Two Stage Exams: Learning Together?

Brett Gilley
Department of Earth, Ocean and Atmospheric Sciences and Vantage College, University of British Columbia - Vancouver

Joss Ives
Department of Physics & Astronomy and Vantage College, University of British Columbia - Vancouver
What do you notice?

from http://www.cwsei.ubc.ca/resources/SEI_video.html
Define two-stage exams

Discuss benefits and drawbacks

A brief review of the literature
How frequently do you use group work in your courses?

On a scale of

- 0: No group work
- 5: I only interrupt group work to make announcements
Have you used two stage exams or cooperative exams?
Define two-stage exams

Discuss benefits and drawbacks

A brief review of the literature
Students complete, then hand in the individual exam

* Our implementation

- Approximately 2/3rds of the total exam time is spent on the solo phase

Solo Phase
Then they get into groups of 3-4 to work on the group exam

• A mix of group formation styles at UBC-V: instructor vs. student formed
• Group exam is nearly identical to the individual exam
• Groups get only one exam sheet and must come to consensus

* Our implementation

Group Phase
Group exams are in widespread use at UBC-V

Over 100 courses
- Physics, Chemistry, Biology, Math, Statistics, Earth, Ocean, and Atmospheric Sciences, Computer Science, Forestry, Pharmacy, Psychology, and Land and Food Systems, Poli Sci,

Many class formats
- 450 student 1st year lectures
- 20 person laboratories
- 20 student 4th year seminars
- 5 student graduate classes
Define two-stage exams

Discuss benefits and drawbacks

A brief review of the literature
What are some possible **benefits** of group exams? **Student or instructor** (Discuss with your neighbors)

- Simple mistakes are cleared up in the moment
- Immediate feedback
- Explanations coming from expert novices
- Learning through articulation of ideas
- Increases problem solving abilities and group work skills
- Students like them
- Learning how to learn

- Stress reduction
- Get a good read on how they did individually
- In-context language practice
More benefits…

• Learning
• Articulating ideas deepens understanding
• Building confidence
• Community belonging
• Diversity of ideas and approaches
• Developing soft skills
• Immediate feedback (right/wrong and learn from mistakes)
• Reducing anxiety

• Solving very challenging problems
• Reinforcing instructional practices
• Boosting grades
• Intense discussions of your favorite discipline
• Leaving the exam room on a high note
Student surveys tell us they really like the format

<table>
<thead>
<tr>
<th></th>
<th>Positive opinions</th>
<th>Negative opinions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rieger 2014 (Physics)</td>
<td>71%</td>
<td>10%</td>
</tr>
<tr>
<td>Fengler 2015 (Mech Engineering) “prefer 2-stage”</td>
<td>76%</td>
<td>15% (all mild, no strong disagreement)</td>
</tr>
<tr>
<td>Rivas 2016 (Nursing)</td>
<td>98%</td>
<td></td>
</tr>
</tbody>
</table>
## Positive feedback from EOSC 114

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
<th>Other Feedback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion</td>
<td>48</td>
<td>Build confidence</td>
</tr>
<tr>
<td>Learn why you were wrong</td>
<td>37</td>
<td>Understand questions better</td>
</tr>
<tr>
<td>New Perspectives</td>
<td>29</td>
<td>Learn techniques from others</td>
</tr>
<tr>
<td>Better grades</td>
<td>21</td>
<td>Other</td>
</tr>
<tr>
<td>Instant feedback</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Review</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>208</td>
<td></td>
</tr>
</tbody>
</table>
## Negative feedback from EOSC 114

<table>
<thead>
<tr>
<th>Issue</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coming to consensus</td>
<td>21</td>
</tr>
<tr>
<td>Time consuming</td>
<td>13</td>
</tr>
<tr>
<td>Unbalanced knowledge in group</td>
<td>6</td>
</tr>
<tr>
<td>Convinced of wrong answer</td>
<td>3</td>
</tr>
<tr>
<td>Realize did poorly individually</td>
<td>3</td>
</tr>
<tr>
<td>Worth too much</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
</tr>
</tbody>
</table>
What are some possible **drawbacks** of group exams? (Discuss with your neighbor)

- Being convinced of the wrong answer
- Challenging to have group-only questions that require a lot of up-front deep thinking
More drawbacks…

- Student anxiety surrounding group work
- Differences in communication skills (EAL)
- Dominating personalities
- Dead wood
- Being convinced of the incorrect answer
- Students learning of their own poor solo performance
- Grade inflation
- Extra time
Say what??

Neil Jon Norcross  Jesus...exams are not "learning opportunities." They are meant to measure what students have already learned. They are in pedagogy what are called summative evaluation as opposed to formative evaluation. The place for this type of activity is during... See More

Like · Reply · 1 · April 9 at 7:46am

Erin Danes  Yuck. My worst nightmare. I hate group work, and end up always having to carry some lazy person. Also I get exam anxiety as it is. I'd much rather just have my solo exam be worth more.

Like · Reply · 2 · April 6 at 11:47pm

Kelgie Sou  meanwhile ubc has had these for ages... (and a bunch of take home finals too) lol

Like · Reply · 16 · April 6 at 3:55pm

5 Replies

Tanis Aiton  Uvic has also done this before. If your group exam mark was lower than your individual exam however, it would not count towards your final grade. The thought was that at least this way everyone will get a chance to learn the material and the answer.

Like · Reply · 2 · April 7 at 11:14am

Termeh Bashiri  Tina Kia UBC physics instructors let students take part of the exam in groups... why os that not a news?

Like · Reply · 10 · April 6 at 4:15pm

1 Reply
Define two-stage exams

Discuss benefits and drawbacks

A brief review of the literature
Correct individuals are infrequently lead astray

<table>
<thead>
<tr>
<th>Category</th>
<th>Correct (%)</th>
<th>Incorrect (%)</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Questions</td>
<td>57.3 ± 1.6%</td>
<td>42.7 ± 1.6%</td>
<td>n=1008</td>
</tr>
<tr>
<td>Individual Questions</td>
<td>97.8 ± 0.6%</td>
<td>2.2 ± 0.6%</td>
<td>n=565</td>
</tr>
<tr>
<td>Group Questions</td>
<td>73.0 ± 2.1%</td>
<td>27.0 ± 2.1%</td>
<td>n=565</td>
</tr>
</tbody>
</table>

Data from Ives N = 37 (2011) Introductory E&M course
Groups outperform individuals and all performance levels learn from the group

Reproduced from Jang 2017
Groups composed of only incorrect individuals show good evidence that learning takes place during the exam.

- **Ives**:
  - 32.9 ± 9.3% (N = 25)
  - 29 ± 2% (N = 568)

- **Singh**:
  - 50.0 ± 9.1% (N = 30)

- **Gilley**:
  - 56.4 ± 6.7% (N = 55)

[Singh 2005] [Gilley 2012]
The majority of studies point to evidence of learning in the short-term...

<table>
<thead>
<tr>
<th>Short-term (0-4 weeks)</th>
<th>N</th>
<th>Discipline</th>
<th>Effect size (Cohen’s d)</th>
<th>p-value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gilley 2014</td>
<td>same</td>
<td>Earth Science</td>
<td>0.54</td>
<td>0.0005</td>
<td>Nearly 10% difference in scores</td>
</tr>
<tr>
<td>Gilley 2014</td>
<td>same</td>
<td>Earth Science</td>
<td>0.39</td>
<td>0.0132</td>
<td></td>
</tr>
<tr>
<td>Rivaz 2016</td>
<td>same</td>
<td>Nursing</td>
<td>1.66</td>
<td>0.001</td>
<td>Treatment scored twice as high as control</td>
</tr>
<tr>
<td>Ives 2014</td>
<td>near-transfer</td>
<td>Physics</td>
<td>0.11</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>Ives 2015</td>
<td>near-transfer</td>
<td>Physics</td>
<td>0.2</td>
<td>0.001</td>
<td></td>
</tr>
<tr>
<td>Cao 2017 Expt 1</td>
<td>near-transfer</td>
<td>Computer Science</td>
<td>0.26</td>
<td>0.003</td>
<td></td>
</tr>
<tr>
<td>Cao 2017 Expt 2</td>
<td>near-transfer</td>
<td>Computer Science</td>
<td>0.19</td>
<td>0.026</td>
<td></td>
</tr>
<tr>
<td>Vogler 2016</td>
<td>near-transfer</td>
<td>Education</td>
<td>No effect</td>
<td></td>
<td>Two different years</td>
</tr>
<tr>
<td>Leight 2012</td>
<td>near-transfer</td>
<td>Biology</td>
<td>No effect</td>
<td></td>
<td>Two different tests</td>
</tr>
</tbody>
</table>
The majority of studies point to evidence of learning in the short-term, **but less so in the long-term**.

<table>
<thead>
<tr>
<th>Long-term (&gt; 4 weeks)</th>
<th>N</th>
<th>Discipline</th>
<th>Effect size (Cohen’s d)</th>
<th>p-value</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vogler 2016</td>
<td>same</td>
<td>Education Psychology</td>
<td>0.43</td>
<td>0.04</td>
<td>12.5% better scores for treatment</td>
</tr>
<tr>
<td>Vogler 2016</td>
<td>same</td>
<td>Education Psychology</td>
<td>0.49</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td>Ives 2014</td>
<td>near-transfer</td>
<td>Physics</td>
<td>No effect</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ives 2015</td>
<td>near-transfer</td>
<td>Physics</td>
<td>-0.11</td>
<td>0.012</td>
<td></td>
</tr>
<tr>
<td>Cao 2017</td>
<td>near-transfer</td>
<td>Computer Science</td>
<td>No effect</td>
<td></td>
<td>Final exam</td>
</tr>
<tr>
<td>Fournier 2017</td>
<td>near-transfer</td>
<td>Human Anatomy</td>
<td>No effect</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
There is evidence that the learning benefits are seen for all performance-levels.

Reproduced from Gilley 2014
In closing
Which **barriers** exist for you?
(Discuss with your neighbor)
Group exams are the highest level of student engagement that we have observed in any of our courses. Even the shyest students participate.


