

**Studying the impact of
English language subjects on
HTI Biomedical Engineering students' engagement
in outcome-based approach education**

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Aim of talk

- Report findings of an OBE project regarding ELC-HTI subject alignment



Background

- Professional-related language training subjects (Post-2012: DSR)
- > 2007: ↑ 99 credits / programme → more English subjects
- Deeper collaboration between ELC and HTI (Biomedical Engineering Programme)
- Enhancing and assessing students' learning outcomes
- New subject ELC3611 (Professional English for BME): teaching, learning and assessment closely aligned with some BME subjects and BME programme outcomes



ELC3611 Subject Learning Outcomes

Communicate effectively in professional and academic contexts through

- 1) writing biomedical engineering-related reports, and**
- 2) delivering oral presentations of final year project progress reports**

To achieve the above ELC outcomes, students are expected to use language and text structure appropriate to the context, select information critically, and present and support stance and opinion.



Project Objectives

- **Objective 1:**

To evaluate the effectiveness of the new English subjects in supporting students to meet the English and communication related learning outcomes of the BME programme

- **Objective 2:**

To identify the human resources and logistical and administrative support required for the deep ELC-HTI collaboration



7 BME Outcomes

- **Outcome 1: (Communicate & advise)**
Communicate effectively and advise clients, professional colleagues and other members of the community
- **Outcome 2: (Critique literature)**
Critically evaluate research and professional literature, and understand the principles and practice of conducting research in different environments relevant to BME
- **Outcome 3: (Evaluate solution)**
Evaluate the effectiveness of solutions against objective criteria
- **Outcome 4: (Solve problems)**
Demonstrate the ability to develop and apply knowledge to solve clinical problems
- **Outcome 5: (Identify objectives)**
Synthesize both knowledge and assessments to identify short and long term solution objectives
- **Outcome 6: (Be responsible)**
Practice competently in a professionally responsible manner
- **Outcome 7: (Understand roles)**
Understand the roles of BME in the health care system and society



Methodology

- **Assessment performance of 2006 and 2007 cohorts compared by**
 - HTI subject lecturers
 - Additional marker from ELC
 - Professionals
- **Survey and interviews conducted on**
 - Students' views of the new subject and its effectiveness
 - Teachers' views of the collaboration
 - Supporting staff's views of the collaboration



Student Sample

- Cross sectional sampling approach

Control group:

2006 intake students (N=33)

(took ELC3601, not aligned with BME subjects)

Target group:

2007 intake students (N=32)

(took ELC3611, aligned with BME subjects)



Survey results

Impact of alignment on BME programme outcomes

Comparing

Control group (ELC3601) No alignment	← →	Experimental group (ELC3611) with alignment
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Significant difference:

- BME Outcomes 2 and 4 (Yes)
- BME Outcomes 1 (Marginal)
- BME Outcomes 3, 5, 6 and 7 (No)

Impact of alignment on BME program outcomes (1)

Results with (marginal) significant difference

**ELC subject
aligned with BME subjects
seemed to help students
achieve BME Outcome 1 better:
(sig.=0.053)**

**ELC3601 (no alignment)
Mean score: 2.96**

**ELC3611 (with alignment)
Mean score: 3.33**

Outcome 1:

Communicate & advise

**BME subjects
aligned with ELC subject
quite clearly helped students
achieve BME Outcome 1 better:
(sig.=0.003)**

**ELC3601 (no alignment)
Mean score: 3.00**

**ELC3611 (with alignment)
Mean score: 3.52**

Outcome 1:

Communicate & advise

Impact of alignment on BME program outcomes (2)

Results with significant difference

**ELC subject
aligned with BME subjects clearly
helped students
achieve BME outcome 2 better
(sig.=0.000)**

**ELC3601 (no alignment) Mean score:
2.84**

**ELC3611 (with alignment) Mean score:
3.76**

Outcome 2: Critique literature

**ELC subject
aligned with BME subjects
quite clearly helped students
achieve BME outcome 4
(sig.=0.028)**

**ELC3601 (no alignment) Mean score:
2.76**

**ELC3611 (with alignment) Mean score:
3.24**

Outcome 4: Solve problem



Impact of alignment on BME program outcomes (3)

- Results with no significant difference
- **Outcome 3: Evaluate solution**
Outcome 5: Identify objectives
Outcome 6: Be responsible
Outcome 7: Understand roles

Impact of alignment on ELC subject outcomes (1)

Did alignment help students develop better skills for doing BME written assignments?

<Yes>

	ELC3601 - Written Assignment ELC3611 - Attachment Report	ELC3601 - Written Assignment ELC3611 - OTR Report	ELC3601 - Written Assignment ELC3611 - Lab Report
ELC3601 (no alignment)	Mean: 2.71	Mean: 2.71	Mean: 2.71
ELC3611 (with alignment)	Mean: 3.43	Mean: 3.33	Mean: 3.57
Significant difference	Yes (p-value = 0.001)	Yes (p-value = 0.008)	Yes (p-value = 0.001)

Impact of alignment on ELC subject outcomes (2)

Did alignment help students develop better General English writing competence?

<Slightly better: no significant difference>

Reflection:

ELC3601 and ELC3611 are profession related language subjects, not General English subjects.

	ELC3601 - Report Writing ELC3611 - Attachment Report	ELC3601 - Report Writing ELC3611 - OTR Report	ELC3601 - Report Writing ELC3611 - Lab Report
ELC3601 (no alignment)	Mean: Specific: 3.28	Mean: Specific 3.28	Mean: Specific: 3.28
ELC3611 (with alignment)	Mean: Specific: 3.50	Mean: Specific: 3.43	Mean: Specific: 3.48
Significant difference	No (p-value =0.337)	No (p-value =0.553)	No (p-value =0.442)



Impact of alignment on student assessment performance

The alignment of ELC3611 with several BME subjects has helped you perform better in BME subject assessments:

<2007 cohort ELC3611: Mean: 3.19 → No strong view)>

Probable reasons for “No strong view”

Transfer problem: BME oral assessment ← → ELC Written

Timing problem: BME assessment done before ELC assessment

- BME Oral Report → ELC OTR written report
- BME written lab report → ELC written lab report

Student comments on the above 2 problems

(2008 cohort ELC3611, SSCM 2009 Nov)

- “... the BME subject of OTR report ... assessed only oral presentations, not on writing. ... better for the ELC to teach and assess oral presentation skills of OTR reports instead [of writing skills]”
- “The BME OTR oral assessments come before the ELC’s teaching and assessment of OTR report. ... less useful ...”

Student attitude toward aligning teaching & learning with programme outcomes

Question (for ELC3611 students):

You would like all the teaching and learning activities you participate in to be tailored towards the BME programme outcomes only.

- No strong view (Mean: 3.10)

- Two types of student comments on breadth vs focus of learning:

Student 1 (disagree):

“Since BME is a multi-disciplinary subject, a wider view rather than only the outcomes should be better.” <breadth>

Student 2 (disagree):

“A goal is essential in learning, but it shall not be the only outcome in learning. Learning should be an open-minded process.” <breadth>

Student 3 (agree):

“With a purpose initiates us to learn more [about BME].” <focus>

Student 4 (agree):

“Although I am not very clear on the outcome of the BME, I like the style.”

Student 5 (no strong view):

“Actually, I do not really know the outcomes.”



Teacher attitude toward subject alignment (1)

The ELC teacher:

- Alignment can help focus on outcome topics in an inter-related manner:

“Aligned with different BME subjects, ELC3611 gives students and me a sense of continuity... e.g. OTR report and Lab report prepare students for the Final Year Project Proposal ... so the teaching materials can be more systematically used to focus on each and every part – the outcome topics – of BME”

<Interview 2009>

Teacher attitude toward subject alignment (2)

The ELC teacher:

- reported more challenging work (involving long-term and short-term outcomes):

“In the past [2008], we talked about outcome as a very long-term thing. ... [whether students] can use good English latter on as a biomedical engineer.

Now we [also] talk about outcome as a more short-term thing. ... On the one hand I have to help them to write good reports for the HTI professor; on the other hand, I have to somehow show them what it means to write a good lab report for any biomedical engineering company. ... The challenge in this year is how I can turn the concrete into general and then turn it back into concrete.”

<Interview 2009>

Impact of alignment on student assessment performances

Comments
being collected
from
external assessors
Internal assessor





Concluding remarks (1)

Objective

To evaluate the effectiveness of the new English subjects in supporting students to meet the English and communication related learning outcomes of the BME programme

Summary of survey results

1) Alignment helped students:

- achieve 3 of 7 BME outcomes(Communicate & advise, Critique literature, Solve problem) directly/indirectly.
- develop better skills for doing BME written assignments,
- develop slightly better General English for report writing (no significant difference).



Concluding remarks (2)

- 2) Students had no strong view on whether the current alignment arrangements was helpful to their assessment performances because of problems with (1) timing of alignment and (2) skills transfer.
- 3) Both students and ELC teacher saw the advantage and disadvantage/challenge of subject alignment:
 - Advantage: learning more focused on discipline
 - Disadvantage/challenge: breadth of learning likely neglected
- 4) Subject alignments required approximately 4 times as much human resources to support.



The way forward (1)

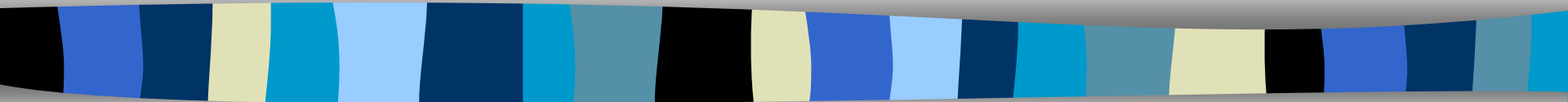
- More data to be collected (e.g. assessment performances)
- Provisional action plan (in response to present findings)
 - Consolidate student awareness of BME programme outcomes
 - Address the alignment related transfer problem by e.g. changing the current OTR Report arrangement
 - BME assess speaking $\leftarrow \rightarrow$ ELC assess writing
 - to BME assess speaking $\leftarrow \rightarrow$ ELC assess speaking
 - (or BME assess writing $\leftarrow \rightarrow$ ELC assess writing)



The way forward (2)

- Address the alignment timing problem (HTI → ELC) by:
 - e.g.
 - changing
 - Current Lab Report arrangement:
 - BME assess (first) → ELC teach & assess
 - to
 - ELC teach & assess (first) → BME assess

Q & A





Spady Outcome Based Education Approach (1994)

- **Spady approach:**
2 keys to having an outcome-based system and
4 principles for the outcome-based systems

Key 1:

To develop a clear set of learning outcomes around which all of the system's components can be focused

Key 2:

To establish the conditions and opportunities within the system that enable and encourage all students to achieve those essential outcomes



No time to present the following slides



Spady Outcome based education Approach

- **Principle 1:**
Clarity of focus on culminating exit outcomes of significance
- **Principle 2:**
Expanded opportunity and support for learning success
- **Principle 3:**
High expectations for all to succeed
- **Principle 4:**
Design down from your ultimate, culminating outcomes



Project Design (1)

Partially consistent with Spady Approach

Project features (similar to Spady's Keys 1, 2):

- A clear set of learning outcomes:
7 BME and 2 ELC learning outcomes
- ELC3611 as main learning platform:
helps students achieve learning outcomes by
aligning teaching and assessments of ELC and HTI



Project Design (2)

The project principles: partially consistent with Spady's

■ Principle 1

Focus on culminating BME outcomes and ELC outcomes at the same time

■ Principle 2

Expand opportunity and support for learning success by three types of ELC-HTI assessment alignments in the subject ELC3611

Assessment Alignment 1:

BME Oral Report → ELC OTR written report

Assessment Alignment 2:

BME written lab report → ELC written lab report

Assessment Alignment 3:

BME final year writing assessment

→ ELC final year project proposal oral assessment

→ BME final year project oral assessment



Project Design (3)

Generally consistent with Spady Approach

■ Principle 3

Set high expectations of learning success:

- good grades (ELC subject outcome)
- apply learning in HTI subjects (BME program outcomes)
- apply learning in future career and life (PolyU generic outcomes)

■ Principle 4

Design down from learning outcomes to:

- Teaching & learning materials
- Teaching & learning schedule
- Assessments



Impact of alignment on PolyU generic outcomes (1)

PolyU generic outcomes

- **Creative thinking: (Generate ideas)**
Be able to generate and experiment with novel ideas, methods, and approaches
- **Critical thinking: (Critique information)**
Be able to examine and critique the validity of information, arguments, and different viewpoints, and reach a sound judgment on the basis of credible evidence and logical reasoning
- **Team Work: (Collaborate & lead)**
Be able to work collaboratively within a team, and have an understanding of leadership and be prepared to lead a team

Impact of alignment on PolyU generic outcomes (2)

Alignment helped develop one of the 3 outcomes:

	Creative thinking	Critical thinking	Team working
ELC3601 (no alignment)	Mean: 3.04	Mean: 3.00	Mean: 2.75
ELC3611 (with alignment)	Mean: 3.43	Mean: 3.52	Mean: 3.14
Significant difference	No	Yes (p-value = 0.012)	No

Student attitude toward assessment alignment (1)

Alignment helpful to student learning?

(No strong view: mean = 3.00 approx)

(No significant difference)

	Aligned assessments helpful to learning	Independent assessments helpful to learning
ELC3601 (no alignment)	Mean: 3.00	Mean: 3.28
ELC3611 (with alignment)	Mean: 3.05	Mean: 2.95
Significant difference	No (with p-value = 0.825)	No (with p-value=0.172)

Student attitude toward assessment alignment (2)

Comments from *ELC3601* students

who prefer aligned assessments:

- **With alignment:** “Three years of assignments we can continuously train our skill in report related to BME.”
- **Without alignment:** “Maybe ELC3601 is just teaching us tone and skill for report or proposal but not related to real situation.”
- **Suggestion:** “Quite a nice suggestion to improve the overall quality of the assignments as a whole.” (Student A)
- **Workload:** “Workload will not be too heavy.” (Student B)

who prefer independent assessments:

- **With alignment:** “Alignment would certainly reduce the chances of student being exposed to different types of writing that they may face during their works.”
- **Assessment method:** “The assessment method should be different, otherwise it’s only another subject in BME.” (Student A)
- **Suggestion:** “BME assessment (criteria) should focus more on technical and professional matter, contents; ELC assessment (criteria) should focus on language and usage.” (Student B)

(Students with ambivalent comments: Students A and B)



Student attitude toward assessment alignment (3)

Comments from *ELC3611* students

who prefer aligned assessments:

- “They [ELC & BME subjects] are dependent on each other, English is important for writing scientific essays.”
- “Align for BME and give clear mind.”
- “They [ELC and BME subjects] should have relationship, BMEers should possess good oral skills.”

who prefer independent assessments:

- (no comments)

The above comments seem to show:

- *ELC3611* students: slightly more positive toward assessment alignment than independent assessments (consistent with mean=3.05 → No strong view)
- Possible reason for “No strong view”: see another finding (next slide)