

Student Out-of-Class Behavior in a Flipped Intro Biology Course: Interaction Patterns and Self-Regulated Learning

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Learning Analytics and Modern Education

Learning Analytics: “the measurement, collection, analysis, and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs”

Why is this important?

Blended learning and flipped learning are increasingly popular.
Technology allows for course improvement and research.
College enrollment is increasing, particularly in STEM fields.

The Flipped Classroom:

Lecture



Active Learning

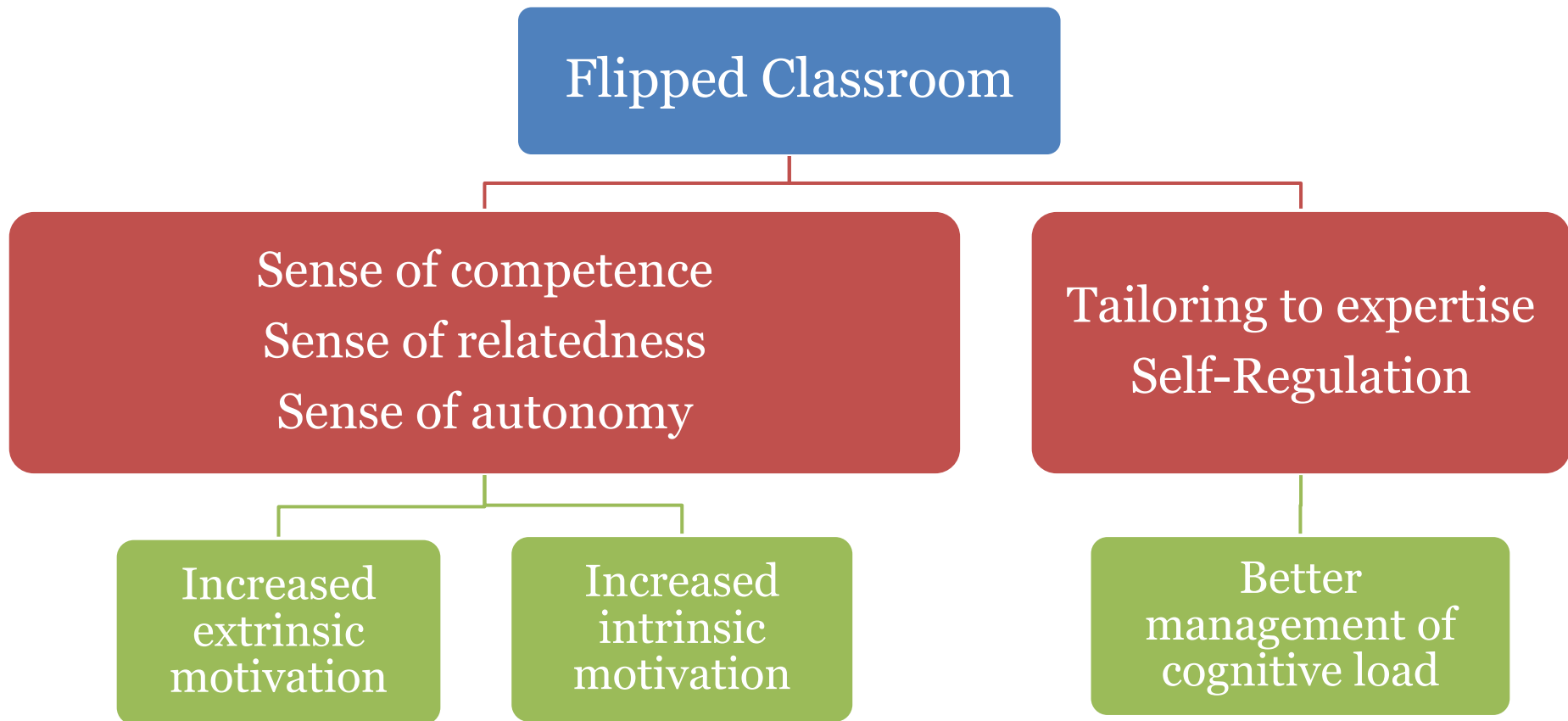


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Benefits

- Students
 - Teachers
 - Researchers
- Out-of-Class Time
 - How are students in this flipped course using their out-of-class time?
 - How does course structure impact student out-of-class behavior?
 - What self-regulated learning strategies are students employing to manage their out-of-class learning?

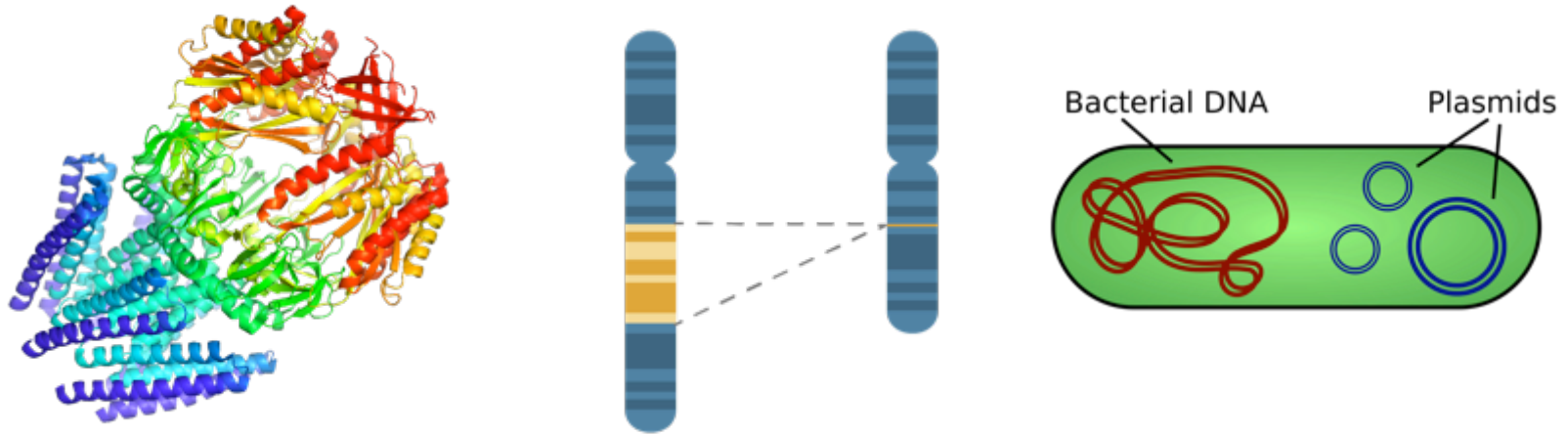
Do real flipped classes match the theoretical framework?



Student out-of-class responsibilities in a flipped course

- Student-centered learning systems, especially flipped courses, require students to take more responsibility for acquiring course knowledge and defining their learning process.
- Students also given more freedom in structuring learning strategies and settings in an online course environment.

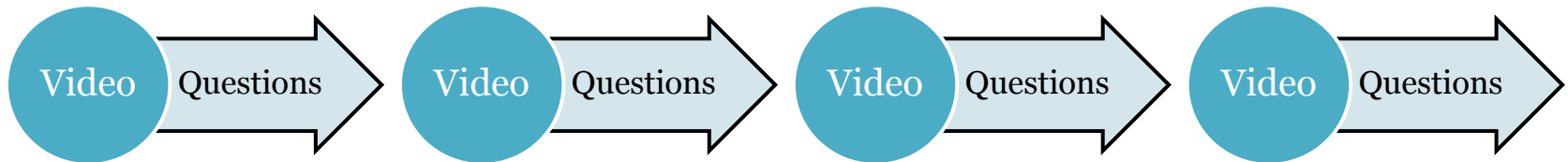
General Biology I



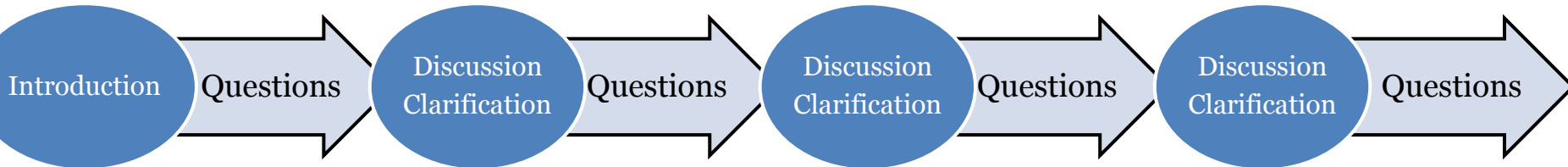
- Introductory course on basic life principles at the cellular and molecular level.
- Required for many science and health related majors.
- Taught as a flipped course in the fall since 2013.
- Fall enrollment between 325 – 600 students.

Flipping It

Before Class



During Class

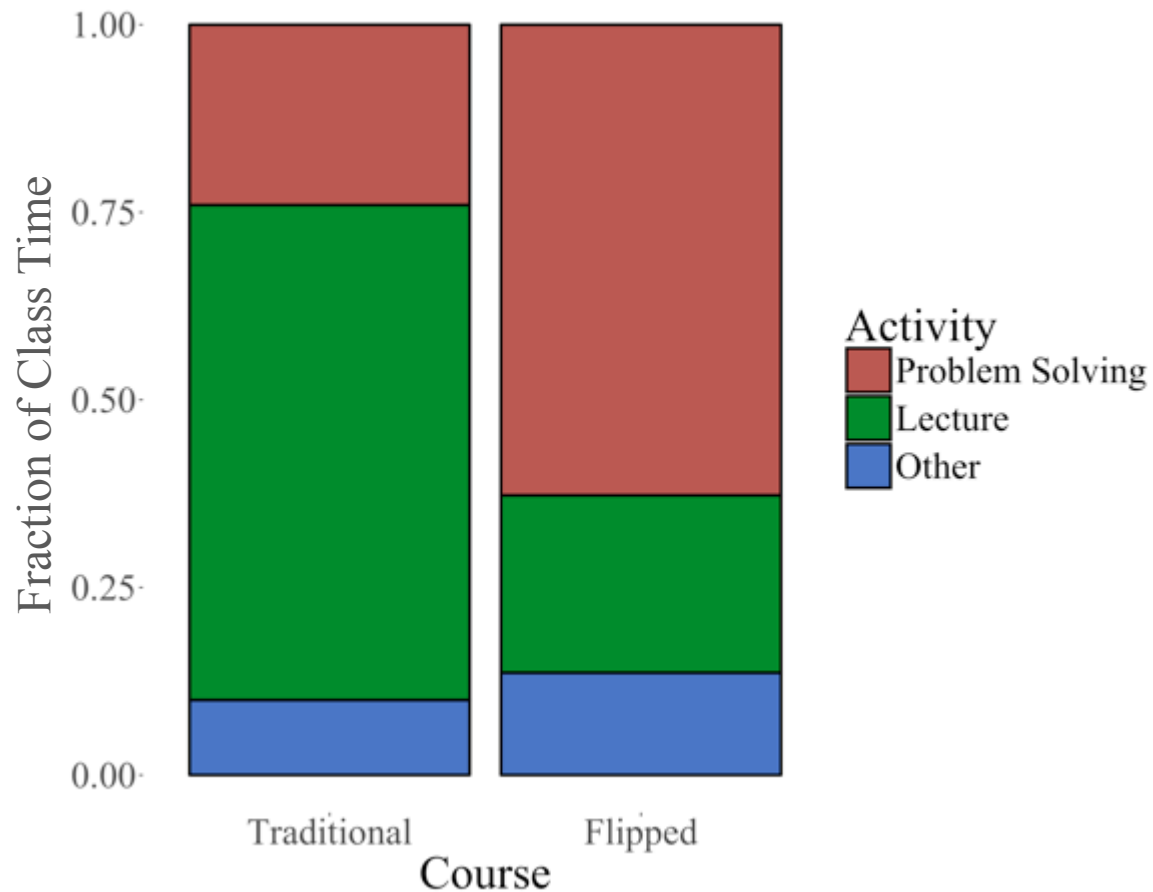




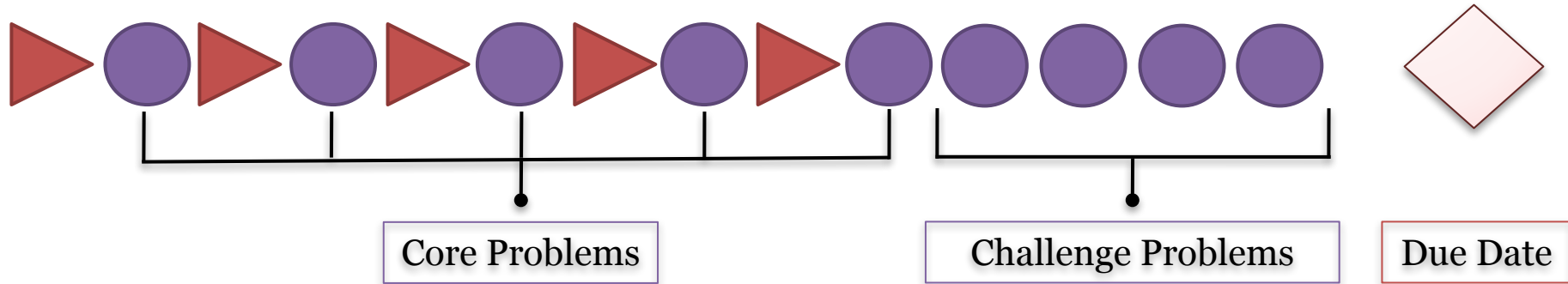
Exam

In-class Activities: Before and After Flipping

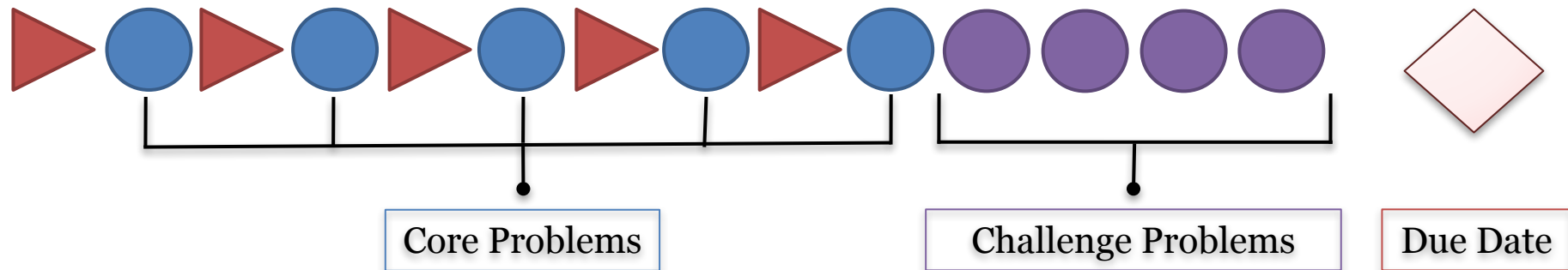
- In-class sessions focus on problem solving using a classroom response system.



Online Changes After Fall 2013



In Fall 2013, all problems allowed students to ‘peek’ at the answer after their first attempt and were allowed many attempts.



In Fall 2014, 2015, and 2016, core problems **no longer allowed ‘peeking’** at the answer and attempts were limited.

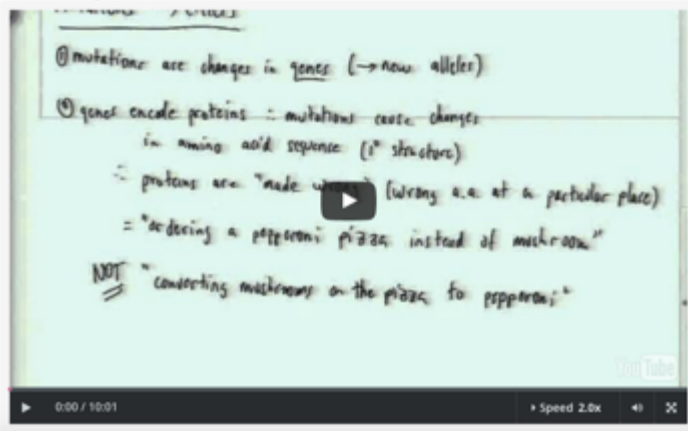
SPOC (Small Private Online Course) Tracking



Biochemistry 4-1 (REQUIRED)

[Bookmark this page](#)

Biochemistry 4-1 (REQUIRED)



Biochemistry 4: Core Question 1

[Bookmark this page](#)

Biochemistry 4: Core Question 1

1 point possible (graded)

Suppose that leu 47 is deep in the hydrophobic core of protein X. Which two of the following mutations would be likely to have a big effect on the structure of protein X?

A table of structures of the amino acids can be found [here](#).

- leu47 -> arg
- leu47 -> val
- leu47 -> asp
- leu47 -> ile

✖

[Submit](#) You have used 1 of 2 attempts

[Save](#)

Video Events

play_video : clicked play on video

Problem Events

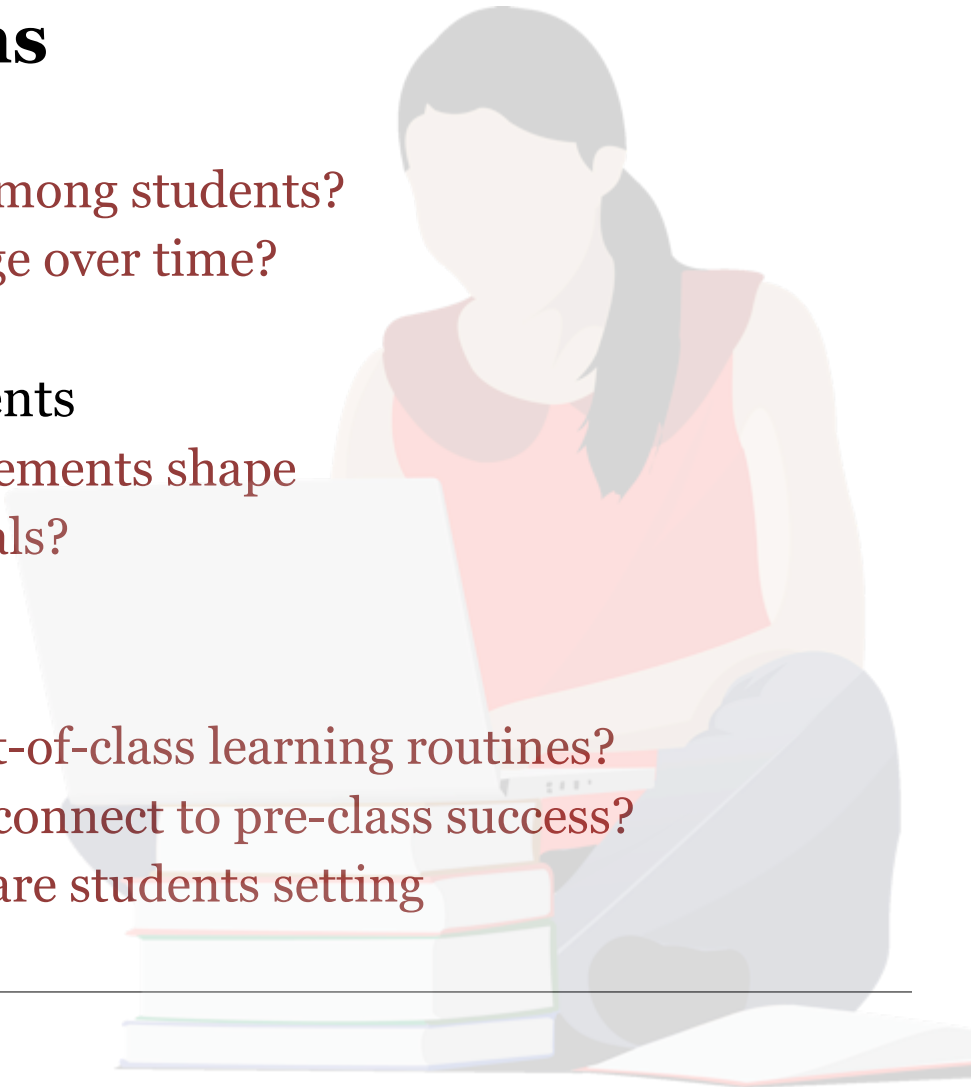
problem_get: loaded problem

problem_check: submitted answer to problem

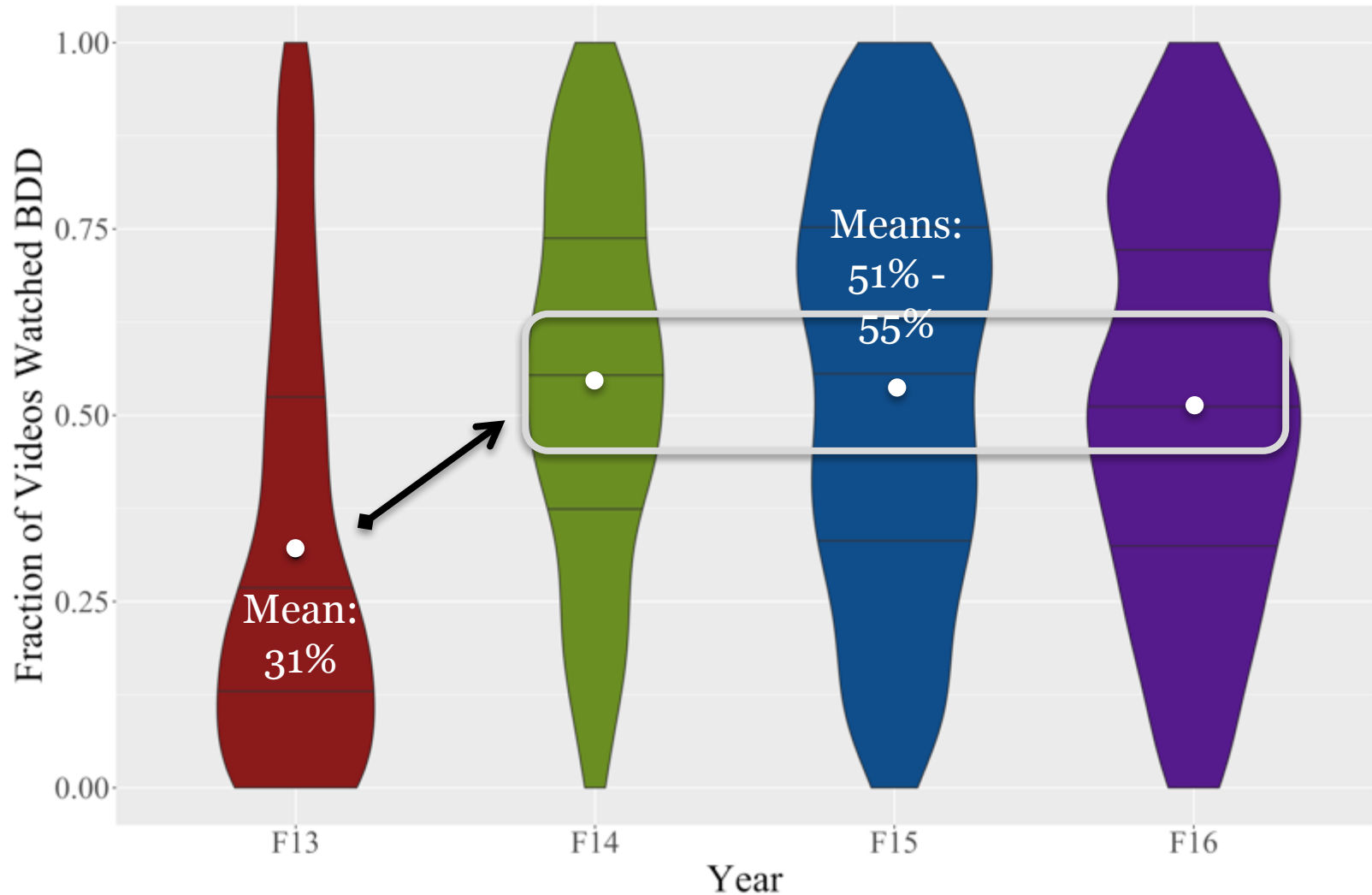
What are students doing online?

Specific Investigations

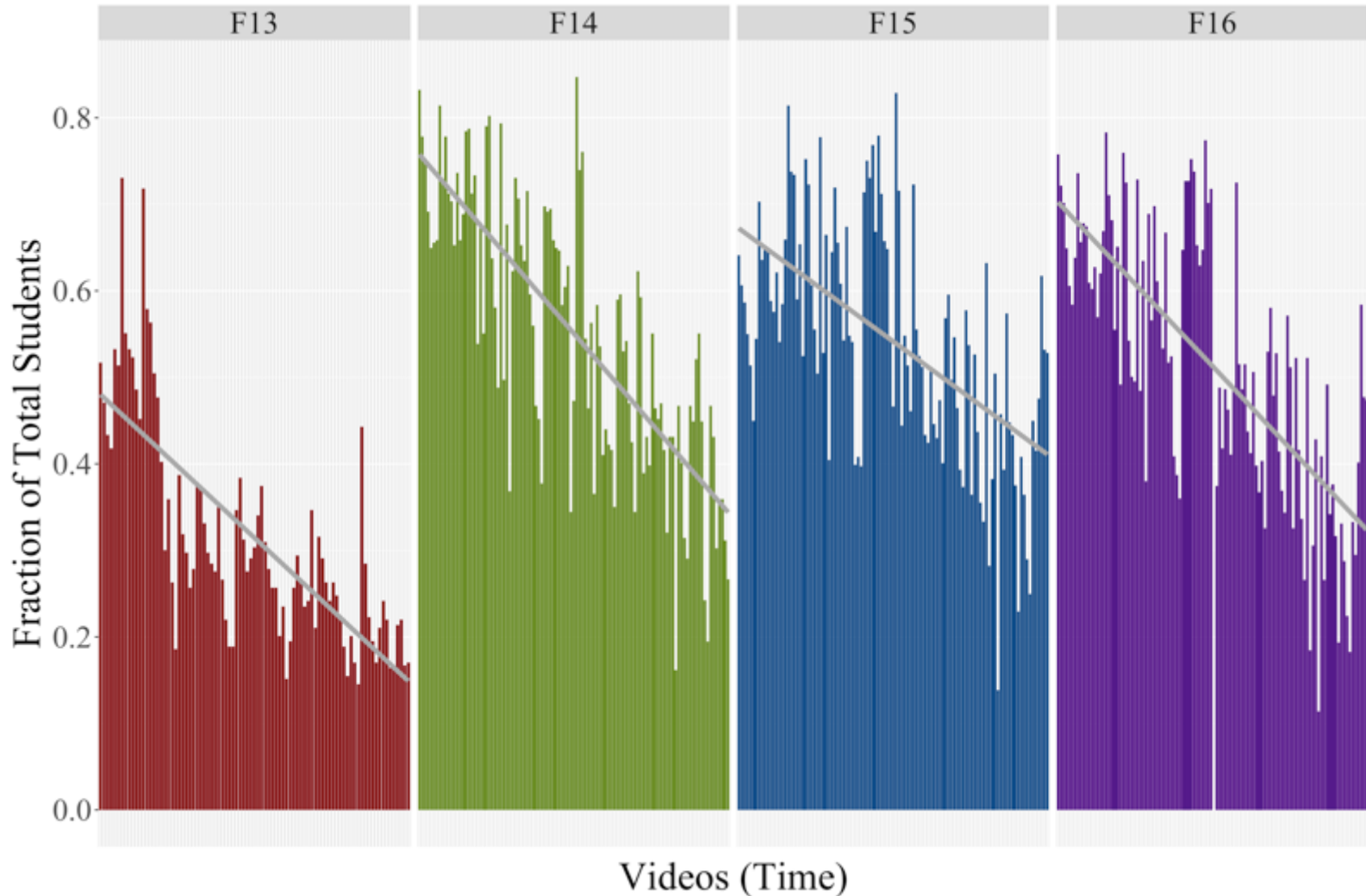
- Individual student behavior
 - How do use patterns differ among students?
 - How do these patterns change over time?
- Influence of course requirements
 - How do core problem requirements shape student use of online materials?
- Student perspectives
 - How do students develop out-of-class learning routines?
 - What resources do students connect to pre-class success?
 - What kind of learning goals are students setting for out-of-class time?



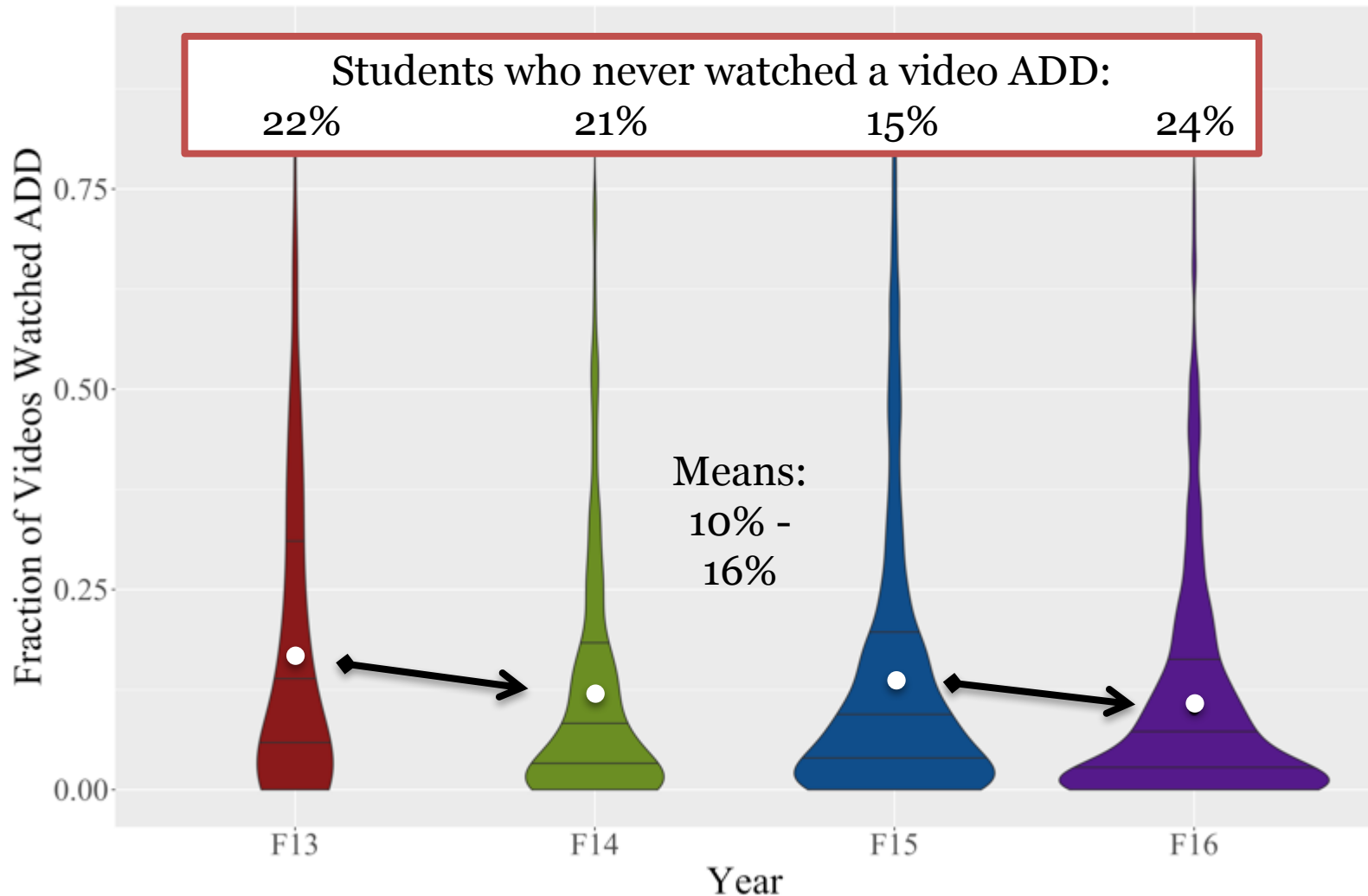
What fraction of videos was watched by each student before the due date?



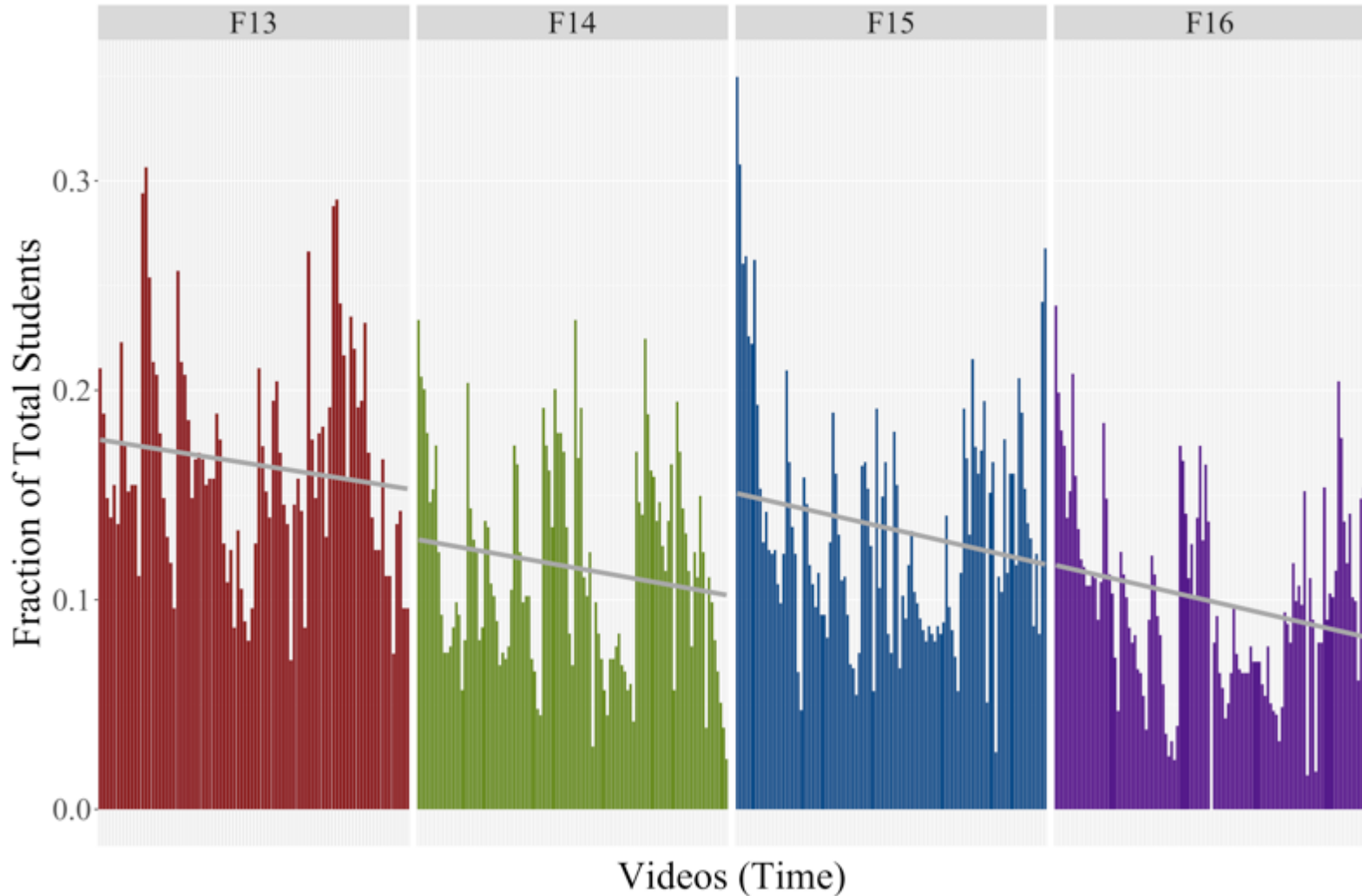
How did this behavior change over the course of the semester?



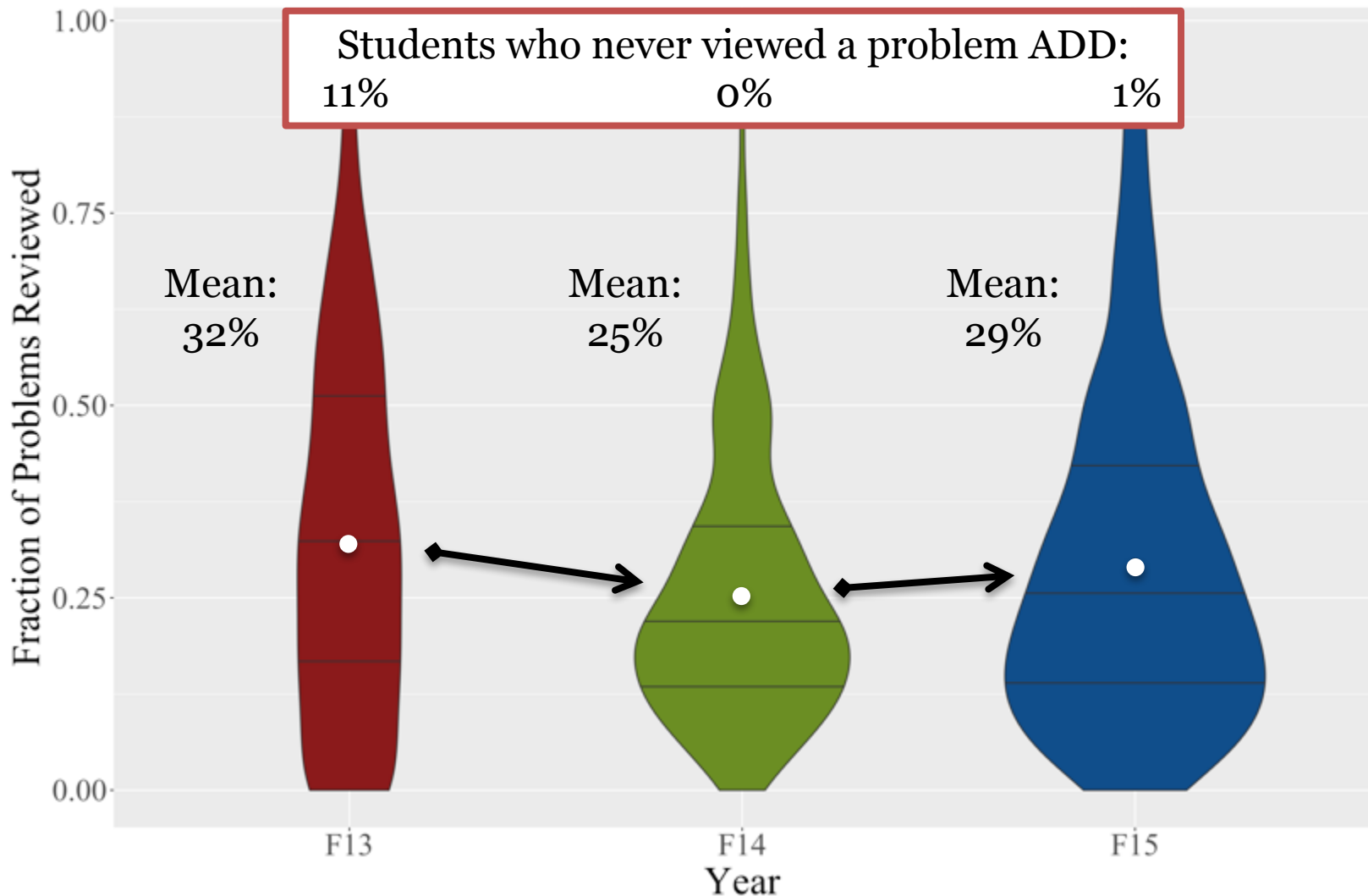
What fraction of videos was watched by each student after the due date (for review)?



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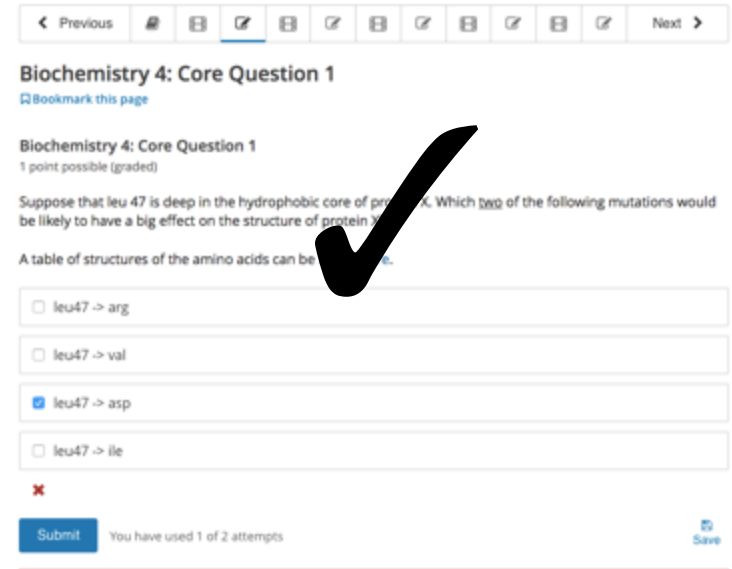
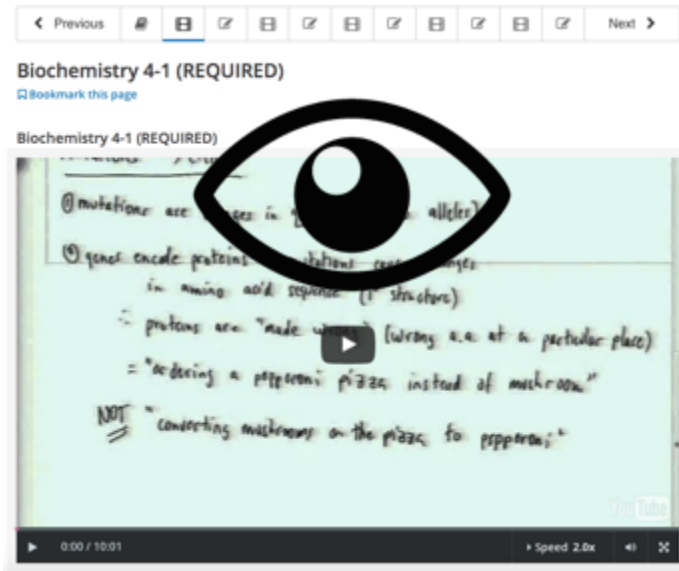
What fraction of problems was viewed by each student after the due date (for review)?



How do students sequence their out-of-class learning sessions?

- Using log files to characterize resource selection and class preparation strategies.
- Investigated two levels of problem preparation:
 - Watch Submit (WS)
 - Look Watch Submit (LWS)
- Allows us to look at multiple levels of out-of-class preparation:
 - Did they watch the videos before class?
 - Did they watch the prior video before answering the problem (WS)?
 - Did they reference the problem before watching the video (LWS)?

Did students watch the videos before submitting an answer to the related problem (Watch Submit)?

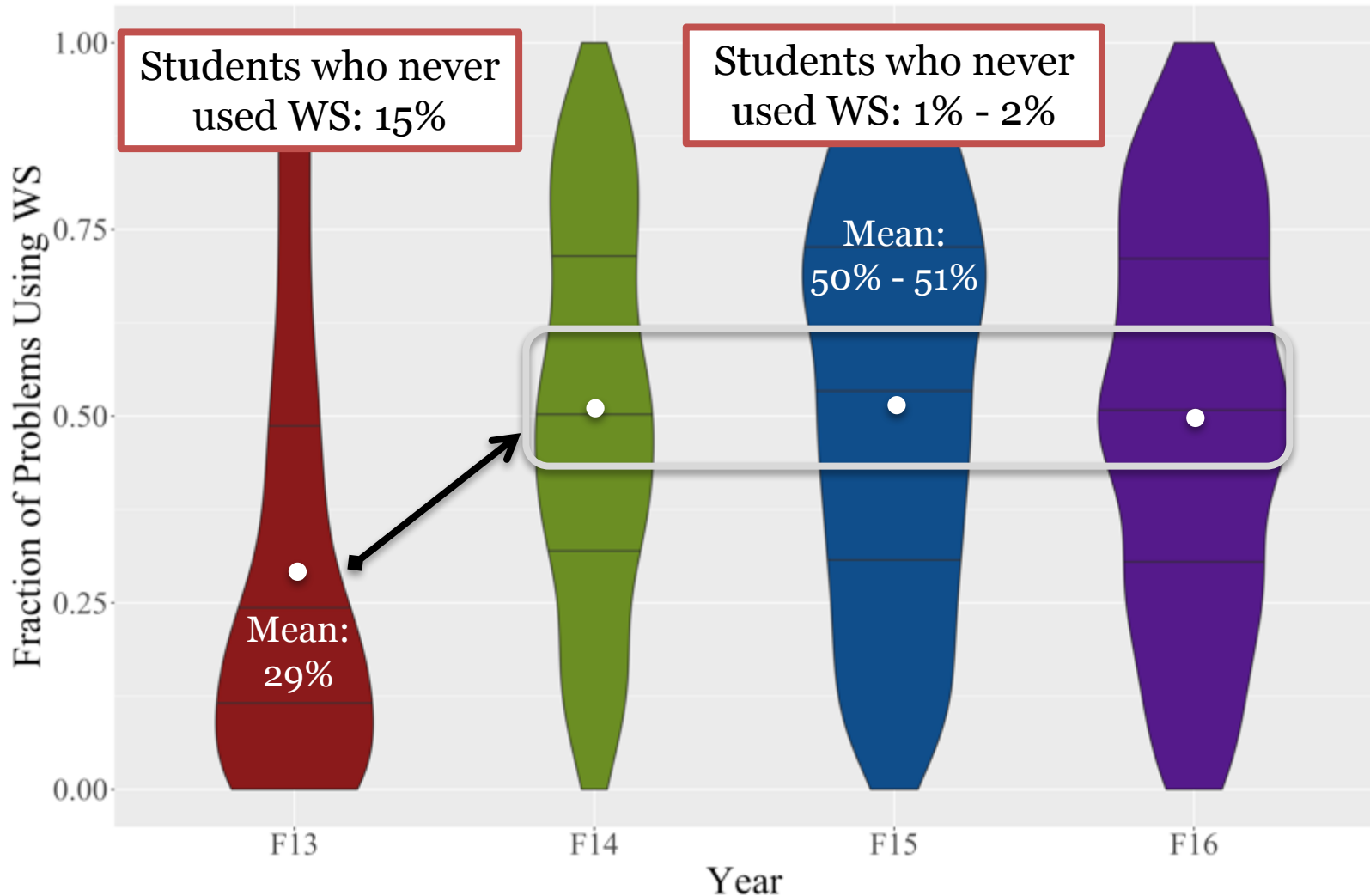


play_video

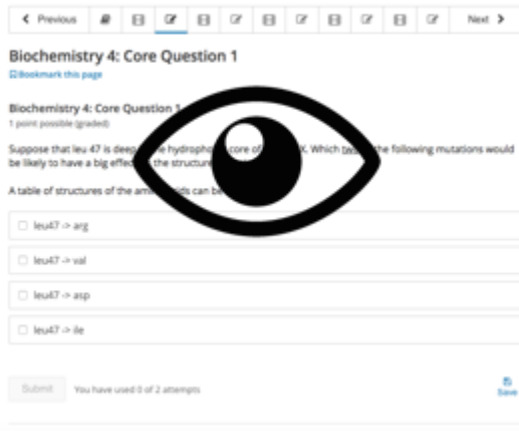
problem_check

- Created a dictionary of all core problems and the associated video that directly preceded each problem.
- For each student and each problem, I determined if there was a play_video event for the associated video before the first time they submitted an answer.

What fraction of problems did each student submit using the Watch Submit sequence?



Did students prepare to watch videos by looking at the associated problem first (Look Watch Submit)?



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Submit You have used 0 of 2 attempts



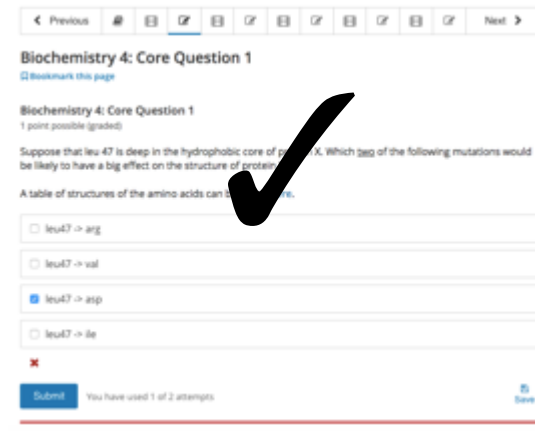
Biochemistry 4-1 (REQUIRED)

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Handwritten notes on a video screen:

- mutation changes in amino acid
- your choice protein in main chain
- protons are "made wrong" (wrong a.a. at a particular place)
- "ordering a pepperoni pizza instead of mushroom"
- NOT "converting mushroom on the pizza to pepperoni"

0:00 / 1:01 Speed 2.0x



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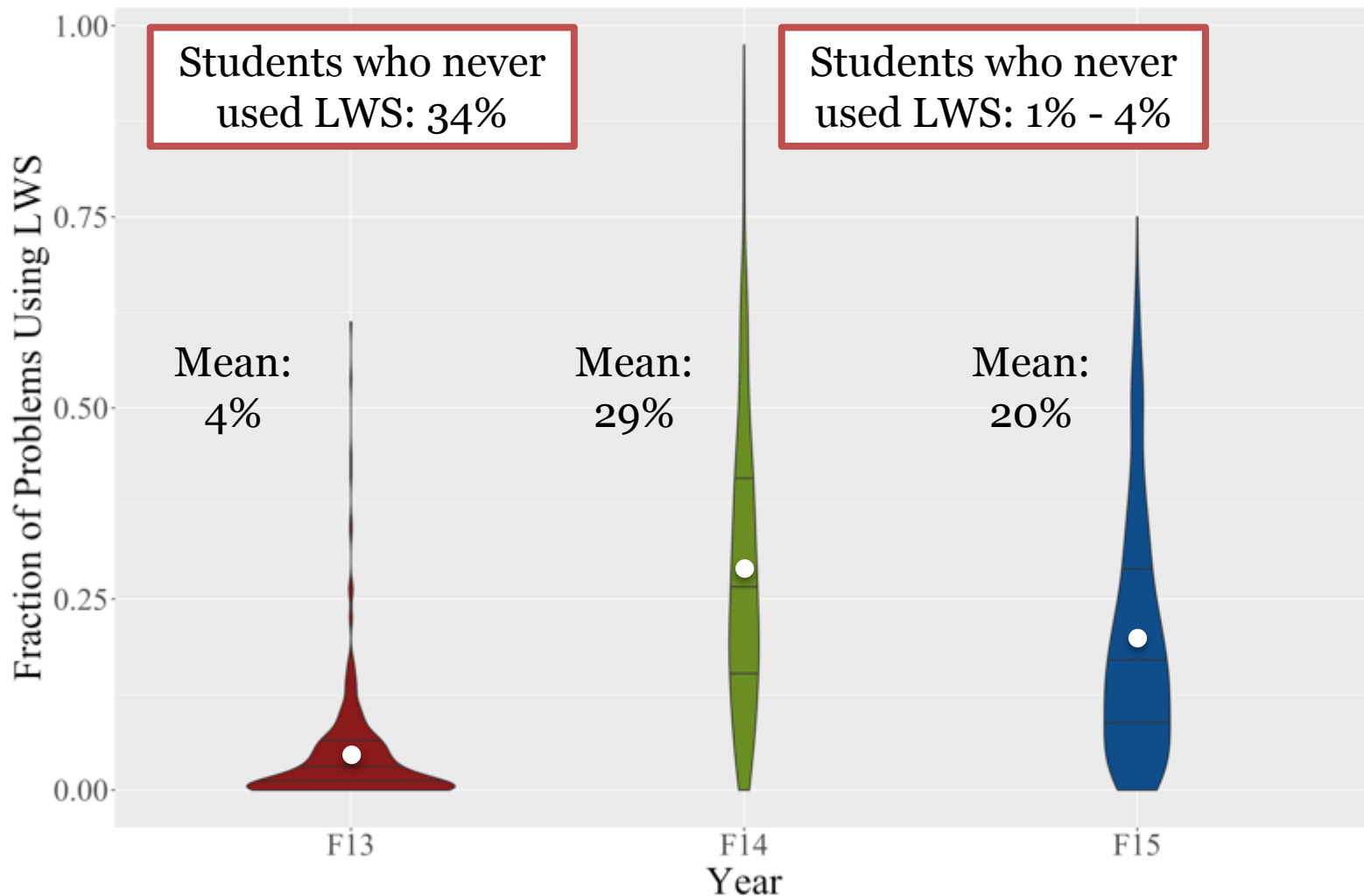
problem_get

play_video

problem_check

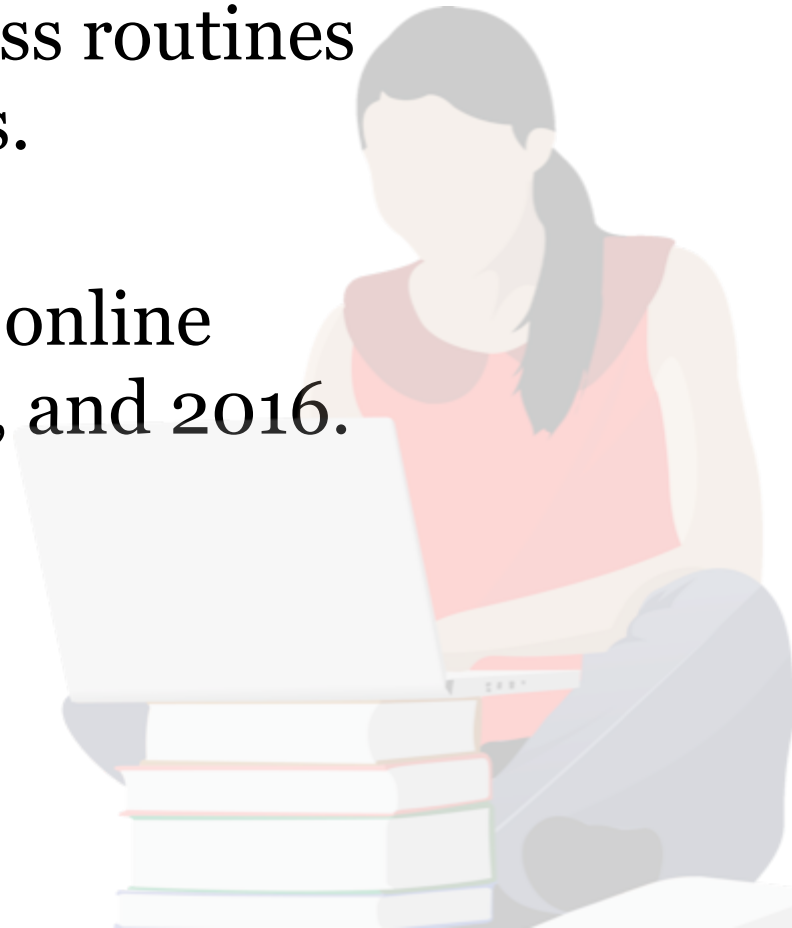
- For each student and each problem, I determined if there was a play_video event for the associated video before the first problem_get event.
- Combined this with the output from the previous WS sequence program to determine which student used LWS.
- Problem_get events were unavailable in Fall 2016.

What fraction of problems did each student submit using the LWS sequence?



How do students select resources and plan their out-of-class time?

- In Fall 2016, we asked students for more details on their pre-class routines using surveys and interviews.
- These data help us interpret online behaviors in Fall 2014, 2015, and 2016.



Embedded Resource Use Survey – Fall 2016

- 50% of students were asked to complete this survey 8 times throughout the semester.

Survey EDIT VIEW SHARE DELETE ...

Which of the following did you use to answer this question?

	Yes	No
Watching the course videos in this session	<input type="radio"/>	<input type="radio"/>
Reading the on-line textbook	<input type="radio"/>	<input type="radio"/>
Other online resources other than the SPOC	<input type="radio"/>	<input type="radio"/>
Talking to classmates, TAs, or tutors	<input type="radio"/>	<input type="radio"/>
Using resources not listed	<input type="radio"/>	<input type="radio"/>
Using prior knowledge	<input type="radio"/>	<input type="radio"/>
Through trial and error	<input type="radio"/>	<input type="radio"/>

What resources did students use to answer online problems?

- Student responses emphasize a reliance on videos for problem success.

Which of the following did you use to answer this question?	Yes (Mean \pm SD)
Watching the course videos in this session.	0.85 \pm 0.06
Through trial and error.	0.69 \pm 0.12
Using prior knowledge.	0.57 \pm 0.12
Talking to classmates, TAs, or tutors.	0.36 \pm 0.05
Other online resources other than the SPOC.	0.28 \pm 0.07
Using resources not listed.	0.20 \pm 0.04
Reading the online textbook.	0.14 \pm 0.02

Response rate for each survey: 48% - 78%

Student Interviews – Fall 2016

- Semi-structured interviews
 - Designed to prompt students to fully describe their out-of-class behaviors.
- Stratified random sample using pre-test scores
- 22 interviews completed
 - 9 fully analyzed for self-regulated learning strategies.



Self-Regulated Learning

- Self-regulated learning (SRL) describes the student-initiated cyclical process:
 1. Defining goals and planning
 2. Implementing strategies to meet those goals
 3. Structuring the learning environment
 4. Evaluating personal progress
- Key to students' abilities to make decisions, solve problems, manage resources, and achieve success.
- Connected to student satisfaction, motivations, goals, and control in the online setting.

How do students in this course describe their self-regulated learning (SRL) strategies?

- Students describe planned approaches that are consistent with several SRL strategies.
- The most frequently described types of SRL behaviors were:
 - Self-evaluation - 100%
 - Goal-setting and Planning - 100%
 - Reviewing Records (Supplementary) - 100%
 - Rehearsing and Memorizing - 89%
 - Keeping Records and Monitoring - 78%
 - Reviewing Records (Notes) – 78%

How do students in this course describe their self-regulated learning (SRL) strategies?

- “I log on to SPOC, I have all my writing utensils ready and I put my headphones in and I’ll probably do 30 second intervals of his videos.”
- “I try **not to go back to the videos ‘cause...my notes are the stuff that I like nitpicked** to make sure that those are probably what I need to know.”



How do students in this course describe their self-regulated learning (SRL) strategies?

- “I’ll start going through the videos in like the quick thing and start to **look for the answers that I’m gonna need for those problems.**”
- “**If the question is stuff that I know** and I’m familiar with I usually kind of get an answer in my head that I think it would be, and **skim over the lecture notes and just to see if that’s correct.**”



What did we learn?

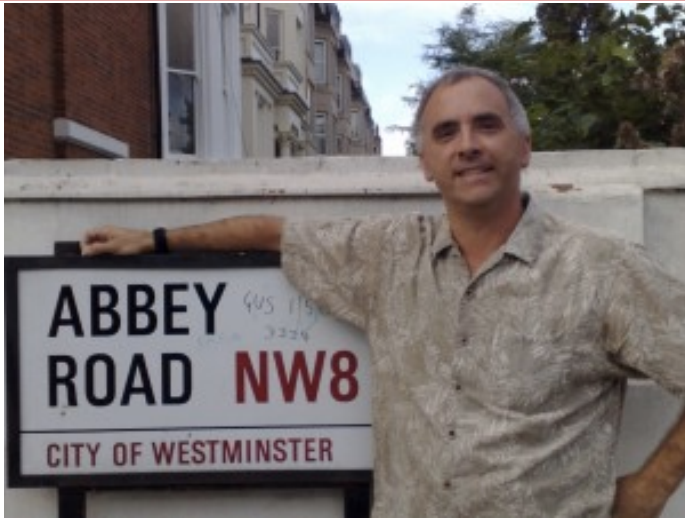
- Most students developed structured pre-class routines that involved selectively watching videos, with preference for those that increased their success on core problems.
- Students did not access the majority of videos or problems after the due date, relying more heavily on supplementary test prep materials.
- The shift in problem grading after Fall 2013 lead to improved student behaviors, increasing video viewing and pre-problem submission behaviors.

Implications

- Provided insight into student adjustment to the responsibilities of a real flipped course.
- Described long-term online use patterns to
 - Improve this course
 - Inform other flipped course instructors
 - Evaluate the expectations for out-of-class behavior
- Demonstrated the impact of a small change in pre-class assessment on student goals and behavior.

Future Directions

- Other members of this lab are working to analyze:
 - Online session length
 - In-video interactions
 - In-class problems
- We are also starting to investigate:
 - Video watching and online problem success
 - Correlations between online behaviors and test scores
 - 2016 pre- and post-test results



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Questions? Comments?

Email: Casey.McCabe001@umb.edu

Feel free to contact me with any further questions or thoughts!

