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

COLLABORATIVE GROUPS

- Groups of 3-4 students
- Students select group members
- Instructor approves groups before exam
- Majority of students chose nearest neighbors

Questions that are Conceptual

On Part One of the exam, students were asked to calculate the rebound speed of the ball. The same question is asked on Part Two; the majority of students answer the question incorrectly and independently in their collaborative groups.

Questions b-d were generally covered in class but were not explicitly connected to this exam problem.

The right panel shows the same fisherman using a laser ray gun on Part Two of the exam. This particular question was identified by 80% of the class as one in which they learned something during the exam.

EFFECTIVE EXAM QUESTIONS

The exam question effectiveness was determined through an assessment of student interview responses and by comparing student scores on questions before and after completion of the exam.

The most effective two-stage exam questions have the following characteristics:

- Stage Two questions are tied to questions on Part One of the exam
- Stage Two questions are conceptual in nature rather than computationally oriented
- Stage Two questions include the more difficult or misconception-laden topics, particularly those that have been part of Think-Pair-Share questions in class discussion
- Stage Two questions require reasoning and extrapolation beyond previously covered content

Questions Tied To Part One

On Part One of the exam, students were asked to calculate the battery potential and the magnitude of the electric field between the plates. These answers are given in the text of the problem in Part Two. The question also requires students to consider the scenario below (left panel) in which a fisherman is to throw a spear to hit a fish below the surface of the water. Considering the refraction of the light rays, students realize that the man should aim below the image of the fish.

The right panel shows the same fisherman using a laser ray gun on Part Two of the exam. This question also requires students to consider the scenario below (left panel) in which a fisherman is to throw a spear to hit a fish below the surface of the water. Considering the refraction of the light rays, students realize that the man should aim below the image of the fish.

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EXAM – STAGE ONE

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

EXAM – STAGE TWO

- Completed collaboratively
- Exam Time = 20-30% of class period
- Point Allocation = 10-15% of exam grade
- Each group submits one solution

Questions Tied to Misconceptions

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Figure from considerable class discussion; fisherman with spear.

Figure from Two Stage Exam; fisherman with laser ray gun.