

Bahrain Polytechnic



بوليتكنك البحرين

Perspective of Alumni in the GCC region



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Introduction

- Engineering Education: PBL and variants are intensively researched
- “Problem-Based Project-Organized Learning” seems to be predominant within GCC (Gulf Cooperation Council) region
- “Project Based Learning” (PjBL) seems to be the preferred term
- History of PjBL in the GCC is relatively short



Introduction

Similarities of Engineering Education in the GCC region:

- English language challenges (secondary vs. tertiary education)
- Focus on rote learning vs. critical thinking and analysis
- Expectation of 'spoon-feeding' (instructor-centered)
- Role of family when choosing discipline of study
- Increasing attention of policy makers (economic diversification)



Introduction

Aim of Engineering programs:

- Development of complementary and interrelated competencies
- Many studies of PBL in engineering education neglect this goal
- Some studies utilized competencies (graduate attributes, student outcomes)
- Framework of this study: 16 competency elements of EA (Engineers Australia, next slide)
- These elements cover all essential skills and attributes



COMPETENCY AREA / Competency Element

1. KNOWLEDGE AND SKILLS

1.1. Theory based understanding of the underpinning natural sciences

1.2. Conceptual understanding of mathematics, numerical analysis, statistics

1.3. In depth understanding of specialist knowledge areas

1.4. Discernment of current knowledge development

1.5. Knowledge of contextual factors such as business, culture, laws, etc.

1.6. Understanding of scope, accountabilities of contemporary engineering



COMPETENCY AREA / Competency Element

2. ENGINEERING APPLICATION ABILITY

2.1. Application of established engineering methods to problem solving

2.2. Application of engineering techniques, tools and resources

2.3. Application of systematic synthesis and design processes

2.4. Application of systematic approaches to the management of projects



COMPETENCY AREA / Competency Element

3. PROFESSIONAL AND PERSONAL ATTRIBUTES

3.1. Ethical conduct and professional accountability

3.2. Effective oral and written communication

3.3. Creative, innovative and pro-active demeanour

3.4. Professional use and management of information

3.5. Orderly management of self and professional conduct

3.6. Effective team membership and team leadership



Purpose

Identification of the engineering alumni perspective regarding:

1. Importance of these competency elements
2. Contributions of PjBL in developing these competency elements
3. Contribution of traditional teaching in developing these competency elements



Purpose

- Importance of engineering competency elements depends largely on the specific socio-economic context
- Country specific research was suggested previously
- Study aims at providing the subjective dimension (i.e. alumni perspective)



Methodology

Research questions:

- What is the perceived importance of these competency elements in relation to requirements at engineering workplaces?
- Is there a statistically significant difference between contributions of PjBL versus traditional teaching?
- Which competency elements are developed predominantly by PjBL and which by traditional teaching?



Methodology

- Questionnaire based interviews with engineering alumni
- Alumni experienced previously same PjBL model at private college
- 5-point Likert scale regarding importance, perceived contribution of PjBL, perceived contribution of traditional teaching
- Demographic data (next slide)



Criteria		#	%
Education:	Bachelor	66	99
	Master	1	1
Position:	Upper management	21	31
	Lower management	46	69
Industry:	Petroleum	24	36
	Construction	32	48
	Manufacturing	2	3
	Other	9	13
Sector:	Private	38	57
	Public	29	43
Size of Organization:	<10	5	7
	10-100	20	30
	>100	42	63
Major of studies:	Mechanical	25	37
	Civil	21	31
	Electrical	6	9
	Petroleum	15	22



Methodology

- Descriptive statistics for research question 1 (importance)
- Wilcoxon test for research questions 2 and 3 (difference in contribution of PjBL vs. traditional)
- Alpha = 0.05



COMPETENCY AREA	Competency Element	Importance		PjBL Contribution		Traditional Contribution	
		Mean	SD	Mean	SD	Mean	SD
	1.1. Theory based understanding...	4.2	1.0	3.2	1.4	4.1	1.0
	1.2. Conceptual understanding of mathematics...	4.4	0.9	3.5	1.2	4.1	1.0
	1.3. In depth understanding...	4.1	1.0	3.8	1.2	3.7	1.1
	1.4. Discernment of current knowledge...	4.3	0.9	4.0	1.0	3.5	1.2
	1.5. Knowledge of contextual factors...	3.6	1.2	3.7	1.2	3.1	1.3
	1.6. Understanding of accountabilities...	4.4	0.9	4.0	1.1	3.7	1.1
	2.1. Application of established engineering...	4.4	1.0	4.1	1.0	3.6	1.1
	2.2. Application of engineering techniques...	4.0	1.0	4.0	1.0	3.4	1.2
	2.3. Application of systematic design...	4.3	1.0	4.1	1.1	3.5	1.3
	2.4. Application of systematic management...	4.2	1.0	4.1	1.1	3.4	1.2
	3.1. Ethical conduct...	4.2	1.0	3.9	1.2	3.4	1.2
	3.2. Effective oral and written communication...	4.1	1.2	4.2	1.0	3.5	1.2
	3.3. Creative, innovative and pro-active...	4.1	1.1	4.1	0.9	3.3	1.3
	3.4. Professional use of information...	4.2	1.0	4.3	1.0	3.5	1.2
	3.5. Orderly management of self...	4.0	1.0	4.1	1.0	3.4	1.2
	3.6. Effective team membership...	4.3	1.1	4.3	0.9	3.2	1.4

Results



COMPETENCY AREA	Competency Element	PjBL		Traditional		Wilcoxon	
		Median	SD	Median	SD	Z	p
1.1.	Theory based understanding...	3.0	1.4	4.0	1.0	-3.740	0.000
1.2.	Conceptual understanding of mathematics...	4.0	1.2	4.0	1.0	-1.629	0.103
1.3.	In depth understanding...	4.0	1.2	4.0	1.1	0.995	0.320
1.4.	Discernment of current knowledge...	4.0	1.0	4.0	1.2	2.267	0.023
1.5.	Knowledge of contextual factors...	4.0	1.2	3.0	1.3	0.387	0.699
1.6.	Understanding of accountabilities...	4.0	1.1	4.0	1.1	2.701	0.007
2.1.	Application of established engineering...	4.0	1.0	4.0	1.1	4.134	0.000
2.2.	Application of engineering techniques...	4.0	1.0	4.0	1.2	2.734	0.006
2.3.	Application of systematic design...	4.0	1.1	4.0	1.3	4.292	0.000
2.4.	Application of systematic management...	4.0	1.1	4.0	1.2	4.036	0.000
3.1.	Ethical conduct...	4.0	1.2	3.0	1.2	2.034	0.042
3.2.	Effective oral and written communication...	4.0	1.0	3.0	1.2	4.659	0.000
3.3.	Creative, innovative and pro-active...	4.0	0.9	3.0	1.3	3.342	0.001
3.4.	Professional use of information...	5.0	1.0	3.0	1.2	5.382	0.000
3.5.	Orderly management of self...	4.0	1.0	3.0	1.2	3.865	0.000
3.6.	Effective team membership...	5.0	0.9	3.0	1.4	5.507	0.000

Results



Rank	Competency Element	Importance		PjBL		Traditional	
#		Mean	SD	Mean	SD	Mean	SD
1	1.6. Understanding of accountabilities...	4.4	0.9	4.0	1.1	3.7	1.1
2	1.2. Conceptual understanding of mathematics...	4.4	0.9	3.5	1.2	4.1	1.0
3	2.1. Application of established engineering...	4.4	1.0	4.1	1.0	3.6	1.1
4	3.6. Effective team membership...	4.3	1.1	4.3	0.9	3.2	1.4
5	1.4. Discernment of current knowledge...	4.3	0.9	4.0	1.0	3.5	1.2
6	2.3. Application of systematic design...	4.3	1.0	4.1	1.1	3.5	1.3
7	3.1. Ethical conduct...	4.2	1.0	3.9	1.2	3.4	1.2
8	2.4. Application of systematic management...	4.2	1.0	4.1	1.1	3.4	1.2
9	3.4. Professional use of information...	4.2	1.0	4.3	1.0	3.5	1.2
10	1.1. Theory based understanding...	4.2	1.0	3.2	1.4	4.1	1.0
11	3.2. Effective oral and written communication...	4.1	1.2	4.2	1.0	3.5	1.2
12	3.3. Creative, innovative and pro-active...	4.1	1.1	4.1	0.9	3.3	1.3
13	1.3. In depth understanding...	4.1	1.0	3.8	1.2	3.7	1.1
14	3.5. Orderly management of self...	4.0	1.0	4.1	1.0	3.4	1.2
15	2.2. Application of engineering techniques...	4.0	1.0	4.0	1.0	3.4	1.2
16	1.5. Knowledge of contextual factors...	3.6	1.2	3.7	1.2	3.1	1.3

Results



Discussion

Similarities of ranking when comparing with Manager perspective:

- effective team membership (managers: 1, alumni: 4)
 - understanding of accountabilities (managers: 4, alumni: 1)
 - application of established engineering techniques (managers: 6, alumni: 3)
- Since most alumni are involved in teamwork and applying techniques, they understood the importance of these competencies.

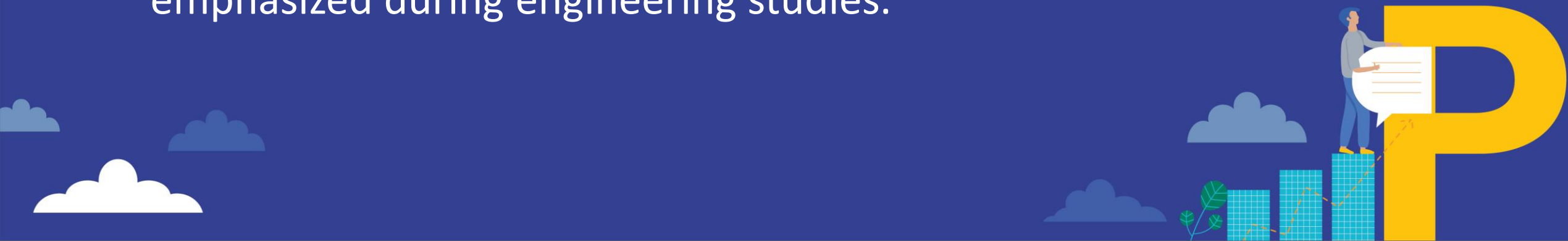


Discussion

Differences of ranking when comparing with Manager perspective - ranked low by Managers / high by students:

- conceptual understanding of mathematics (managers: 13, alumni: 2)
- application of systematic design (managers: 15, alumni: 6)

➤ Alumni may still over-emphasize these competencies since these are emphasized during engineering studies.



Discussion

Differences of ranking when comparing with Manager perspective - ranked high by Managers / low by students:

- effective communication (managers: 3, alumni: 11)
 - in-depth understanding of specialist knowledge areas (managers: 5, alumni: 13)
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- Alumni may still not have experienced the extent of consequences of miscommunication
 - Alumni may not have been involved in highly specialized activities.



Discussion

- All competencies are developed more effectively by PjBL, except '1.1 theory based understanding of the underpinning sciences'
 - Results confirm for 12 out of 13 significantly different competencies the results of previous studies
- The exception might be related to the fact that students were able to deliver projects without a need to look into underlying theories



Conclusion

- 12 out of 13 significantly different competencies are perceived to be developed more effectively by PjBL (including all 'application ability' and 'professional attributes' competencies)
- Only 'theory based understanding of the underpinning sciences...' was perceived to be developed more effectively by traditional teaching
- Some competencies require sufficient experience and leadership responsibilities in order to develop a Manager perspective



Thank you

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