & Treagust, 2003; Prince, 2004)
- Scrum agile methodology: (Milentijevic, Ciric & Vokinovic, 2008)
- Attitudes towards a subject matter: (Greenwald, 1989)
- Intrinsic motivation: (Pintrich, 2003)
- Learning styles: (Tsingo, Bosnic-Anticevich, & Smith, 2015)
- Constructivism: (Dewey, 1938; Piaget, 1973)
- Experiential learning: (Dewey, 1938; Piaget, 1970; Kolb, 1984)

## METHODOLOGY

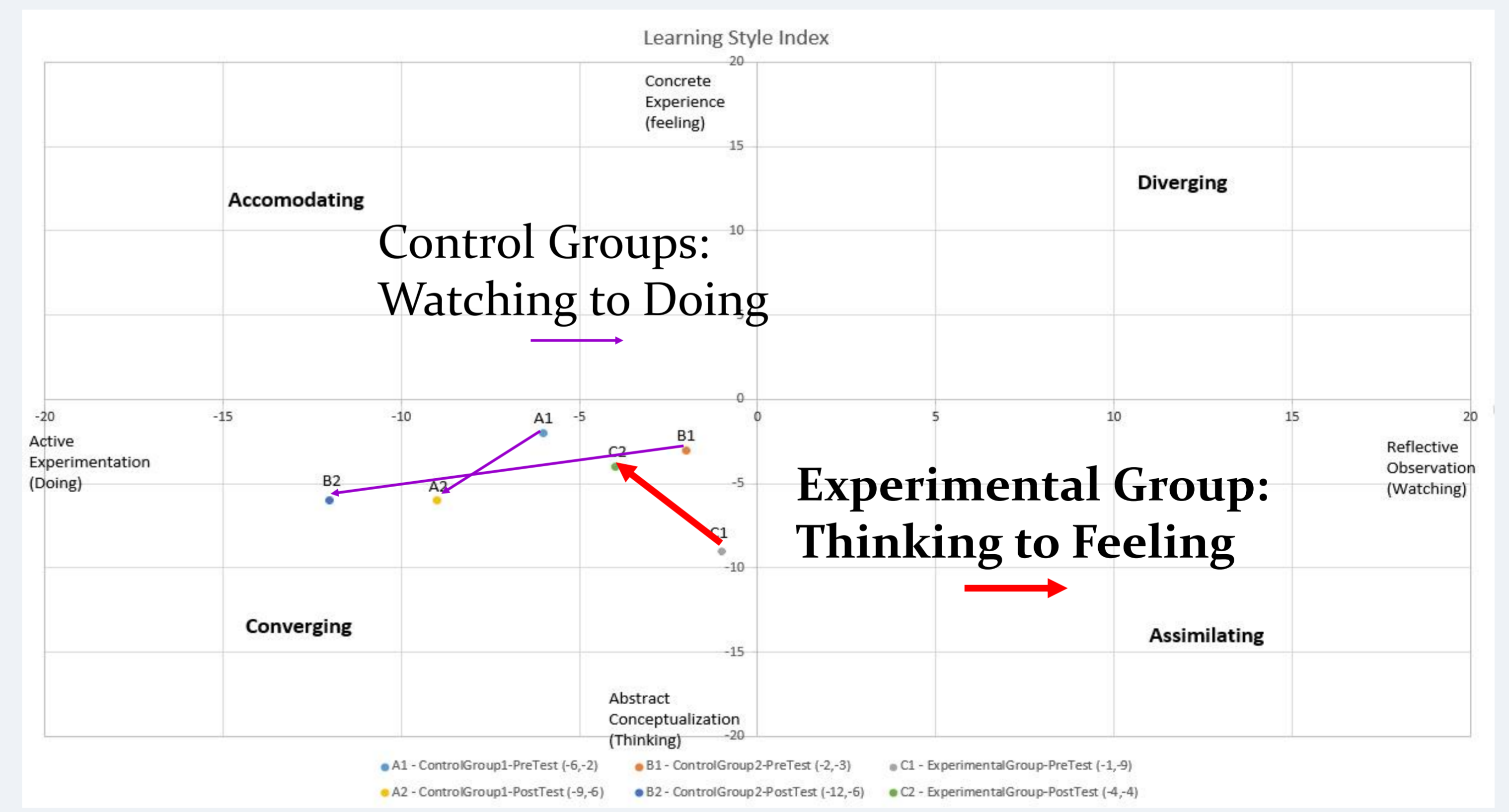
- Sample size of 25 first-year students
- Mixed-method research:
  - Quantitative research: quasi-experimental time series with a non-equivalent control group
  - Qualitative research: sequential explanatory design
- Conducted during the Winter 2016 semester in the Analog Circuits 2-hour weekly laboratory class

	Pre-Test								m i d t e r m b r e a k	Treatment								Post-Test
	W1	W2	W3	W4	W5	W6	W7	W8		W9	W10	W11	W12	W13	W14	W15	W16	
Lab Group #1 (Wed8)																	Control Group #1	
Lab Group #2 (Wed10)																	Control Group #2	
Lab Group #3 (Thurs1)																	Experimental Group	
Midterm Test																		
Final Test																		
Lab Report #1				X														
Lab Report #2												X						
Quizzes												X		X		X		
Pre-Test Questionnaire				X		X		X										
Post-Test Questionnaire																	X	
X = activities done by all groups																		

## RESULTS

- | Students' Academic Achievement  | Students' Attitudes  | Students' Intrinsic Motivations   |
|---|--|---|
| <ul style="list-style-type: none"> <li>× No significant change</li> </ul>   | <ul style="list-style-type: none"> <li>× No significant change in the emotional construct (feeling towards electronics)</li> </ul>   | <ul style="list-style-type: none"> <li>× No significant change in the interest construct (importance of task)</li> </ul>  |
| <ul style="list-style-type: none"> <li>✓ PBL lab activities more interesting than prescriptive lab activities</li> <li>✓ PBL lab activities were more helpful in understanding the theory than prescriptive lab activities</li> </ul> | <ul style="list-style-type: none"> <li>× No significant change in the behavioural construct (behaviours associated with electronics)</li> <li>↑ Increase in the cognitive construct (beliefs about electronics)</li> </ul> | <ul style="list-style-type: none"> <li>× No significant change in the cognitive engagement construct (quality of engagement)</li> <li>↑ Increase in the academic efficacy construct (confidence in their skills)</li> </ul> |

### Students' Learning Styles (Kolb's LSI)



## CONCLUSION

- The research goal was to **compare two laboratory teaching methods**: PBL (active learning) vs prescriptive learning (deductive learning)
- No significant change in students' **academic achievement** when using PBL
- Mixed results in students' **attitudes** towards learning electronics
- Mixed results in students' **intrinsic motivation** when using PBL
- Positive changes in students' **perceptions** of PBL
- Students' **learning styles** moved from watching to doing in the control groups (using prescriptive learning) and from thinking to feeling in the experimental group (using PBL)