Video Lectures on Scalable-Learning as the perfect match to Peer Instruction

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School of Technology & Health
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PI+SL
Peer Instruction why?

1. reasonable to spend lecture time on concepts
2. gives better results (measurable & measured)

Peer Instruction why not?

no lectures!
Mamo’s data clearly shows that videolectures with self-assessment quizzes, followed by student-centred in-class session increase students’ learning:

1. yes, definitely!
2. maybe
3. no way!
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What are the strengths of this way of running a course?
Mamo, at the end of the course, asked his students the following (answer was anonymous):

I read about ionising radiation in the text book:

1. no, not at all
2. only few parts
3. around 50% of the suggested readings
4. yes, everything suggested

What do you think they answered?
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What do you think they answered?

Is this a problem? If yes, suggestions?
Relative change of students performance
(32 stud 2013: avg 37.2%, 31 stud 2014: avg 43.5%)

- lowest score from 2013 eliminated
- highest score from 2013 eliminated

avg 11.8%
avg 17.5%

score 2014 - score 2013 (%)

- t-value against null hypothesis of 0 difference:
  3.5306 (highest from 2013 eliminated)
  2.7076 (lowest from 2013 eliminated)

NB: the distribution is not Gaussian
(and neither Student’s t-like)!
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here is where I expected teaching form to have biggest impact

lowest score from 2013 eliminated

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Is this something we should discuss as if the data were reliable?

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Does this disadvantage certain kinds of students?
slides for video
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in class

green arrow points to home
Scalable-Learning

- videolecture 5-10 minutes: one concept
- multiple-choice question
  - right answer
  - tracked!
  - wrong answer
  - hints
    - right answer

- videolecture 5-10 minutes: next concept
Question 2
Emission 1.2: optimal emission energy

OCQ | Photons emitted should preferably:

- All leave patient (Correct)
- Some leave, some attenuated (Incorrect)
- All absorbed (Incorrect)

Question 3
Emission 1.2: optimal emission energy

OCQ | Optimal energy for SPE with NaI

- 2 keV - 2 TeV (Incorrect)
- > 511 keV (Incorrect)
- 100 keV - 300 keV (Correct)
- Any energy will do (Incorrect)

Question 4
Emission 1.3: other desirable properties of the source

OCQ | I have a very cheap isotope to sell you. Its half life is 1 s, so it will immediately disappear right after the patient has been scanned. Is it usable?

- Yes! You just need to inject a very high activity. The dose will be the same, since the integrated number of emitted p... (Incorrect)
- I have more isotopes than I can use. But I have a good friend you can sell it to ... (Correct)
start by reviewing this (PI question(s) on this concept)
start by reviewing this (PI question(s) on this concept)

continue with these 2
start by reviewing this
(PI question(s) on this concept)
continue with these 2
no need to spend time on this
next year: review lecture on this

start by reviewing this (PI question(s) on this concept)

continue with these 2

no need to spend time on this
what have i done

• recorded lectures with screen-cast program: ppt-presentation with my voice over

• divided in chunks 3-13 min and added self-assessment quizzes (around 1 every 3 min)
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time?
what have i done

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• divided in chunks 3-13 min and added self-assessment quizzes (around 1 every 3 min)

time?

• first lecture module: ~2 weeks

• last lecture module: ~3h
what have i done

• recorded lectures with screen-cast program: ppt-presentation with my voice over
• divided in chunks 3-13 min and added self-assessment quizzes (around 1 every 3 min)
• in-class session prepared to match students needs (individuated through scalable-learning)
Course: Medicinska bildgivande system, HL1202

- Mandatory, 2 year engineering program
- Treats medical imaging with: ultrasound, magnetic resonance, ionising radiation (transmission & emission) + medical photography, optical endoscopy, thermoscopy
- Pre-knowledge for ionising radiation part: 1-variable analysis, Modern Physics
- 35-40 students/year

Ionising Radiation

- TI
- EI
- US
- MRI

2013: no SL
2014: SL
no changes
Comparison of students results on Ion Rad part: 2014 (using Scalable Learning) vs 2013 (no SL)

- **Score (%) on Ionising Radiation, with SL**
  - Avg 43.5%

- **Score (%) on Ionising Radiation, without SL**
  - Avg 37.2%

graphs showing data distribution
Normalisation of data

- 32 students passed the MR-threshold on the 2013 exam, 22 passed the TI-threshold 2014.
- Students’ performance on MR, US and rest (that is total score - score on IonRad) can be used for normalising results of the 2 classes.

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<tbody>
<tr>
<td>35.2 p (of 66 p)</td>
<td>33.5 p (of 66 p)</td>
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Since the results are very close and in favour of the 2013 class, no normalisation is necessary.
extra slides

• these will (most probably) not be used
Changes in teaching 2014 vs 2013

2014:
- Pre-recorded video-lectures with self-assessment questions uploaded on Scalable-Learning (SL) (6 modules). These were mandatory to watch with deadline midnight day before corresponding in-class session.
- In-class session designed after results on self-assessment questions, questions by the students, analysis of lecture statistics from SL. In class-session comprehended: short summary (30’), review of self-assessment questions (30’-1h) Peer-Instruction questions (1h-30’)
- Mandatory laboratory exercises on: Ionising radiation detectors, CT and Gamma Camera (each with reports)
- 1 PBL seminar (2 x 2h, 1 week apart) on design of microCT for small animal imaging

2013:
- 6 Classroom lectures: Presentation of material followed by PI-questions and discussion. Usually 3-5 PI-questions per lecture.
- Mandatory laboratory exercises on: Ionising radiation detectors, CT and Gamma Camera (each with reports)
- 1 PBL seminar (2 x 2h, 1 week apart) on liver cancer imaging with PET
Changes in students participation
2014 vs 2013

2014:
- Video-lectures were mandatory, practically all students watched them and completed the self assessment questions.
- 20-25 students showed up for in-class sessions. According to students own assessment on final survey:

![Bar chart showing attendance]

- Laboratories and seminar were also mandatory so participation was close to 100%.

2013:
- 1 week around 20 students were present at lectures. Following week 35-40 students were attending lectures
- Laboratories and seminar were also mandatory so participation was close to 100%.

Caveat: in 2014 course started with ultrasound while in 2013 Transmission was taught first
Outlook

MCQ | In the in-class session Mamo addressed the questions and doubts I had

I should do better than this with SL!!!!

MCQ | The chance that I will watch again some of the lectures on scalable-learning is (1 low - 5 very high)

OCQ | This is what helped me most for understanding the course material (inonising radiation imagin)
Outlook

MCQ | I read about ionising radiation imaging in the text book

| Number of Students (Out Of 42) | Students
<table>
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<tbody>
<tr>
<td>no, not at all</td>
<td>6</td>
</tr>
<tr>
<td>only few parts</td>
<td>9</td>
</tr>
<tr>
<td>around 50% of the suggested readings</td>
<td>15</td>
</tr>
<tr>
<td>yes, everything suggested</td>
<td>4</td>
</tr>
</tbody>
</table>
F Lundell & L Filipsson

different strategy
Outlook

F Lundell & L Filipsson

different strategy

1. MCQ | I read about ionising radiation imaging in the textbook
   - No, not at all: 12
   - Only few parts: 18
   - Around 50% of the suggested readings: 6
   - Yes, everything suggested: 4

2. MCQ | Before this course, I knew so much about the interaction of radiation with matter
   - Nothing: 4
   - Very little: 12
   - Something: 18
   - Enough: 0
   - A lot: 4

3. MCQ | Now I know so much about the interaction of radiation with matter
   - Nothing: 4
   - Very little: 12
   - Something: 18
   - Enough: 4
   - A lot: 4
Outlook

F Lundell & L Filipsson
different strategy

this is actually not
part of the course
more details: improve lectures!

HOW?!!?!!

- The number of photons emitted by the source right? not the camera?
  0:30-0:40
Tentative analysis

• Video-lectures increase time with teacher ...
• ... and more time is left for discussion during in-class session
• There is a clearer stepwise increase in Bloome's taxonomy for the different activities
• ... but fewer students participated in in-class sessions
• NEW => there's room for improving video-lectures (SL helps!) and in-class sessions

one extra observation

2 students from previous year got access to SL and their scores were 44% & 39%
Re-exam results are better than usual.
Other things to consider (independent of SL)

- Result is still low

- Final is testing “deep” learning, no or very few points are awarded for rote-learning. This seems to pose a great challenge.

- SL seems to improve student’s learning but more has to be done. A goal of an average of around 60% for the class as a whole is reasonable.

- Area of improvement: make student better understand how labs and seminars should be used. Create environment that encourage discussion among students and asking teachers (99% of the questions outside classroom were not on the material)