Two-stage tests: turning testing into learning opportunities across course assessments

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Session outcomes

- Increase awareness of the benefits of using two-stage exams.
- Increase awareness of literature on two-stage approaches.
- Gain tips in implementing the two-stage exams in your own classes.
- Experience mock mini-version of two-stage tests.
What are two-stage exams?

Students complete & hand in an individual exam

Immediately followed by same/slightly more difficult exam written in groups of 3-4

85% individual: 15% group

Group can only bring grade up

Modified from Ives, 2014
https://learnification.wordpress.com/category/course-components/group-quizzes/
1 exam per group

F2013 BIOL 2040 (Dr. Kelly)
GROUP Final Exam – Dec. 15, 2013
Duration: 60 minutes

1. Clearly PRINT names & student numbers of all group members on the cover page.

2. There are 4 scantrons in your package. Do NOT remove the staple! There is a 10 mark deduction for separating the exam.
   a. Do NOT change the answers to Q1 or Q2. These represent your group code and will ensure that you get the grade associated with the top page.
   b. Each member must put their name and student number (and bubble in their student number) on one scantron. It does NOT matter whose name goes on the

Group component → CONSENSUS
Two-stage exams - which courses?

Different disciplines

Any class size ≥2 students

Many different formats
It’s test time!

GROUP QUIZ:
1. Get into groups of 3-4 people and raise your hand. The instructor will come give you ONE exam sheet and ONE IF-AT (Scratch & Win) card.
2. Neatly write your names and student numbers at the top of the exam and on the back of the IF-AT card.
3. Scratch once your group has reached agreement.
4. If your answer is wrong (no ★), then discuss until you come up with a new answer, then scratch.
5. **STOP** scratching once you reveal the correct answer.

<table>
<thead>
<tr>
<th>POINTS – give your group points for each question</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>10 points</strong> = correct answer on 1st choice</td>
</tr>
<tr>
<td><strong>5 points</strong> = scratched two options, correct answer was 2nd choice</td>
</tr>
<tr>
<td><strong>2 points</strong> = scratched three options, correct answer was 3rd choice</td>
</tr>
<tr>
<td><strong>1 points</strong> = scratched four options, correct answer was 4th choice</td>
</tr>
<tr>
<td><strong>0 points</strong> = scratched five options, correct answer was 5th choice</td>
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</table>
Benefits of two-stage exams

“A two-stage group exam is [a] form of assessment where students **LEARN** as part of the assessment.”

— Joss Ives, 2011
Feedback when students are most receptive to it and when it will have the greatest impact on learning.
Two-stage exam (at UBC)
What do you notice?

Used with permission of B. Gilley
Engaged collaborative learning

All students **PARTicipate**
Even students who are normally quite shy

**Why?**
Development of collaborative skills

“If you ask someone else for help on a problem in an exam, you are CHEATING, but if you don’t ask for help on a problem in the real world, you are a FOOL.”

- Dan Schwartz, cognitive psychologist (quoted in Wieman et al. 2014)

Example from course Learning Outcomes:

B Communicate information, arguments, and analyses accurately and reliably (in both written and verbal form) on your own, in pairs, and in small groups, during lectures (and associated activities), tutorials, and exams.
B1. Work effectively and collegially with peers in lectures, tutorials, and exams.
   a. Listen to what your peers have to say, and participate in discussions collegially.
B2. Communicate information, arguments, and analyses accurately and reliably in verbal and written form during class activities, and on assignments, quizzes, and exams.
   a. Given a problem, identify what is asking, what is known, and what information is needed to solve the problem. Summarize provided information into a model if necessary.
Students enjoy them!

“I like that that some of the questions on the group survey were the harder questions from the individual test ... it relieved some anxiety of debating these questions after the test, but it allowed me to understand them better and where I potentially went wrong.”

“...gave us a chance to see different perspectives on how to answer the question, especially if we happened to get it wrong on the individual portion. It helps you to learn because you figure out, as a group, how to do it the right way.”

“I liked that the two stage test gave us an opportunity to improve our mark and learn instantly from our mistakes instead of waiting till the answer key came out. By discussing the answer with our group it gave us a chance to debate and really stick by what we learned”

“...was able to learn new approaches to solving questions by other group members ... gave me a chance to also justify my solution and reasoning.”

“In reality, scientist must work together to solve problems, and so the group portion also served as a way of developing critical thinking and interpersonal skills in addition to the academic benefit.”

“At first I was not really comfortable with the idea, but after the first test I realized it is such a good method for learning from your mistakes and the subjects that are not clear to you. It also helps you to look at problems from different point of views. Moreover, I gained much more confidence while answering to questions in a group and the fact that the group mark was a boost to the overall mark was really encouraging.”

“Being able to discuss your thoughts with other people is really beneficial because you'll hear things from other people that you didn't previously know. I think just verbalizing your thought process and hearing everybody think out loud helps us work through a problem.”
Students see their value in learning!

I found the group part to be very helpful and constructive. It also **forced me to study harder** because I knew I would have to be in a group and I wouldn't want to let them down. It also helped me to learn new approaches to solving problems and how to avoid missing crucial information in questions. I would highly recommend to continue using the same structure of the midterms and class overall in future years.

N=309 (92% response rate)
Even grad students (TAs) enjoyed them!

“I don't think I've ever been given a high-five during an exam until I was involved with two-stage exams. **Students loved them and I loved being there. I could see students learning and learning to learn during the exam.** This is in stark contrast to "other" exams where students simply look stressed and are regurgitating their binge-studied facts onto the sheet. I really like two-stage exams and will almost certainly use them when I'm a prof.”

“It certainly was exciting to implement them. Smiling faces during exams are rare sights and the two stage exams certainly brought out a lot of them. Although invigilating these exams were more physically and mentally exhausting than a conventional exam, there was an unparalleled satisfactory high which followed them.”
Increased retention and learning

Collaborative Testing Increased Retention

Taken from Cortright et al., 2003

Adapted from Gilley & Clarkston, 2014
Both weak & strong students benefit

- Weakest teams outperform 95% of individual students (Fengler & Ostafichuk, 2015)

\[
\frac{S_{\text{team}} - S_{\text{indiv}}}{100\% - S_{\text{indiv}}}
\]

Taken from Fengler & Ostafichuk, 2015

Taken from Cortright et al., 2003
What about concepts all group members struggled with?

Minority of individuals (>1) in group correct

- (144) 9%
  - Group Correct: (92) 60%
  - Group Incorrect: (52) 40%

All individuals wrong
More than one answer

- (38) 3%
  - Group Correct: (30) 79%
  - Group Incorrect: (8) 21%

Gilley & Clarkston, 2014
Benefits of two-stage exams

“Captures their excitement around exams, in the exam.” – Brett Gilley

- Peer interaction & feedback
- All students given chance to participate
- Development of collaborative skills
- Students enjoy them!
  - Decreased stress; better attitude towards exams (summarised in Bacon, 2011)
- Promote higher level thinking
- Increased retention of concepts (Gilley & Clarkston, 2014)
- Increased student learning
  - Weakest teams outperform 95% individual students (Fengler & Ostafichuk, 2015)
  - Helps both high & low achievers (Giuliodori et al., 2008; Fengler & Ostafichuk, 2015)

Modified from Ives, 2011 (blog post)
Logistics: the nuts & bolts
aka learn from my failures

• Student pushback?
  • Tell students about the two stage exams: tell them early; tell them often.

• Time?
  • ~ 2/3 individual, 1/3 group

• Increased marking?

• Free riders?/domineering students?

• Cheating?

• Just agree with smartest student?
Do group members just accept the answer of the student they think knows best?

Taken from Rieger & Heiner, 2014
Logistics: the nuts & bolts

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  • Tell students about the two stage exams: tell them early; tell them often.

• Time?

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• Cheating?

• Just agree with smartest student?

• Forming groups?
Logistics: how would YOU form groups?

Evidence-based methods vs. Ease of practice

Instructor assembled

- E.g., tutorial affiliation
- Performance on a previous test/assignment or some other criteria (maximize diversity)
- Tools to help: CATME

Student assembled

Instructor assembled

- E.g., tutorial affiliation (alpha order)

Oakley et al. 2004, p11-12
Logistics: the nuts & bolts
aka learn from my failures

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- Time?

- Increased marking?

- Free riders?/domineering students?

- Cheating?

- Just agree with smartest student?

- Forming groups?

- Students with accommodations?
Two-stage exams WORK BEST in classes that use GROUP WORK and ACTIVE COLLABORATIVE learning strategies

Reinforce message that collaboration is important

- Peer instruction with clickers/worksheets
  Work on Q on own & submit answer; then get into groups, discuss & revote

- Two-stage tutorials

- Two-stage review
  1st day of class & prior to each test

Crouch & Mazur, 2001
Crouch et al. 2007
Smith et al., 2009, 2011
Final thought...

I really like collaborating. I get to understand different concepts from different perspectives and sometimes, it makes concepts more clear or it deepens my understanding of the concept. The mentality of a group exam is very similar to reality. In the "real world", we are expected to work in groups to combat a big project or to work towards a goal. I love this because it makes feel as if we are coming to school to learn and not to compete against each other.

- F2015 Student, Genetics
References

- Ives, 2011. FFPERPS