

Two-Stage Exams: An Effective Learning Tool?

Kristi Concannon, King's College, PA

THE TWO-STAGE EXAM

A two-stage exam[†] is a process in which students complete an exam in two parts, first independently and then as part of a peer learning group. In principle, the two-stage exam:

- Reinforces the importance and the benefits of collaborative learning
- Demonstrates that learning can and should take place throughout the entire semester, not just in compartmentalized chunks
- Provides immediate feedback on exam performance
- Encourages exams to be a learning and not just a regurgitative process
- Reminds students that mastery of content is not achieved through memorization and regurgitation, but through practice and application

Stage One

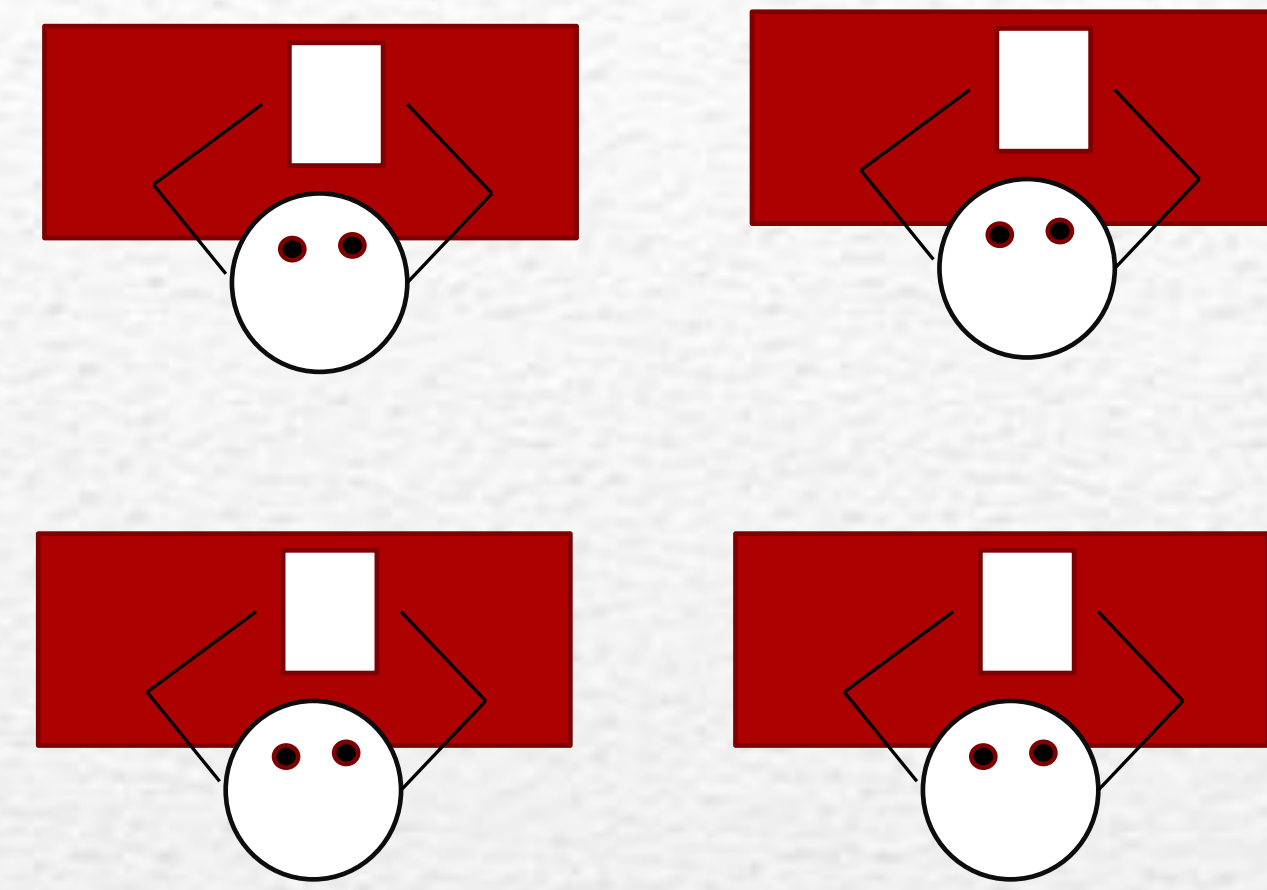
- Completed independently
- Exam Time = 50-60% of class period
- Point Allocation = 85-90% of exam grade

Stage Two

- Completed collaboratively
- Exam Time = 20-30% of class period
- Point Allocation = 10-15% of exam grade
- May contain some of the same problems as were on Stage One.
- May contain conceptual questions, computational problems or both.
- Each group submits one solution.

Collaborative Groups

- Groups of 3-4 students
- Groups selected and approved ahead of time
- Vast majority of students chose nearest neighbors



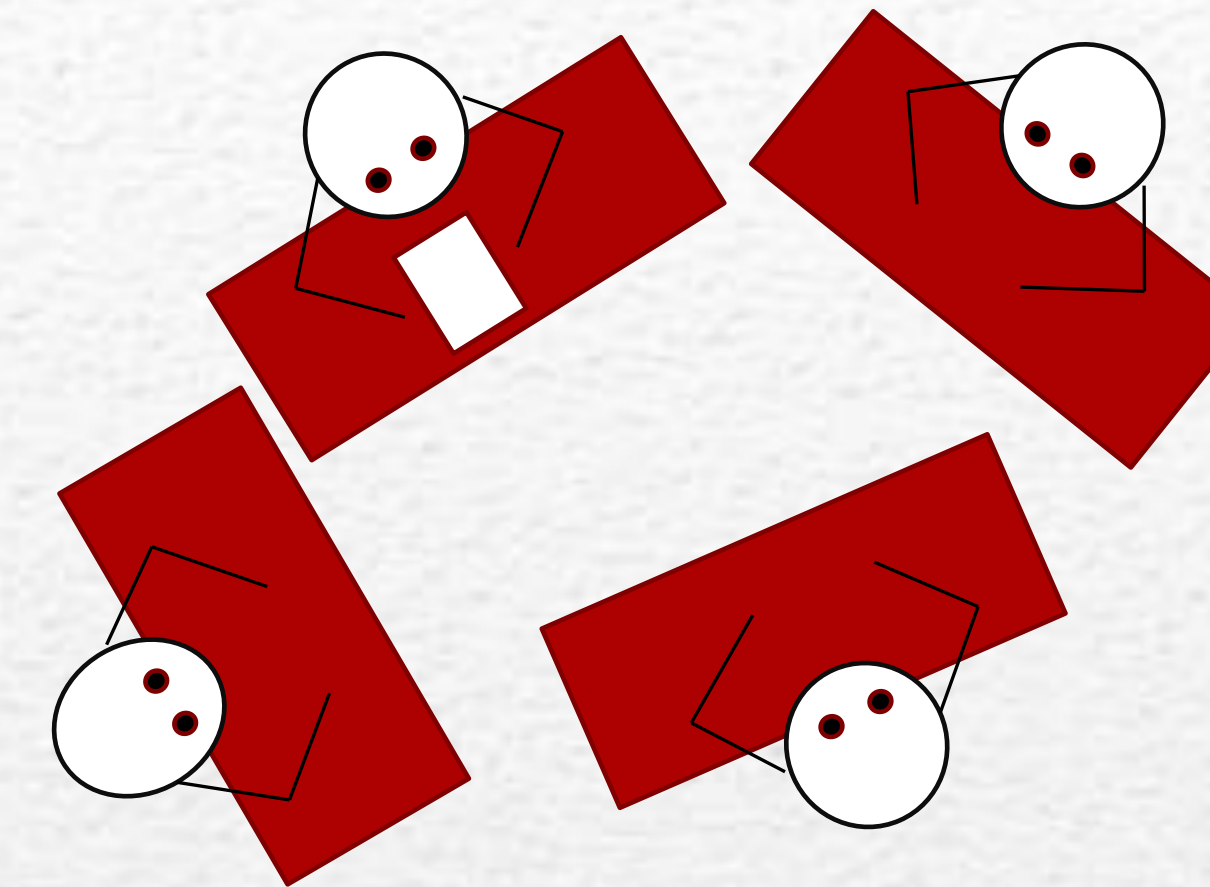
STAGE ONE

- Sample problem (1 of 4 on Part One):

A 200 g rubber ball is dropped from rest from a height of 1.0 m onto a hard floor. The figure below shows the force that the floor exerts on the ball.

a. Find the impulse on the ball during the interaction with the floor.

b. If the ball reaches the ground at a speed of 4.4 m/s, what is the rebound speed of the ball?



STAGE TWO

- Sample problem (1 of 2 on Part Two):

A 200 g rubber ball is dropped from rest from a height of 1.0 m onto a hard floor. The ball reaches the floor at a speed of 4.4 m/s and the floor provides an impulse of 1.2 Ns to the ball.

a. Find the rebound speed of the ball.

b. During the collision of the ball with the floor, is the energy of the ball conserved? Briefly explain your answer.

c. During the collision of the ball with the floor, is the momentum of the ball conserved? Briefly explain your answer.

d. If the ball were to land on a squishier floor, what would happen to the shape of the graph? Make a quick sketch to illustrate your answer.

EFFECTIVE STRATEGIES

The two-stage exam is most effective:

- In a 75-minute class period than a 50-minute class period.
- Given in one class period rather than split over two different days.
- When students are allowed to choose their group members
- When questions on Part Two build off of questions on Part One

CONCERNS

- How will this affect overall exam grades?
- Does this change the difficulty level of exams?
- How can we ensure fair group dynamics?
- Should the instructor intervene if students don't pull equal weight?
- Is it necessary to reach a single answer?
- Do students remember what they learn?

STUDENT ATTITUDES

At the end of the semester, students volunteered to participate in an interview to discuss the two-stage exam process. A question of interest is whether students from different backgrounds – those taking a class required by their science major or those taking a general education requirement – view the two-stage exam process differently.

Students answered questions on a 3-point Likert scale.

	Mean Response per Question		
	3 = agree	2 = neutral	1 = disagree
	Science Major (N=28)	Gen. Ed. Course (N=17)	
Reduced Stress	1.6 ± 0.8	2.2 ± 0.9	
Improved Confidence	1.5 ± 0.8	2.5 ± 0.9	
Learned During Exam	2.4 ± 0.9	2.1 ± 0.7	
Improved Feedback	2.2 ± 0.6	1.7 ± 0.9	
Affected Grade	2.4 ± 0.7	2.7 ± 0.5	
Points Allocation Fair	2.8 ± 0.4	2.9 ± 0.3	
Time Allocation Fair	2.2 ± 0.7	1.9 ± 0.6	
Group Assignment Fair	2.4 ± 0.6	2.6 ± 0.7	
Process is Positive	2.7 ± 0.6	2.6 ± 0.6	
Would Recommend	2.6 ± 0.6	2.5 ± 0.5	

OBSERVATIONS

General Education students are more likely to say:

- The Two-Stage exam reduces stress and improves their confidence
- The time allocation was unfair, typically preferring a longer time period for the individual portion
- The Two-Stage exam affected their grade, with most saying it improved their grade

The vast majority of all students find the experience positive and would recommend it to other instructors.

[†]G.W.Reiger and C.E. Heiner, Journal Of College Science Teaching, Vol 43, No. 4, pg 41