Alternative Assessment: Tips and Ideas for Engineering & Science Courses

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Outline

• Alternative Assessment: definition
• Guiding principle: constructive alignment
• Example implementations: translating principles into practice
• Online assessment tools
• Flipped Assessment
• Final tip
• Q&A
Alternative assessment is an assessment that...

- is also known as authentic assessment
- measures what students can do and cannot do
- is beyond the traditional closed book written examinations
- allows students to receive feedback for improvement (most of the time)
- can easily be aligned to outcomes
- may require more time and effort
Possible forms of alternative assessments?

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Possible forms of alternative assessments

- Portfolio
- Various forms of reports
- Reflection
- Students develop exam questions with full answer
- Progress report
- Proposal
- Open book tests or quizzes
- Take home written exams
- Building or developing a model
- Making summaries or essays
Outline

• Alternative Assessment: definition and scoping
• Guiding principle: constructive alignment
• Example implementations: translating principles into practice
• Online assessment tools
• Flipped Assessment
• Final tip
• Q&A
Guiding principle: Constructive Alignment (John Biggs, 1999)

- Intended outcomes must clearly be indicated
- Teaching and learning activities match outcomes
- Assessment drives learning
- Students learn according to how we assess them
Can you get to the red door?
Scaffolding to support student learning

Zone of Proximal Development (ZPD)

Assisted level

ZPD = Distance between individual performance and performance with social support (Vygotsky)
Scaffolding to reach the ILO

Intended Learning Outcomes (ILO)

Teaching and Learning Activities

Assessment Tasks
Guideline for constructing the assessment

- Define the outcome
- Create activities that will bring up the active verb in the outcome
- Decide on the guidance needed, or any form of scaffolding required
- Try it out, and make revisions
Outline

• Alternative Assessment: definition and scoping
• Guiding principle: constructive alignment and How People Learn (HPL) Framework
• Example implementations: translating principles into practice
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Example 1:
Assessment in Problem Based Learning
(Can also be used in Projects)
Told what to learn
Learn
Give exercises for illustration

Identify what to learn
Learn
Apply

Commonly used Teaching and Learning (T&L) Model

Deductive T&L

PBL: Is it possible to turn it the other way around?

Inductive T&L

Powerful for engaging learning & developing self directed learning

Topic(s)

Problem

Topic(s)

Problem
The PBL Process

- Meet the problem
- Problem identification & analysis
- Self-directed learning
- Peer teaching, synthesis & application
- Presentation & reflection
- Closure

Typical PBL Medical School Model
Cooperative Learning Implementation: Performance Level of a Group (from K. Smith, 2007)

Cooperative Learning Principles

- Positive interdependence
- Individual accountability
- Face to face interaction
- Appropriate interpersonal skills
- Regular group function assessment
Informal Cooperative Learning Pattern

- Individual construction
- Construction and interaction with neighbor/team member
- Overall class interaction with instructor

Involves everyone!
Cooperative Problem-based Learning (CPBL)

**Cooperative Problem-Based Learning (CPBL) Model**

- **Phase 1**: Overall class problem identification & analysis
  - Individual PTN
  - Team PTM
  - Team Presentation

- **Phase 2**: Individual notes, Peer teaching in team & overall class discussion
  - Team synthesis & application for solutions formulation
  - Team consensus on final solution generation

- **Phase 3**: Individual meet the problem, restatement & identification
  - Team discussion & consensus

**Closure**

Mohd-Yusof, et al. (2011) found that CPBL enhances students’ motivation and learning strategies, problem solving abilities, and team working skills.
Scaffolding in organization of problems for a whole semester in a course

STUDENTS as “Novice Problem Solvers”

STUDENTS approaching “Expert Problem Solvers”

Complexity of engineering processes

Professional achievements

Expectation

CPBL Problems
FINAL CASE STUDY

Design of Automatic Control System for CCM Chemicals (M) Sdn Bhd

The Scenario

Now that you have experience as a process engineer, you have decided to join a process control consultancy firm, PARAGON Consulting Sdn. Bhd. You are hired because of your knowledge in chemical engineering, experience as a process engineer, and credentials. Since many of the firm's engineers are electrical and mechanical engineers, your job scope includes: i) provide expertise to other engineers to understand, describe and analyze chemical processes, and ii) design automatic control systems for chemical processes.

One Tuesday morning, you received the following email from the general manager:

To: Design Team <design.team@paragon.my>
From: Abu Bakar Iman (abi@paragon.my)
Date: 29/03/2011 11:00AM
Subject: Design of automatic control system for CCM Chemicals

Good day engineers,

I had a meeting with CCM Chemicals' plant manager last week. They are now having problems with the existing control systems of their chlorine gas absorption processes. To be specific, they are facing difficulty to maintain the process variables at the desired operating conditions. Plus, they are experiencing inconsistencies in the online measurement of the product specs too. There are two chlorine gas absorption columns operating, as part of Chloralkali Process for chlorine production, in the company. At the moment, CCM Chemicals is urgently looking for a prospective consultancy firm to solve these problems. Due to our excellent track record in the previous consultancy projects, they decided to hire for this project. The following are some technical requirements:

- Requirement 1: Design a new control system that can maintain the process variables within the desired operating conditions.
- Requirement 2: Implement an online measurement system to ensure consistency in the product specs.

Please provide your feedback on how you would approach this project. We need a comprehensive proposal that outlines your design strategy, expected outcomes, and estimated project timeline.

Best regards,

[signature]

The Scenario

Your team has been assigned to work on the CCM Chemicals project. The team has been grouped in two, and this is your team. You are responsible for designing the control system. Before starting the project, it is important to understand the project requirements and identify potential challenges. Being a process engineer, you should be able to identify the key process parameters and their impact on the overall system performance.

Hi guys,

We are going to work on this project. The project requirements are clear.

"Very good!"

"Yes, let's get started!"

And at the end of the project:

"Great job, team!"

"Yes!"

"Well done!"
Example 2:
A Zine Assignment
Application, Analysis and Synthesis
### Questions

**The investigation questions:** What do we want to know about papers describing HCDE related research? In CH and CSCW best papers? How do we engage in HCDE-related work? What might ethics look like over time? What might we need to understand ethics?

**The learning questions:** What do we need to be aware of for ethics? How do we each understand ethics? What might ethics look like over time? What might we need to understand ethics?

### Part 1, First Pass (Due Tuesday, November 28th)

1. Do this. Think about your curated papers in light of the ethical issues addressed explicitly, and (b) the extent to which your thoughts, read the Belmont report, a human subjects. You might also look at Brezina et al. for the position papers from the 2015/2016/2017.
2. Prepare this. Prepare a single sided handout with considerations and potential ethical concerns. The handout should be one or more questions that you think would be addressed in the paper.
3. Submit this. Submit a numbered list of your questions to the course website.

### Part 1, First Pass discussion

- Across CH and CSCW papers, how do the papers consider ethics?

### Part 2, Second pass (Due Wednesday, December 6th)

#### Paper 1: Add the citation

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<th>What is our goal? (10 min)</th>
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<td>What goes with what? Self-organizing and draft here section of the one based on your feedback.</td>
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<td>3.</td>
<td>What's interesting? (30 min)</td>
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<table>
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<th>1.</th>
<th>What are ethical issues addressed explicitly in each paper?</th>
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#### Question 2: Looking beyond the ethical issues addressed in the paper, what additional ethical issues seem latent in the work? To answer this, you might do a close read of the method section, think about what all would have been entailed in the work overall, how it connects to the Belmont report, etc.

#### Paper 2: Add the citation

| 2.1 | (2.1) Fill this in |

### Part 2, Second Pass discussion

- Across CH and CSCW papers, how do the papers reflect ethical considerations?

* This concept of a virtual notebook is a metaphor of a notebook as the means to:

You can also find more information on the [UTM Website](www.utm.my) or contact the [Virtual Targeted] team for further assistance.
Should we talk about ethics?

Too much red tape: ethics will slow us down, hinder innovation, whose ethics anyway? We just uncover what’s already there, people will believe anyway pursuit of knowledge > individuals care is not our practice what people do with our research is beyond our control bias with incentives (e.g. providing benefits) lose support from funding donors who cares???? survival of the fittest (we men will win)

Explicitly addressed?

Yes, ethics

Ethics mandates are the requirement of doing ethical work.
- Ethics are important in the sense that if we don’t do what we’re doing the thinking we do we think we’re good scientists.
- We’re wrong, we don’t think we’re wrong, we must be considering our response to others.
- Is it even worth ethical considerations?
- There’s no guarantee of our work that can be widely used if we don’t do it through ethics.
- See 70 Amazon.
- We’re doing new things that we don’t know whether it’s ethical or not.
- Ethics is hard.

No, ethics

- Only things that are considered not unethical matter.
- We need won to do our work.
- We have power, in an authoritarian, it is all too easy.
- Always consider ethical decisions when considering gender.
- Ethics is hard.
- Is what we do.
- If we know that we won’t the world, we areinger of
- Enemies whenever you

Innovative ● entrepreneurial ● global
InstrumentZine Assignment
Possible Zine Assignments?

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Online Assessment Tools

Why formative assessment is important?

Can you name some of the online tools suitable for formative assessment?

What is the best way to use these tools?

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Low Bandwidth Online Formative Assessment Tools
Outline

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- **Flipped Assessment**
- Final tips
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Characteristic of Surface Learners

Intellectual Development Stages

1. **Dualism**: Facts; only right or wrong, true or false; “I know I can learn this if you just tell me what I need to know.”

2. **Multiplicity**: Everyone has an opinion so all are equal; Students may distrust authority, reason, abstraction, and science

3. **Relativism**: See the existence of disciplinary reasoning through criteria/arguments; Students may appear successful

4. **Commitment**: Students realize they must make choices and commit to solutions; understand context for particular choices

- **Surface Learner**
  - Exam oriented
  - A lot of memorisation
  - I think the lecturer didn’t teach this at all
  - Will this be in the exam?

- **Deep Learner**
  - How I can easily remember this?
What do you think it means by flipped assessment?

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• Students think like the lecturer
• Students developed exam questions with complete solution
Methodology

ROLE OF STUDENTS & LEARNING OUTCOME ADDRESSED

Students are given role as faculty members to setup final exam questions for a specific learning outcome.

REQUIREMENTS OF THE ASSIGNMENT

It must be an original question and solution
70-80% of the question must be on higher taxonomy (based on Bloom Taxonomy Level 4-6). You have to choose the right guide word based on the attachment given.
Students may include analogy to the daily application or any industry related process
Students must prepare a complete solution, which includes the derivation and step by step solution to the final answer.
It must be tailored to closed book format, free from grammatical and English related error, formatted well (alignment, space) with the allocated mark should be up to 25 marks
Students are advised not to prepare too many guided sub-questions as guided question may bring the level of taxonomy towards low order thinking skills taxonomy.

SUBMISSION AND GRADING

Student to submit their assignment via Turnitin and the grade is given via Turnitin. Rubric is developed in Turnitin, which encompasses 4 main parameters:
• High Order Thinking Skills (HOTS) - 30%
• Originality - 20%
• Solution - 40%
• Format/Language - 10%
Example of Instruction

ASSIGNMENT

You are the newly appointed chemical engineering lecturer in one of the private colleges and being tasked to teach reaction engineering course for the 2nd year degree students. Towards the end of the semester, you have been tasked by the dean of your faculty to prepare an exam question that is related to the non-isothermal steady state reactor design for your students.

The dean would like to see an improvement from the past exam questions, he feels that it would be very easy to the students if you only address on 1st order reversible reaction. Therefore, he wanted to see the question to involve 2nd order reversible reaction with respect to each reactant. He wanted you to avoid ionization reaction at all cost as part of the question. The question must be able to address reactor sizing in the case of non-isothermal steady state reaction, which therefore should include all the relevant parameters to size it.

Further requirements to prepare this exam question are:

i) It must be an original question and solution
ii) 70-80% of the question must be on higher taxonomy (based on Bloom Taxonomy Level 4-6). You have to choose the right guide word based on the attachment given.
iii) You may include analogy to the daily application or any industry related process instead of typical A → B → C + D
iv) You must prepare a complete solution, which includes the derivation and step by step solution to the final answer.
v) It must be tailored to closed book format, free from grammatical and English related error, formatted well (alignment, space) with the allocated marks should be up to 25 marks
vi) You are advised not to prepare too many guided sub-questions as guided question may bring the level of taxonomy towards low order thinking skills taxonomy.

There’ll be a faculty examination meeting on Saturday 20 August 2016. Therefore, you are given one week to prepare this exam question starting from 12 August 2016 until 19 August 2016 11.59pm. The faculty meeting will not consider any late submission, which in this case will affect your salary and annual performance. This has to be submitted through Turnitin (www.turnitin.com) to check the similarity and originality, by using the following details

Class ID: 12898162
Enrollment password: REMAY2016

During the faculty examination meeting, they will rate each submitted exam question based on this rubric. In order for you to get the right assessment, please follow strictly the rubric, which is given in the appendix section.

ALL THE BEST!
Question 1
A group of individuals from Guitareads Ltd are trying to produce new anti-rust guitar strings. Sinister Gates was hired to make a reactor to produce the coating layer for the strings. He decided to use Furon (A) which decomposes into the coating layer, Pyro (B) and Cerus (C). The flow rate of Furon (A) is 124 mol/s. The reaction is a gas phase reaction that is carried out adiabatically, and the product will then be liquefied into the final coating layer. The reaction is as follows:

\[ 2A (Furon) \rightarrow B (Pyro) + C (Cerus) \]

Provided information:
- \( E_A = 75000 \text{ J/mol} \)
- Heat Capacities at 25°C:
  - \( C_{p,A} - C_{p,B} = C_{p,C} = 105 \text{ J/mol K} \)
- \( \Delta H_{rxn} = -9950 \text{ J/mol} \)
- \( K_c = 4.4 \times 10^{38} \text{ K} \)
- \( C_{aci} = 3.1 \text{ mol/m}^3 \)

a) What are the assumptions you need in order to proceed? Can you elaborate on the reason why the energy balance is important in this reaction? [6 marks]

b) Assuming an equilibrium conversion of 80%, in order to achieve a final conversion of 75%, what reactor arrangement would you recommend that is economical to achieve this conversion? [17 marks]

c) Based on what you know, how would you propose to increase the conversion with the given equilibrium conversion? [5 marks]
Students’ Feedback

This assignment allowed me to revise the whole chapter

This assignment allowed me to reach a deeper understanding on the related chapter

Mean Average: May-15 (3.65) May-16 (4.36)

Mean Average: May-15 (3.58) May-16 (4.00)

The most constraint facing me while completing this assignment

Unable to solve the question...

Prone to last minute work

Limited Creativity

Question given is tougher...

Do not understand Bloom...

Question prepared is not...

Prone to plagiarize others

Limited time to complete
Students’ Reflection

It is an interesting method of learning as for me, I believe that we as students have to give our full commitment to complete the task given by the lecturers no matter how challenging it is.

I think it is good for students to be practice as they need to fully understand the topic to create question about it. Thus, by hook or by crook they need to understand the topic very well.

At first, sure student will complain, its hard and all that. But in the end of the day, the knowledge matters. This kind of test will be an advantage for the students who keep working hard and keep doing some research. Its fun in the end of the day. And it will be satisfying if you really put some effort.

Actually, take home test is not bad at all as it teach us to think creatively and understand how our lecturers struggle much to create questions for us. After all, thank you for everything and pardon my english :’)

I love the idea of take home test, but i am not that creative. Every time i think of smthg, when i tried to search it, i found out someone else had done the question. (google it to make sure i am not doing any plagiarism in my head 😊) and, doing active learning with take home test sure is a difficult thing to be learnt in a short time. Sometimes, I can understand the chapter by reading, watching video and do some research, but for chapter 8 RE for example, it was hard to understand it and then we need to do the take home test about the chapter. Sure, lecturer always said, met us if u have any difficulties. But my difficulties is i don’t know what i didn’t understand. But at the end, i did survived this subject. No matter how difficult the task given, it is all a matter of yourself right. Either you want to push it until your limit. Or u want to always be in your comfort zone.
i like the idea of flipping the classroom. but maybe because it was the first time, so it took some time for me to adapt with the new way of learning. thanks!

I am a person who at first i can’t understand about the chapter. And then, when it comes to creating questions and solutions, it becomes too hard for me... that’s all.

It was absolutely the best way to test your student. It really helping me in understanding the topic. Before making the question one have to really understand the topic before one questioned others. But one thing that I hope is follow up. Because after the student already did the question it just that. For me I really want to know what my marks and what I did wrong. But I never do that and it was my fault. Anyway thank u for this kind of opportunity.. it was really fun.

Last semester my result is improving than the other semester.. So, I feel I will try my hard and my best for the other next semester to keep improving my understanding and ability to create critical thinking in this course.
Students’ Performance

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- Example implementations: translating principles into practice
- Online assessment tools
- Flipped Assessment
- Tips to keep in mind when designing assessments
- Q&A
Things to think about…

- Purpose of the assessment (Why)
- What to assess
- How to assess
- Who will do the assessment
- Suitability of the assessment for the students
Guiding principle: Constructive Alignment (John Biggs, 1999)

Intended outcomes must clearly be indicated

Lecturer’s Intention

Student’s Activity

Assessment Tasks

Assess intended outcomes

Teaching and learning activities match outcomes
Constructive Alignment (Biggs)

Ensuring learning outcomes

From Strobel, 2008
Open book or take home written tests

• Eliminate the possibility of students finding answers online
• Open-ended questions, which may have:
  – Provide choices or options in coming up with the answer
  – Simulation or programming components
  – Various possible design or solution for the answer
  – Real-world problem
Sample question for a take-home quiz

• A pot of water is boiling on a stove. Calculate the degrees of freedom and develop a mathematical model.
Reflection

Models of Reflection

Gibbs Reflective Cycle:

- Description: What happened?
- Feelings: What were you thinking and feeling?
- Evaluation: What was good and bad about the experience?
- Analysis: What sense can you make of the situation?
- Conclusion: What else could you have done?
- Action plan: If it arose again what would you do?
Which Alternative Assessment You Want to Give A Try?

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Q & A Session

www.menti.com 30 10 20

Let's write your own Reflection for this session:
https://padlet.com/krdutp/AA
Thank You

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