

Identifying and Mitigating Student Behaviors that Lead to Failure

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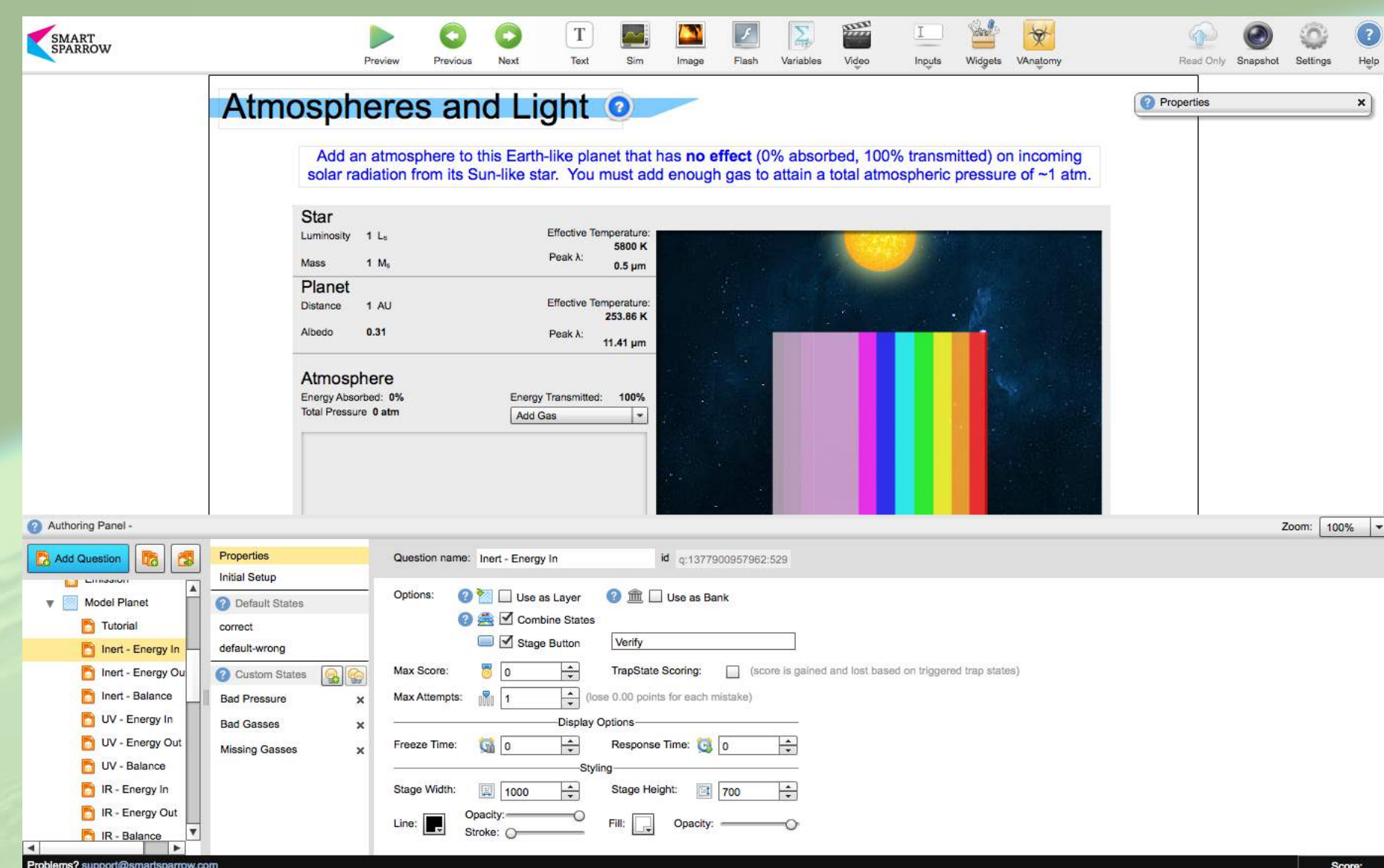
www.habworlds.org

www.smartsparrow.com

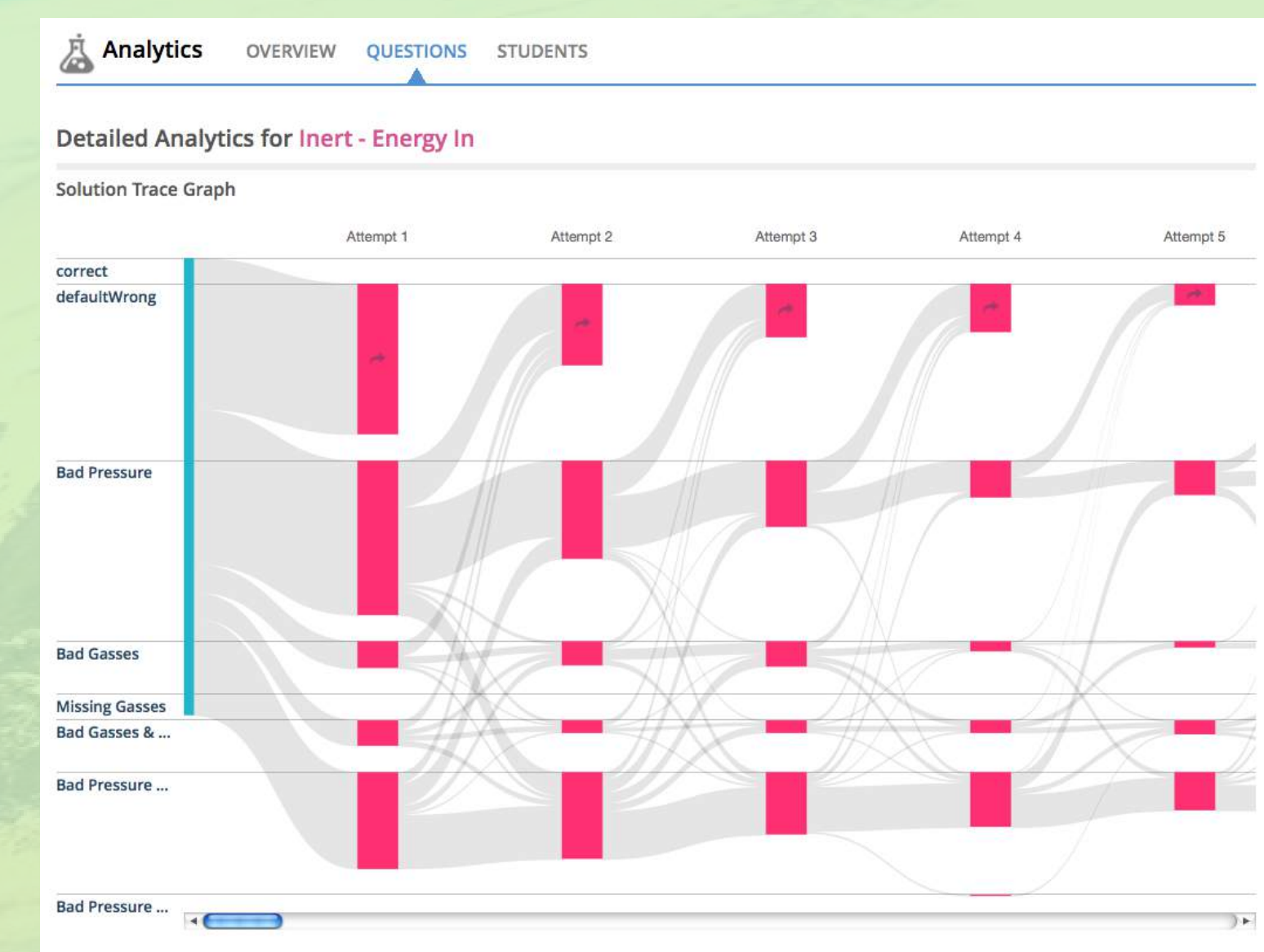


SES 106: Habitable Worlds

Organized around the Drake Equation, “SES 106: Habitable Worlds” is a 4-credit online-only fully interactive astrophysics lab course that teaches astrophysics as an integrative science, covering topics from stars to civilizations. This course is a digital native, built using Smart Sparrow’s Adaptive eLearning Platform (AeLP), which gives the instructor the power to set the content of the stage, granularity of feedback, and adaptive pathways. The system provides robust data and analytical tools that allow us to investigate how students interact with the exercises, both in aggregate and at the individual level.



To teach basic concepts, we build our lessons (using text, video, and simulators to illustrate concepts) and adaptive feedbacks and pathways in the AeLP.



Common pathways and errors are analyzed afterwards to identify problematic areas and assist in redesigning the lesson.

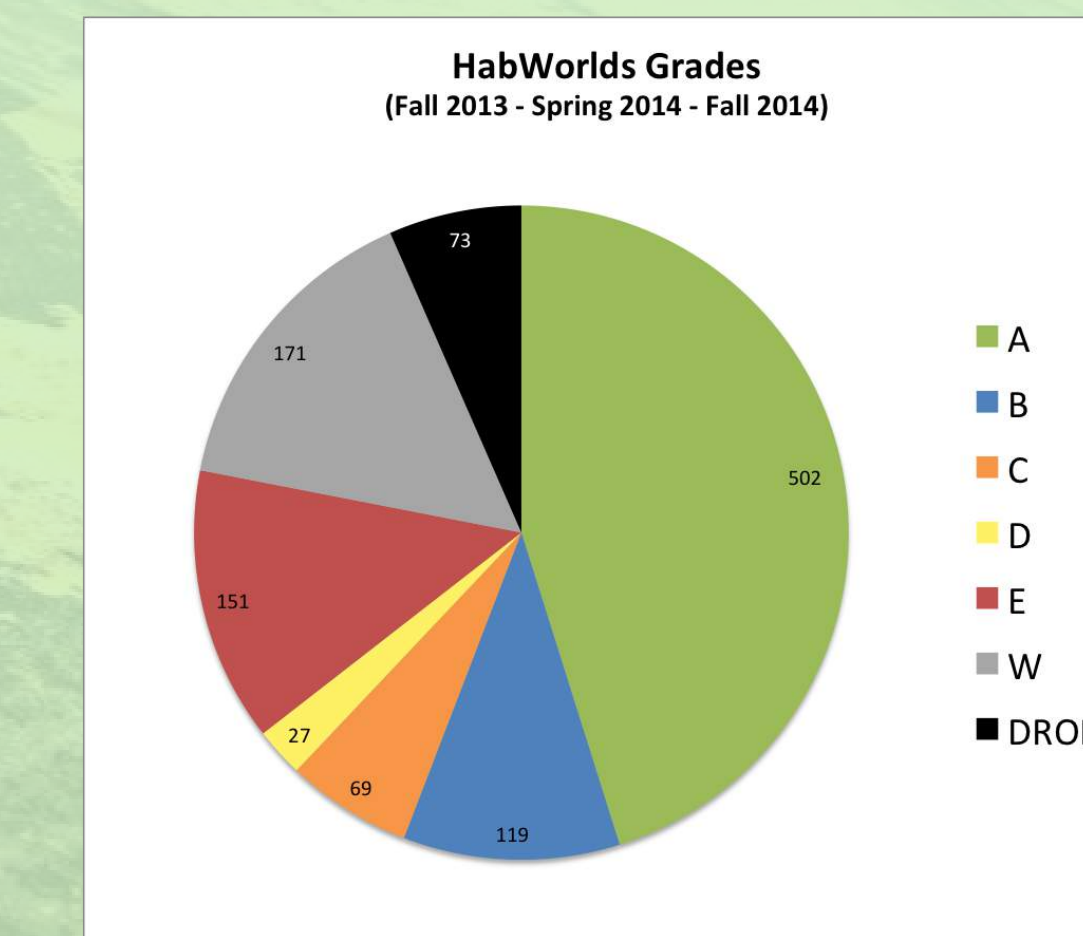
Student Behavior Analysis and Intervention

Science literacy is increasingly important in day-to-day life in the modern world. For many students, a gen-ed science course in college is their last formal interaction with science, hence student retention is important if we’re interested in training a science-literate public. Towards that end, we have investigated day-of-start and completion rate of activities in the HabWorlds curriculum and whether they correlate with student performance and other demographic information. Based on the results that we found, we devised and tested a simple intervention to see if we could affect the outcomes we predicted based on previous behavior in the course.

Completion Rate

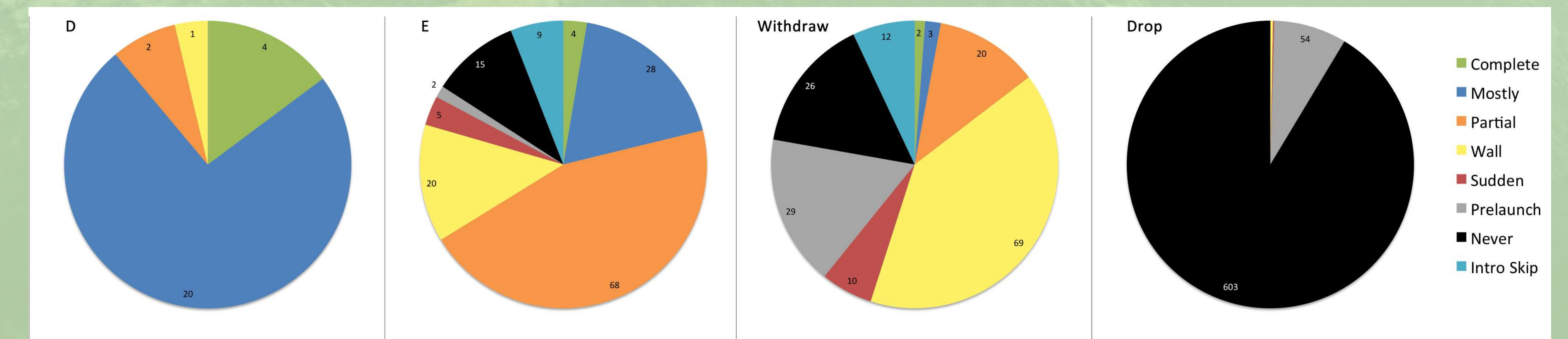
All course content is available for at least seven full days and there are no time limits while students are working on the content (aside from the week-end deadline). Material is designed to be challenging and students cannot proceed to the next activity in the exercise until they have successfully completed the preceding content. Students are supported through their struggles via a robust discussion platform (Piazza, www.piazza.com) where students and instructors interact and assist each other through challenging concepts.

Grades



Course content consists of “training” (points for completion), “application” (points for correctness), and the project (points for correctness). Each type of activity is weighted at 33%. Training exercises are designed to block progress if a student cannot complete the task and granted points at an accelerated pace (more points at end of exercise than at the beginning). Application exercises could be retaken, with best result (F13, S14) or average result (F14) recorded as the grade. DEW grades represent 34% of students.

DEW Behavior



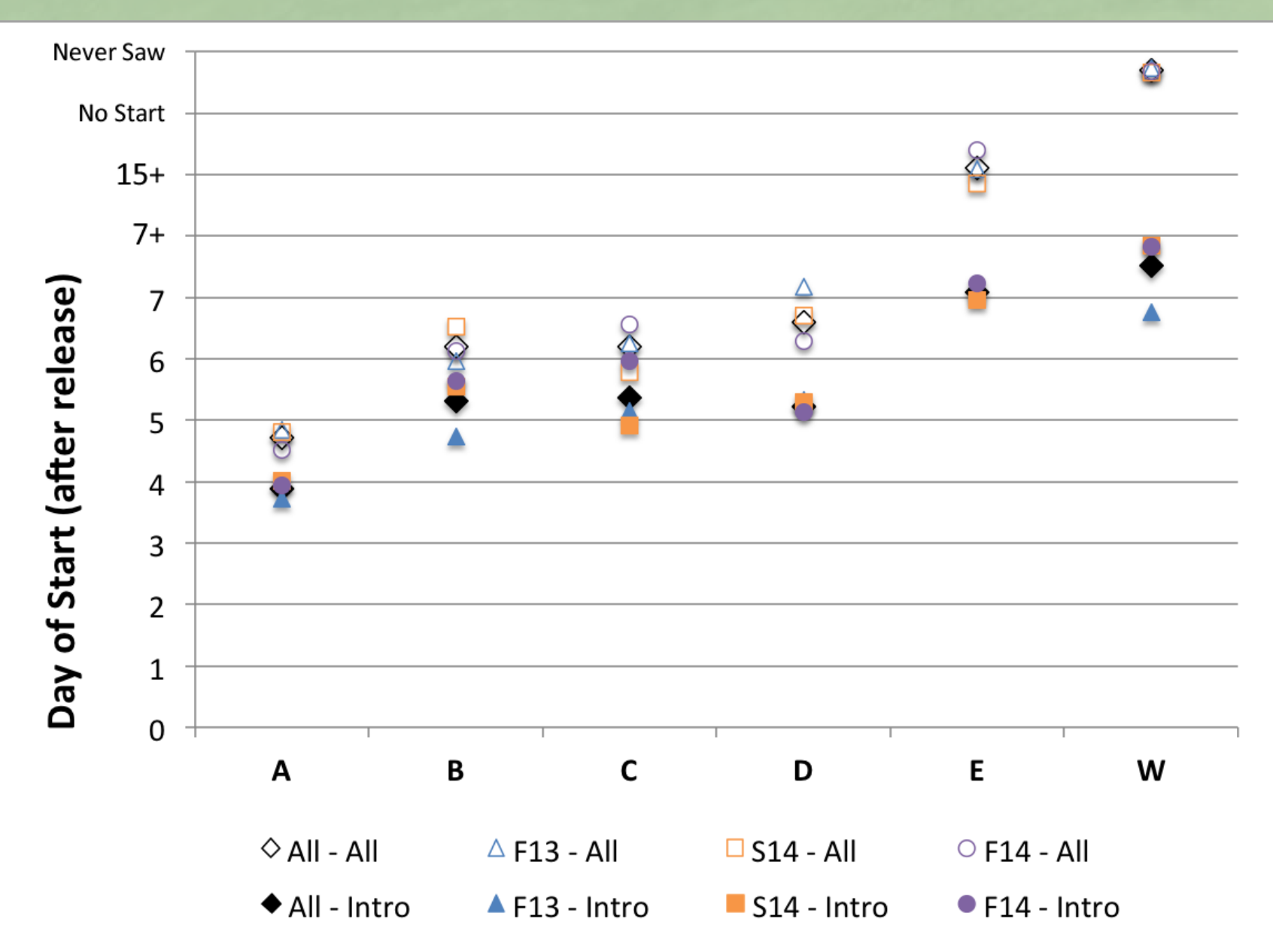
- D students complete most work, struggle on application and project materials
- E students struggle significantly, but continue to engage material from week to week
- Withdrawing students disengage after hitting one or two difficult spots in training activities
- “Drop” students represent all who add, then drop after course appears in course catalog (9+ months from start)
- Majority of dropping students never see course content
- Dropping students who see course content usually drop after encountering math content in first exercise

While the students who withdraw and drop are a lost cause, the majority of students who fail the course are not. With proper engagement and support, these students can be assisted, especially if we can identify these students quickly.

Day of Start

Course materials consist of weekly “training” exercises on topics related to a theme, coupled with “application” exercises to test abilities to apply skills acquired in training exercises. Number of training exercises per week varies from 4 to 6. They were typically released on Wednesday and due the following Tuesday, although sometimes exercises were released early or deadlines were extended depending on the desires of the instructor. The majority of exercises ran on a weekly timetable.

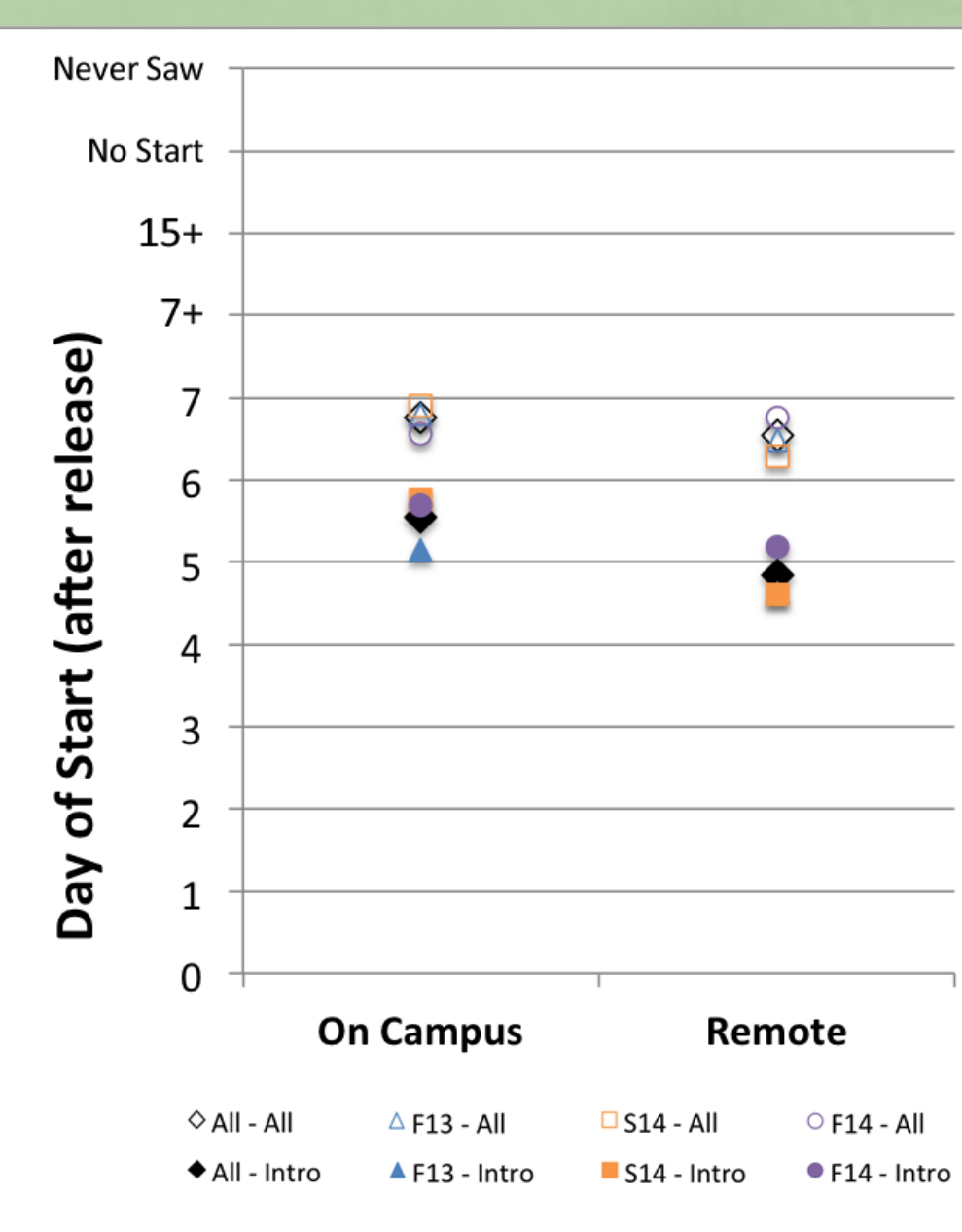
Start vs. Final Grade



- Strongest correlation between start day and grade
- Day-of-start behavior evident and statistically distinguishable in Week 1 of course
- “A” students overwhelmingly start earlier
- “D” students start earlier in week 1, but falter as the class progresses
- “E” (failing) students start late and fall further behind as the class progresses
- “W” (withdrawing) students start late and disengage

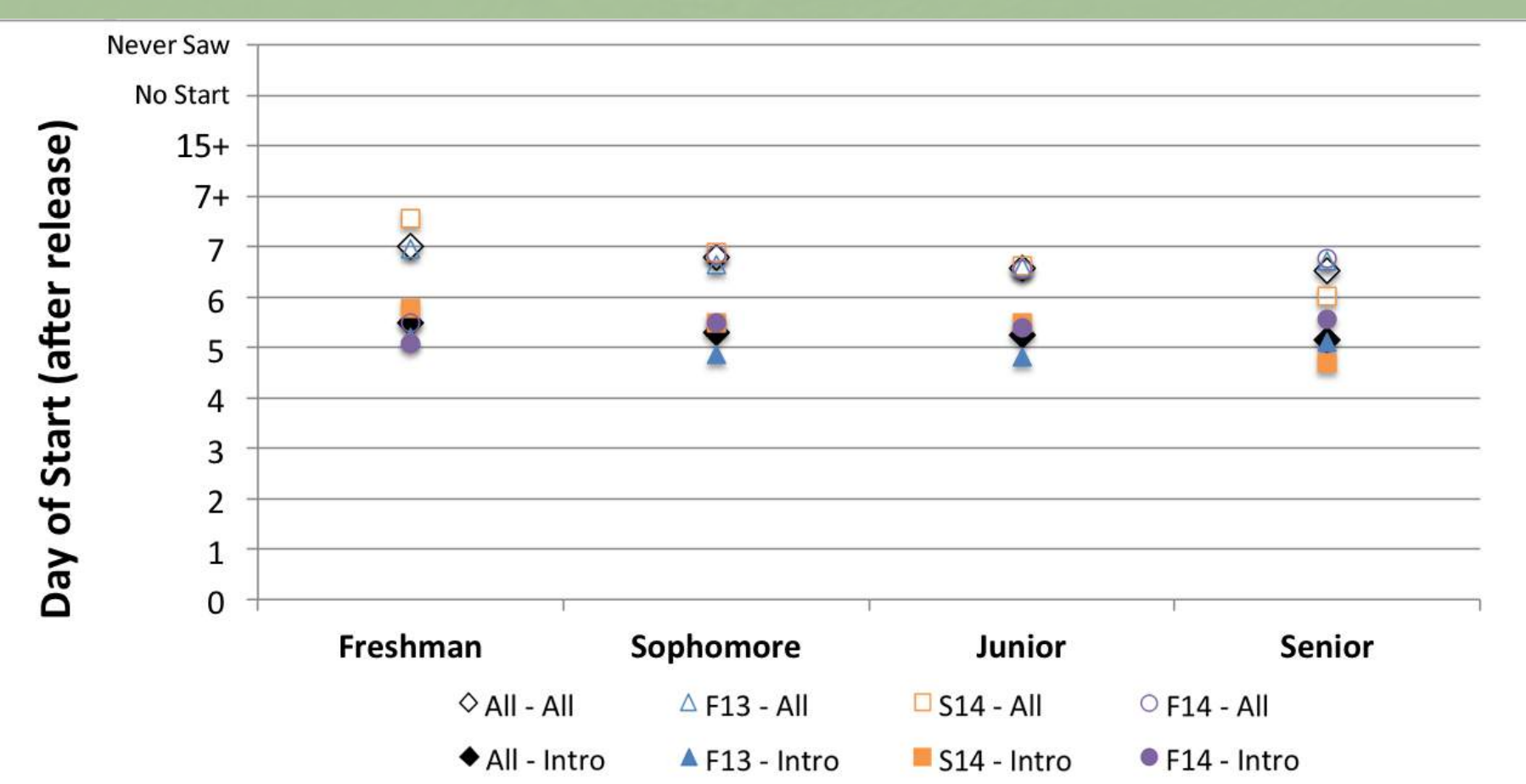
DEW students show distinctive behaviors that are evident very early in the term. D students seem aware of their weaknesses but can’t overcome them. E students are faltering throughout. W students disengage without trying.

Start vs. On Campus/Remote



- Strong correlation between type of student most semesters
- Traditional students start work later than non-traditional students
- Pattern persists through entire course

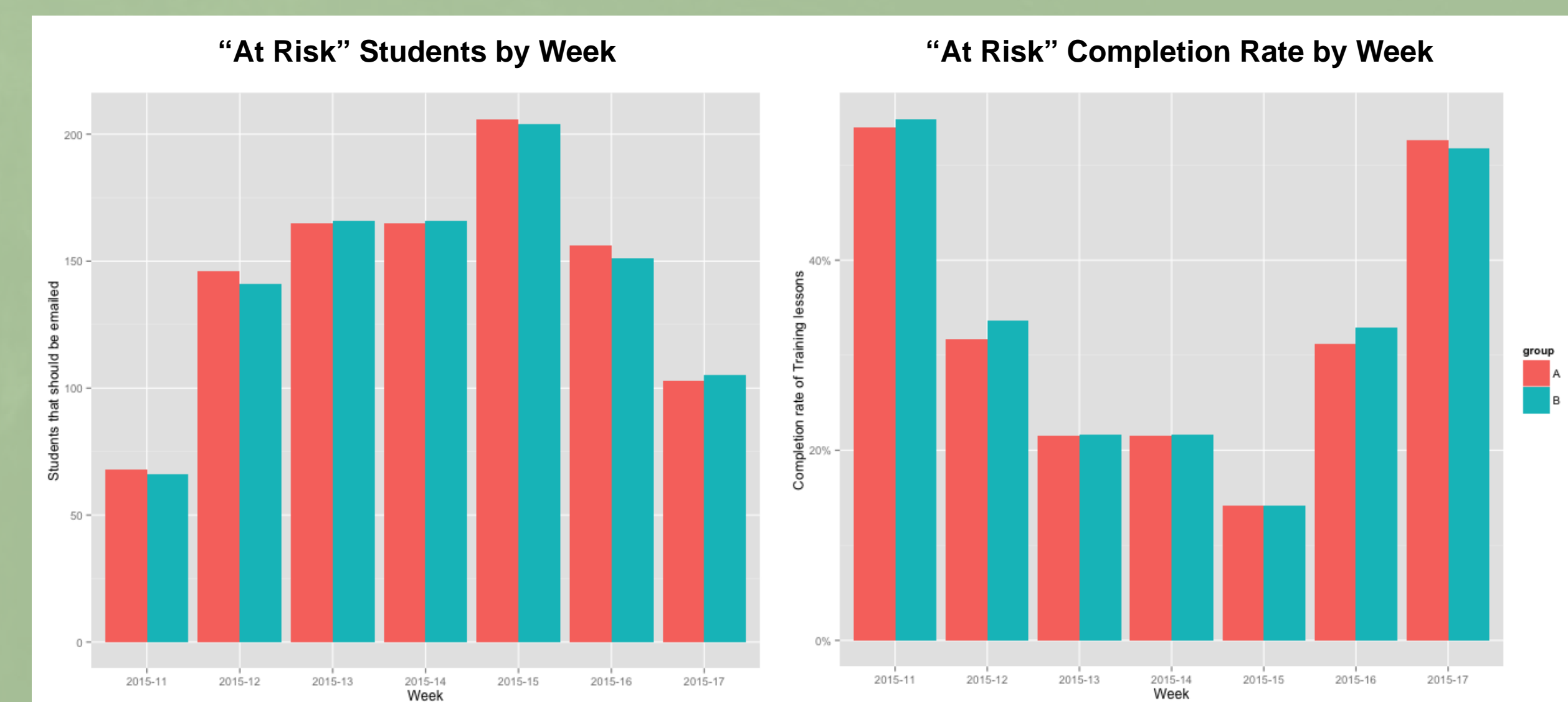
Start vs. Academic Level



- Weak correlation between start day and academic level
- Sophomores/Juniors tend to start earliest

Intervention

During the Spring 2015, we implemented an “early warning” intervention system. A student was deemed “at risk” if less than 50% of training exercises remained incomplete or unstarted 48 hours before the deadline. The cohort was randomly divided into A and B groups. An “at risk” student in the A group received a personalized e-mail, while the B group did not.



- Weeks 1-2
 - 75% message open rate
 - 10% message response rate
- Weeks 3-7
 - 55% open rate, negligible response rate
- No statistically significant difference in behavior or effect of intervention between A and B groups
- Students who are most “at risk” of failure are aware of their shortcomings and begin to tune out our warnings. A more active intervention strategy may be necessary to help these students succeed.