

Innovations in Teaching Seminar **IITS 2017**

*Pedagogies of learning technologies:
how does technology create new possibilities for learning?*

3 Oct 2017, Tuesday

Lecture Theatre 7 (NS1-02-03)

8:30am to 5:00pm



Faculty Showcase

A. Prof Tan Seng Chee

Associate Professor

Acting co-Director

Centre for Research and Development in Learning

Even the Earth wasn't formed in a day:

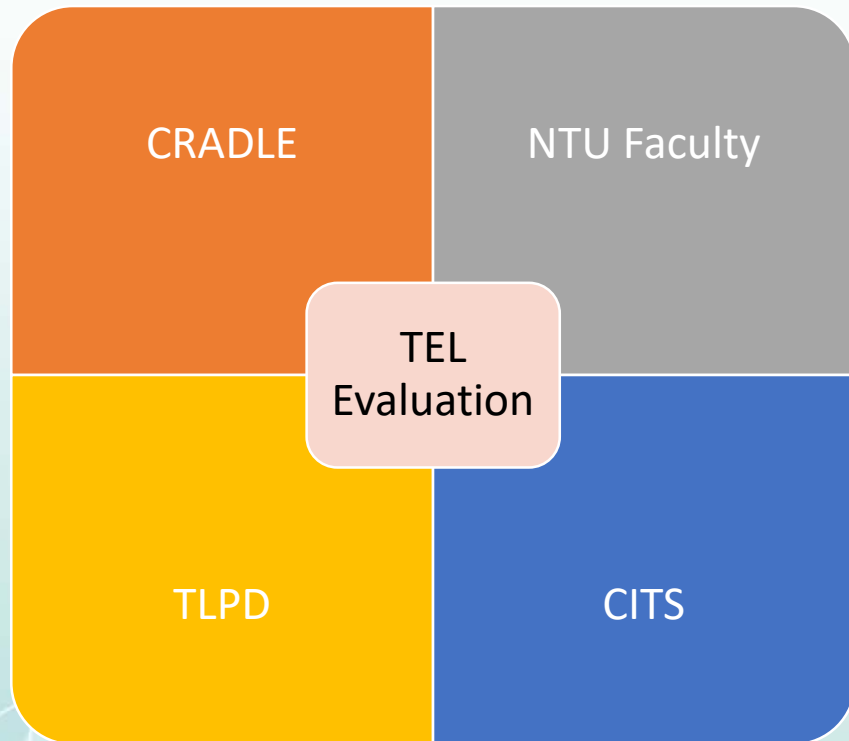
A three-year CRADLE-ASE collaboration to design pedagogically driven TEL activities



Organized by Centre for IT Services (CITS),
in collaboration with
Teaching, Learning & Pedagogy Division (TLPD).

Supported by
John Cheung
Endowment
(Social Media for
Teaching and Learning)

Background



Aims to **Improve**, rather than to prove

Case studies on good practices and ways to improve TEL development and implementation

Acknowledgements:

- Kevin Hartman
- Teaching team from the Asian School of the Environment (ASE)



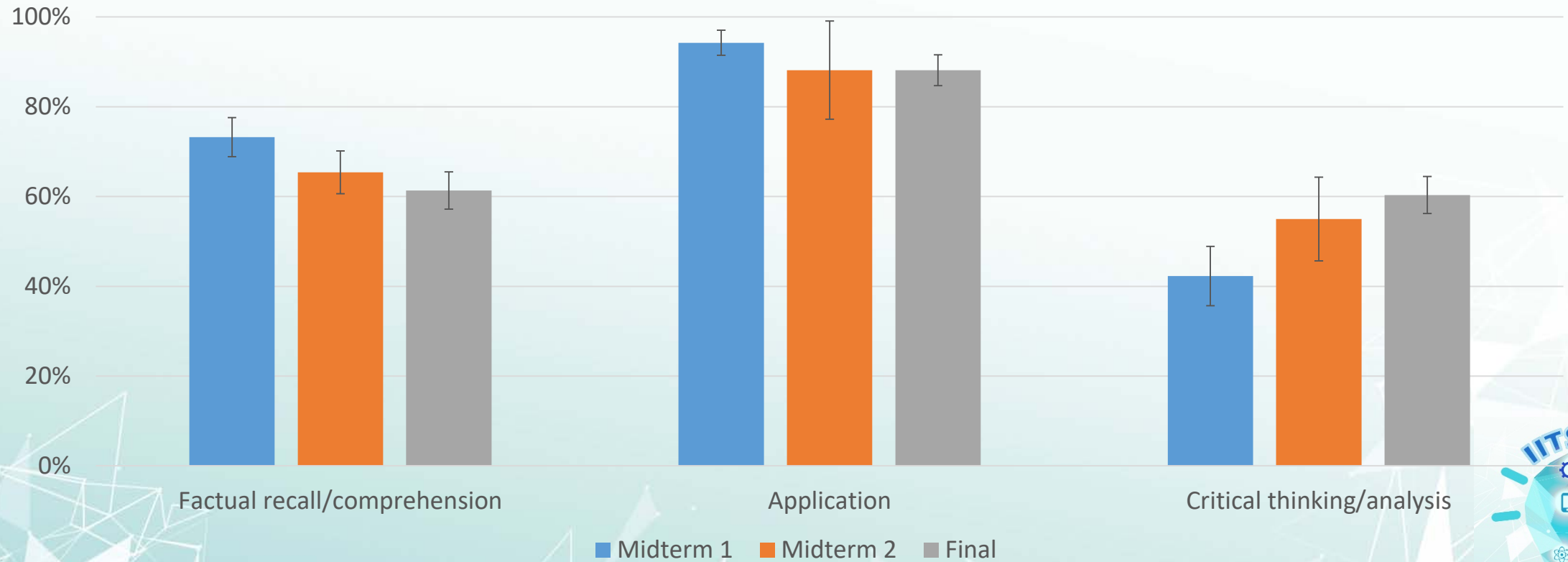
In the beginning... (Year 0)

- The course covered environmental science topics
- Designed for 150 science students
- Used clicker questions to keep students engaged through lecture
- Assessment:
 - 3 individual peer review essays (1 page/essay), two midterms and a final to assess student learning
 - Students generated answers to 3 essay questions throughout the semester
 - The following week, students reviewed 3 of their peers' essays



In the beginning... The instructor felt the course worked

Reasoning level performance by exam



But... Students didn't feel the course worked

*"If [the instructor] doesn't know how to **give proper instructions** on handing in via online portals, please don't even bother using that medium. It's the students and their grades and their **effort/time being wasted** at the end of the day. Moreover, it's outrageous how **peer reviews** are credited into our GPA grading? There is **no proper and CLEAR guideline**. Different people have **different marking standards** and this is unfair..."*

*"**Students are not qualified** to mark our essays. A review is a review, it is good but it should not be taking into account for GPA? ..."*

*"The contents of **exam** is really bad. **It does not focus on understanding important concepts, but just memorizing data**. Hence, the purpose of the courses cannot be achieved. Learning by heart all those data for the exam, then forget everything after that is a **waste of time**."*

Only an average of **55%** of students indicated approval on the 7 SFT items related to the instructor and course teaching methods

53% of students used the SFT to indicate an **above average workload** for the course



In the beginning... The course didn't work

- 550 students enrolled in the course instead of 150
- Majority of students were required to take the course to meet the requirement for graduation
- Students were anxious about, frustrated with, and hostile toward the course and the idea of peer review
- Students were overwhelmed with the amount of information presented during lectures
- Students found many of the US and Hong Kong examples irrelevant to Singapore
- Instructor and students experienced significant technical difficulties
- **Students felt powerless**

The course needed transforming

- The instructor sought help from CITS
- CRADLE sought to help the instructor



Learning activities in Year 0

Activity	Year 0
Lecture focus	Content
Clicker questions	Factual
Individual essays (specific topics)	3
Peer review	3
Midterms	2
Final exam	1
Acceptance	55%
High perceived workload	53%



Between Year 0 and Year 1

CITS

- Re-chunk content
- Redistribute group discussion throughout lecture rather than in focused case study in last hour
- Change one individual essay to a group essay

Colleagues

- Explain the course design to students thoroughly
- Explain the intention behind learning activities to students
- Explain the importance of peer review in science
- Explain the changes made between Year 0 and Year 1

CRADLE

- Reorganize half the lectures around central themes and recurring questions
- Rebalance the midterms to measure recall, application, and critical reasoning
- Measure engagement via clicker question participation and online material accesses



Learning activities through Year 1

Activity	Year 0	Year 1
Lecture focus	Content	Content/Themed
Clicker questions	Factual	Factual/Discussion
Individual essays (specific topics)	3	1
Group essays (specific topics)		1
Peer review	3	1
Midterms	2	2
Final exam	1	0
Group discussion opportunities	70% of lectures	90% of lectures
High perceived workload	53%	45%



Learning activities through Year 2

Activity	Year 0	Year 1	Year 2
Lecture focus	Content	Content/Themed	Themed
Clicker questions	Factual	Factual/Discussion	Discussion
Individual essays	3 (specific topics)	1 (specific topics)	1 (open-ended)
Group essays		1 (specific topics)	1 (open-ended)
Peer review	3 (individual essay)	1 (individual essay)	1 (individual essay)
Calibrated exemplars (peer review)			6
Midterms	2	2	2
Final exam	1		
Group discussion opportunities	70% of lectures	90% of lectures	100% of lectures
Student generated questions and solutions			Weekly
Chat room discussions			1
High perceived workload	53%	45%	47%



Learning activities through Year 3

Activity	Year 0	Year 1	Year 2	Year 3
Lecture focus	Content	Content/Themed	Themed	Themed
Clicker questions	Factual	Factual/Discussion	Discussion	Discussion
Individual essays	3 (assigned, specific topics)	1 (assigned, specific topics)	1 (open-ended)	0
Group essays		1 (assigned, specific topics)	1 (open-ended)	1 (assigned, open-ended)
Essay revision				1
Video production				1
Peer review	3 (individual essay)	1 (individual essay)	1 (individual essay)	2 (group essay, video)
Midterms	2	2	2	2
Final exam	1			
Group discussion opportunities	70% of lectures	90% of lectures	100% of lectures	100% of lectures
Calibrated exemplars			6	9
Student generated questions and solutions			Weekly	Weekly
Chat room discussions			1	0
High perceived workload	53%	45%	47%	44%



Priorities of TEL transformation

Communication strategies

- Contract between students and teaching team
 - Students email to course address during working hours
 - <24 hours response
- Explain course design and activity intentions
- Demonstrate expert reasoning

Assessment changes

- Balance exam items across content weeks
- Balance exam items across learning categories
- Give students opportunities to contribute
- Give students opportunities to receive feedback

Content development

- Make lectures interesting
- Make lectures understandable
- Give students opportunities to contribute

Activity prototyping

- Try something new every semester
- Use current semester to test for the following semester



Recorded lecture videos

- Each week, the entire 3-hour lecture session was recorded
- Recorded lectures were posted within hours of the end of class
- Students could access recorded lectures throughout the semester
- We tracked which students accessed the recorded lectures and how many times they accessed each one



Results of recorded lecture videos

Students who accessed the recorded lectures more often were:

- More likely to correctly answer exam questions related to what happened in class
- Were **no more likely** to correctly answer **critical reasoning** questions than students who did not watch videos

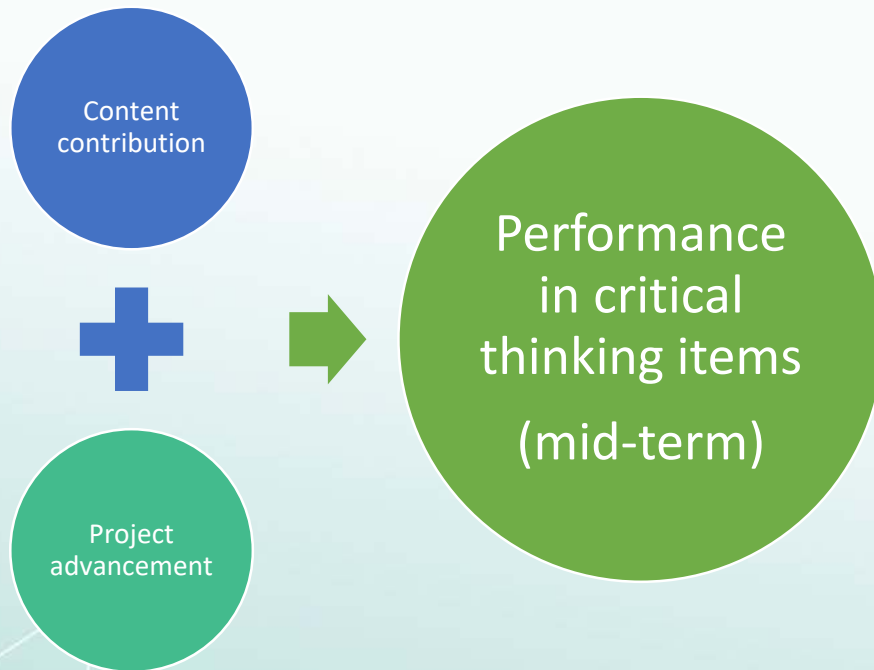


Online group discussion (Chat)

- LAMS activity
- Class divided into 127 groups; Groups comprised of 5 members with previous experience working together
- Instructor provided assignment prompt and starting resources
 - Groups tasked with developing a plan to resolve a local issue related to carbon emissions
- To receive participation credit, students needed to use the provided chatroom
- Discussion coded for
 - Content contribution
 - Project advancement



Results of online group discussion



Active and constructive participation in online group discussion of assignment recruits critical reasoning

Most students would have rather written another essay. Too time consuming.



Better organized lectures

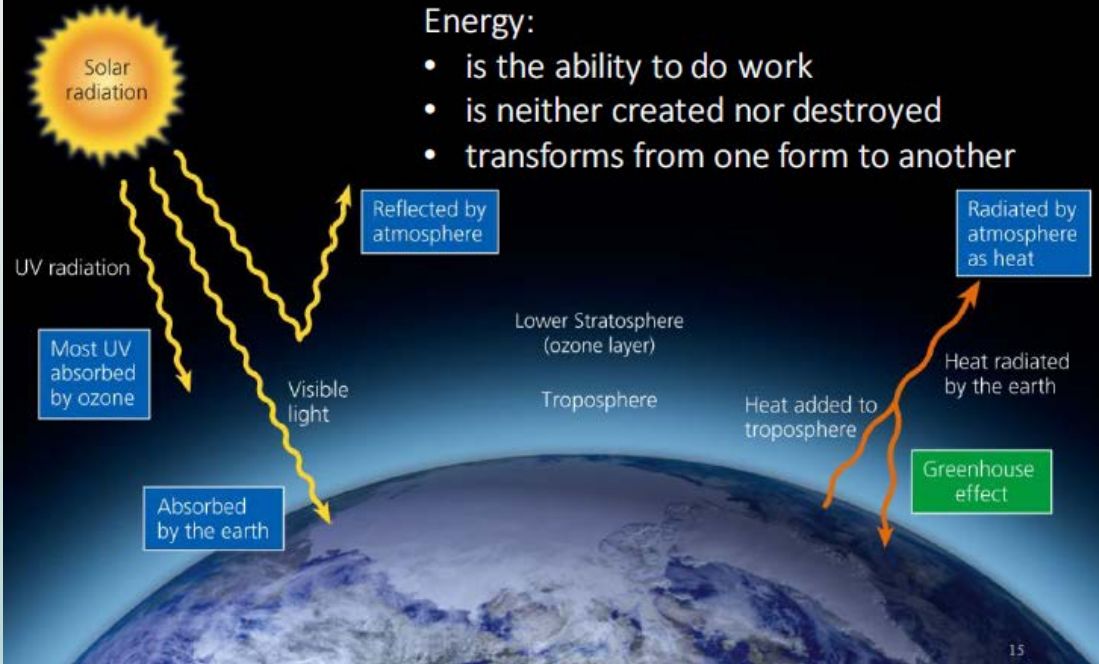
- Pruned unnecessary, unclear, and tangential content from lectures
- Included more organizational diagrams
- Included more simulations
- Redistributed opportunities for small group discussion throughout lecture
- Connected content of lecture to an ongoing narrative



Energy to and from the Earth

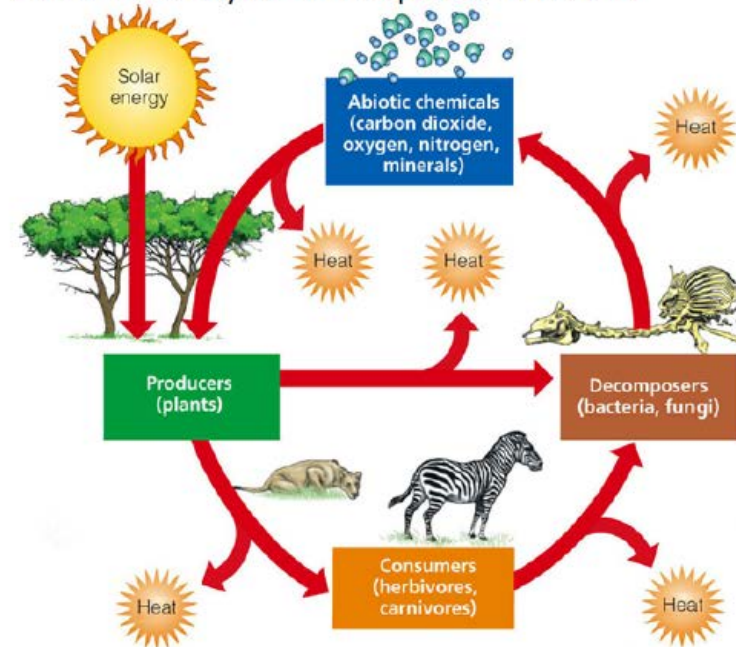
Energy:

- is the ability to do work
- is neither created nor destroyed
- transforms from one form to another



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The Main Structural Components of an Ecosystem: Species roles

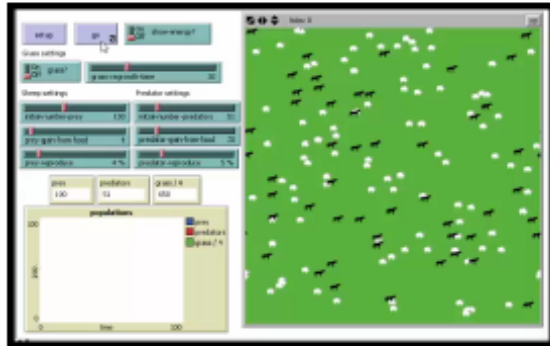


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Agent-based modelling of predators and prey (Model 1 / Take I)



Agent-based modelling of predators and prey (Model I / Take II)



Agent-based modelling for predator and prey (Model 2 / Take I)



Grass rules

If eaten, regrow in y cycles

Prey rules

Choose a random direction

Use energy to move in that direction

If on grass, eat grass and get energy

If have enough energy, reproduce x% of the time

Predator rules

Choose a random direction

Use energy to move in that direction

If near a sheep, eat and get energy

If have enough energy, reproduce x% of the time



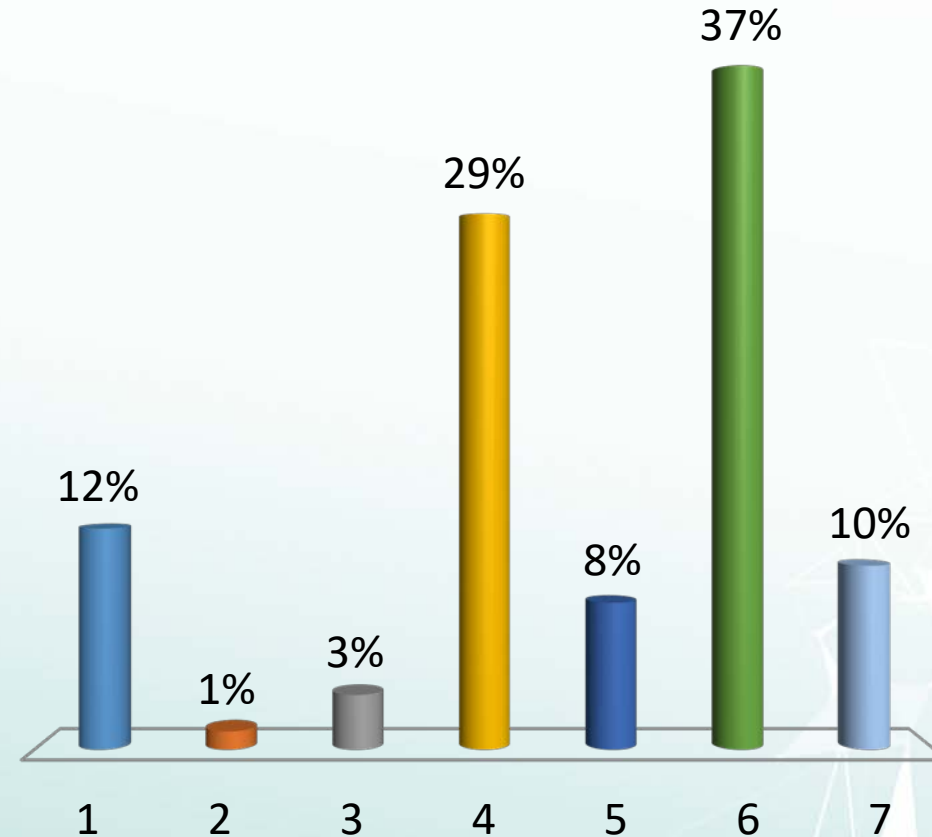
Discussion oriented clicker questions

- Many of the course concepts do not lend themselves to questions with yes/no or right/wrong answers
- Each lecture was paced by **over-arching clicker questions** that the instructor polled **multiple times**
 - Answers ranged from “implausible” to “plausible, but incomplete”
 - Instructor then reasoned through the question and provided more information to eliminate the implausible and highlight the plausible
 - Instructor gave class opportunities to engage in small discussions about confusing or controversial answers
 - Questions were revisited as students were given more information
 - Changes in responses were shown to the class

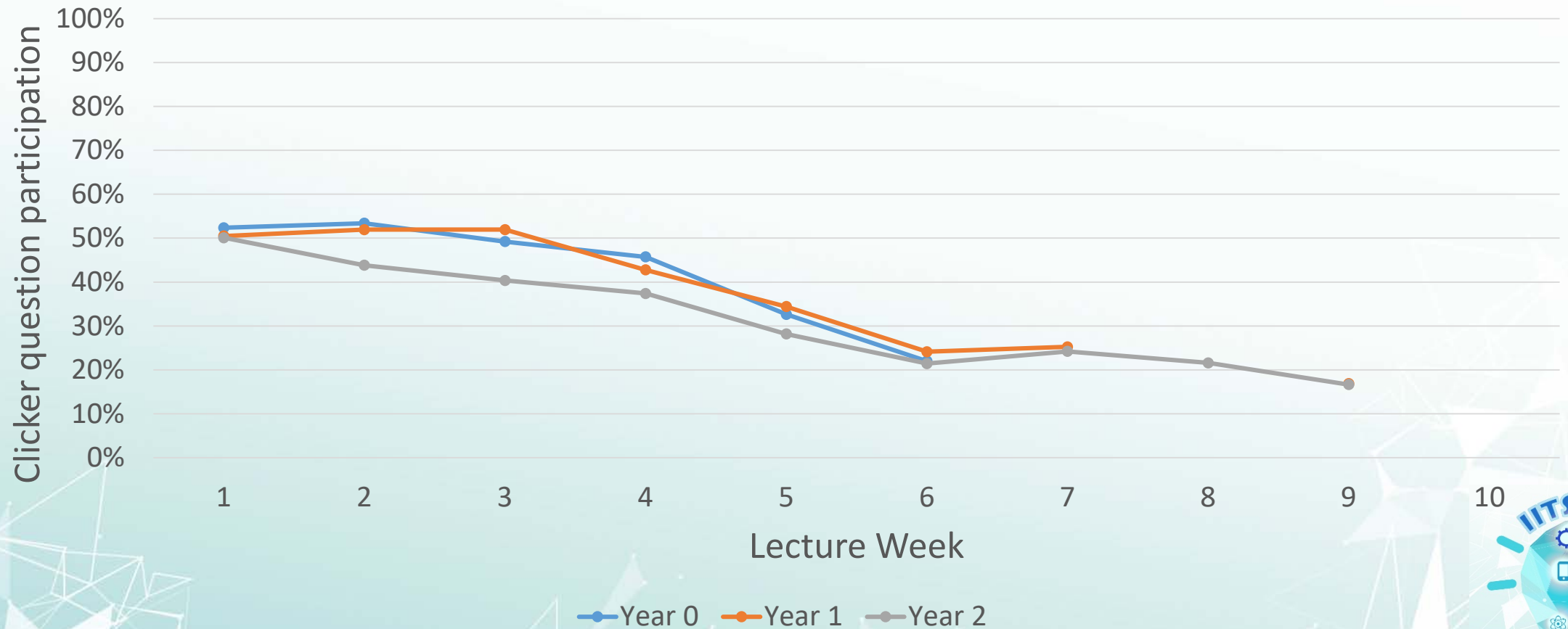


Example clicker question: When is the best time to have a child?

- A. Once I have met the right partner
- B. Once I finish my education
- C. Once I get my first job
- D. Once I have established my career
- E. Once I have a flat of my own
- F. Once I have enough money saved
- G. Never



Clicker participation by lecture week



Percent of students claiming to have watched at least 80% of lectures online



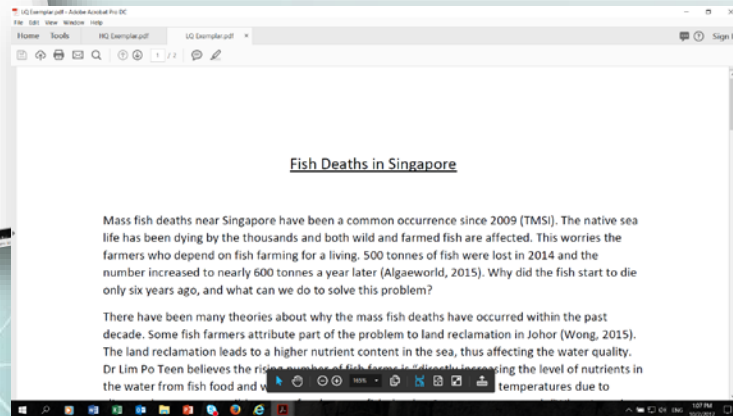
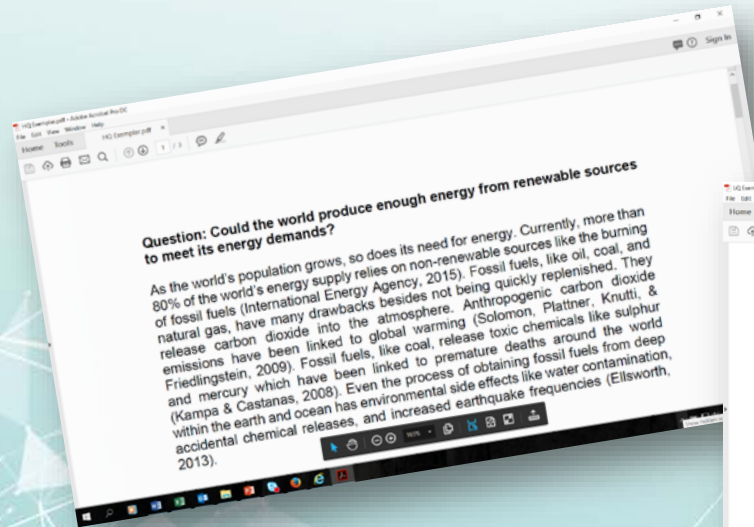
Results of discussion oriented clicker questions

- Course still showed attendance declines
- Students who participated in clicker questions performed more accurately on **critical reasoning items** (transfer items) on the exams than students who did not participate
- Few students who did not initially participate in answering questions began to after the first midterm
- Conclusion: **Answering clicker questions requiring critical reasoning** is related to accurately answering future critical reasoning questions on the same material



Calibrated exemplars

- To practice peer reviewing other's work, we provided students with opportunities to evaluate written work in the same way they would eventually be evaluated
- Students were provided with models of low, medium, and high quality
- Each model accentuated two of the evaluation rubric's categories



Example of rubric category

Using the following rubric, how would you rate the written action plan's use of argumentation?

Category	Sophistication				
	Level 0	Level 1	Level 2	Level 3	Level 4
Argumentation	Does not present an argument	Presents a simple argument with a single point which may wander or not have a solution	Presents a simple, but focused, argument with a solution	Presents a focused argument that considers alternative solutions and evaluates them	Presents a focused argument that considers alternative solutions, evaluates them, and offers an insightful resolution

- Level 0
- Level 1
- Level 2
- Level 3
- Level 4



Results of calibrated exemplars

- Students showed greater acceptance of peer review according to weekly polling
- When compared to the evaluation of the teaching team:
 - Students evaluated the initial presentation of class of exemplars as being of medium quality
 - Upon the second instance of each exemplar, students were more accurate in their assessments
- Conclusions
 - **Repeated opportunities to practice** peer review in low-stakes conditions prepares students for higher-stakes peer review activities
 - Multiple instances of **contrasting cases** promotes learning



Peer review

- Originally peer review was about improving the **quality of student writing**
- The activity gradually moved more toward being able to **communicate** an environmental action plan to non-experts, recognizing the **quality** of proposed solutions, and appreciating **how science works**



Video assignment

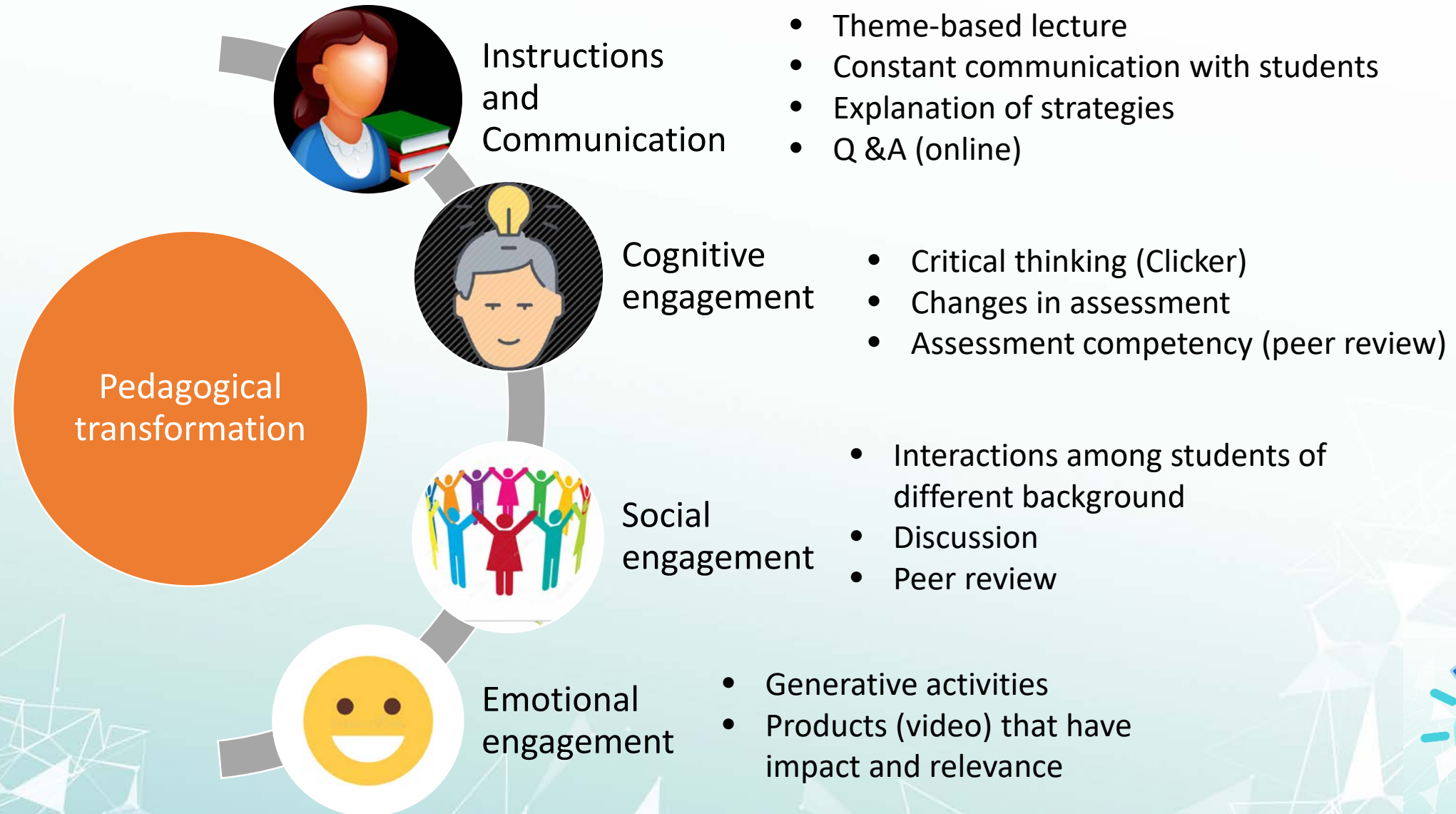
- 67 groups of 4-5 students
- Groups were composed of:
 - 1-2 engineering majors
 - 1-2 science majors
 - 1 Humanities and/or business major
- Groups captured and edited a 5 minute video to “sell” their solution to an issue with Singapore’s food sustainability
- Groups uploaded their video to AcuStudio



Results of video assignment

- All groups completed the assignment by the deadline
- Evaluation scores for videos did not correlate with scores for written solutions
- Differences in group composition predict differences in video genres
 - Groups with business school members were more likely to role-play
 - Groups with humanities members were more likely to use animated handwriting
- Conclusion:
 - Group members' past assessment experiences inform how groups make sense of ambiguous assessments
 - Video quality is not necessarily related to the quality of the written work that it was based on (different skills)





Final impressions

*“[The] classes are **always fun and interesting** and [the] explanations are easy to understand. **I like the clicker questions** during lectures as they help me **keep track of my own thoughts** and also allow me to **know what my peers are thinking.**”*

*“[The instructor] is **ever ready to address students queries** and provides very clear and precise answers.”*

*“Case scenario taught in class **opened my eyes** to the issues of the world and their unique individual solution. Prof is **good at relating concepts** from different chapters and topics. This is a **truly integrative module.**”*

*“The **best lecturer** I've had. **Inspiring** and made me start thinking in a different way which is useful to learn.”*

