

Enhancing Student Belonging with Online Interventions: Iterative improvements

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Social belonging

- Feelings of inclusion in a community
- Relates to students' perception of the inclusion of the learning environment
- Relates to students' motivation and self-efficacy
- Belonging uncertainty more likely during transition (e.g., to college)



Self efficacy

- Belief in one's capability to succeed
- Relates to persistence and engagement
- Can affect effectiveness with which students engage with learning
- Positive feedback loop



Belonging and self-efficacy intervention (prev. lit.)

- 30-minute activity done in the second recitation
- Writing prompt for students to reflect on concerns they have about physics/college
- Testimonials from other students
- Normalizing struggle: everybody goes through it
- Adapted for in-class
- Goal: interactive online activities (scale)

Binning et al., Changing Social Contexts to Foster Equity in College Science Courses: An Ecological-Belonging Intervention, Psychol. Sci. **31**(9), 1059-1070 (2020).

Rationale for Interactive Online Interventions (IOIs)

Calculus-based Intro Physics

- primarily in-coming engineering majors
- 16 sections of 135 each/yr (~2000 students)
- Lab and recitation taught by graduate TAs

Wide variation in students' academic preparation, motivation, mindset, etc.

Wide variation in approaches to teaching, willingness to teach beyond content, etc.



Supplement with resources to personalize instruction and attempt to level the playing field.

Lessons from previous data

- Even short (e.g., 45 s) videos students can skip ahead
- Writing prompt: ~90% submit answer suggesting engagement with the activity
- MC questions with feedback can also be engaging (IVET tutorials)

Takeaways

- Break up “long” (e.g., 2.5 min) videos into multiple parts and include a question if possible to encourage engagement
- Record videos in office (similar in style to some popular youtubers)
- Use real students as much as practical

Wk1: What worries you IOI

Replicate in person intervention but online

Students reflect on their worries

Discuss with each other

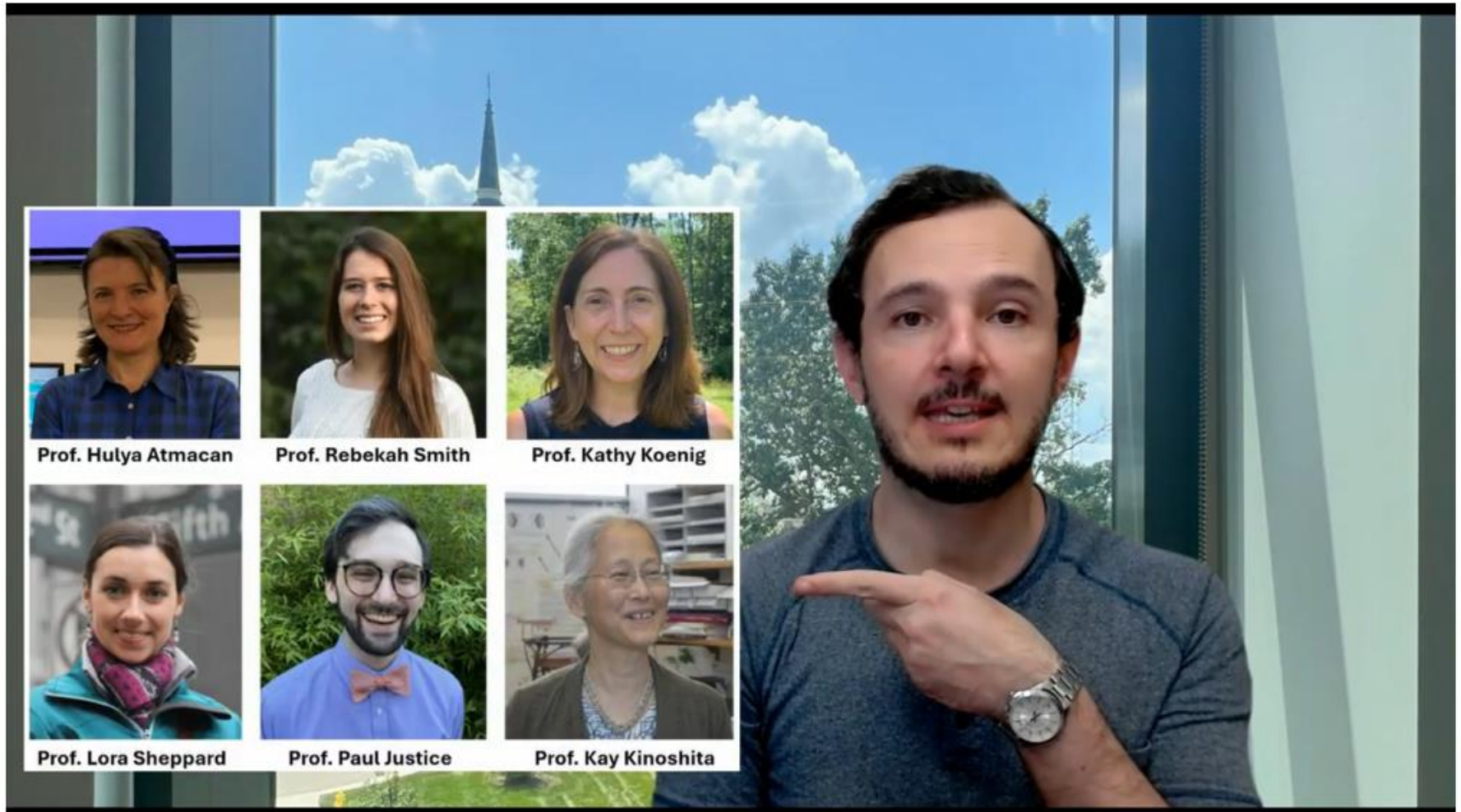
Read quotes from graduating seniors

Normalize struggle: success is a path with a beginning, middle, and end, and along the way there can be ups and downs. Take advantage of support available, engage with the course, do your best.

Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Prof. Hulya Atmacan



Prof. Rebekah Smith



Prof. Kathy Koenig



Prof. Lora Sheppard



Prof. Paul Justice



Prof. Kay Kinoshita

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Wk1: What worries you IOI

Changes from last year:

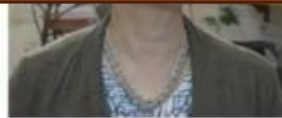
- Provide rationale for activity
- Include pictures of other instructors who typically teach intro courses to help students feel like the entire department is invested in their success



Prof. Lora Sheppard



Prof. Paul Justice



Prof. Kay Kinoshita

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Wk1: What worries you IOI (last year)

What Worries You?

Interactive Online Interventions



In the textbox, type a few sentences about what you are most concerned or worried about right now.

Enter your answer here

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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Q1. In the textbox, type a few sentences about what you are most concerned or worried about right now.

Enter your answer here

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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Change from last year:

- Video filmed in office with items showcasing personality
 - Attempted to learn from popular youtube science communicators (e.g., Hank Green)

Q1. In the textbox, type a few sentences about what you are most concerned or worried about right now.

Enter your answer here

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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Q1. In the textbox, type a few sentences about what you are most concerned or worried about right now.

Enter your answer here

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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Almost all students (~95%) engaged meaningfully with the prompt based on their responses

Q1. In the textbox, type a few sentences about what you are most concerned or worried about right now.

Enter your answer here

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Wk1: What worries you IOI (last year)

What Worries You?

Interactive Online Interventions



Concern	%
Workload, fast pace, falling behind Time management	57%
Ability to succeed Develop good study strategies Understand material, do well on exams, get good grades	47%
Balancing school with extracurriculars Making friends, maintaining a social life Finding a study group	8%
Other: Large classes Finding a job or internship Away from home Uncertainty about choice of major	17%
No concerns	3%

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Wk1: What worries you IOI (last year)

What Worries You?

Interactive Online Interventions



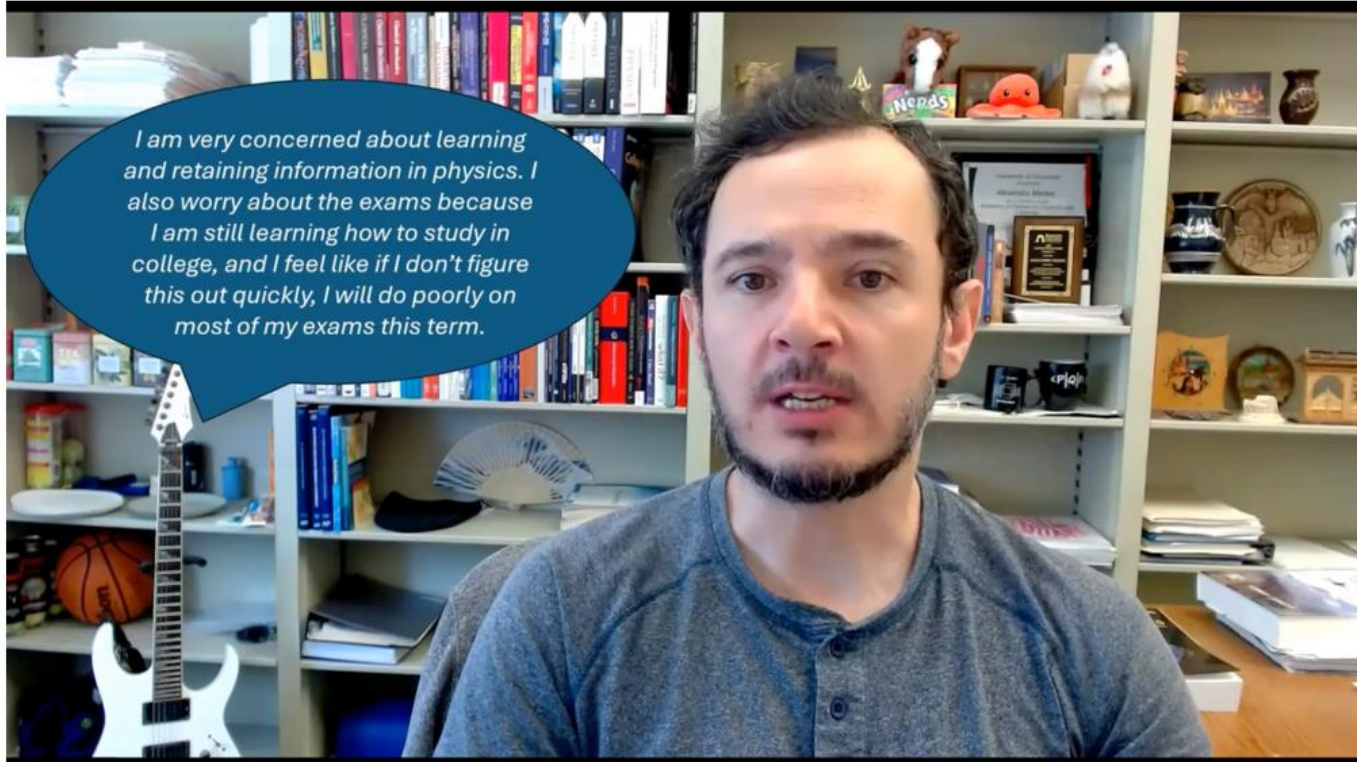
- New, unfamiliar experiences
- Isolation

- Long video (3:36) in which typical concerns were summarized
- No task for students under the video
- Broke up video and discussed the various concerns separately
- Included questions to increase engagement

Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



What percentage of students do you think shared concerns similar to one in this quote, where they said they worried about developing good study habits to do well on exams?

- ☐ 30%
- ☐ 50%
- ☐ 70%

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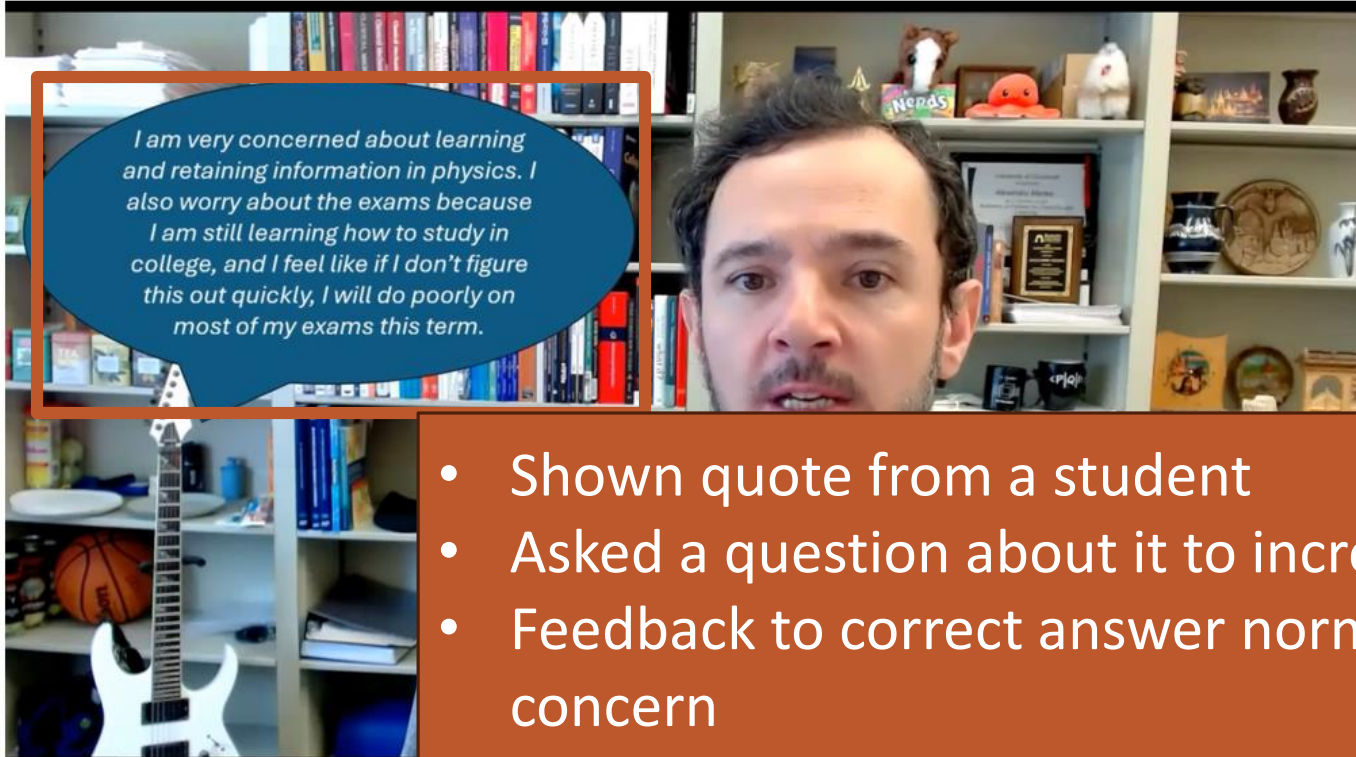
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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



I am very concerned about learning and retaining information in physics. I also worry about the exams because I am still learning how to study in college, and I feel like if I don't figure this out quickly, I will do poorly on most of my exams this term.

- Shown quote from a student
- Asked a question about it to increase engagement
- Feedback to correct answer normalizing the concern

What percentage of students do you think shared concerns similar to one in this quote, where they said they worried about developing good study habits to do well on exams?

- ☐ 30%
- ☐ 50%
- ☐ 70%

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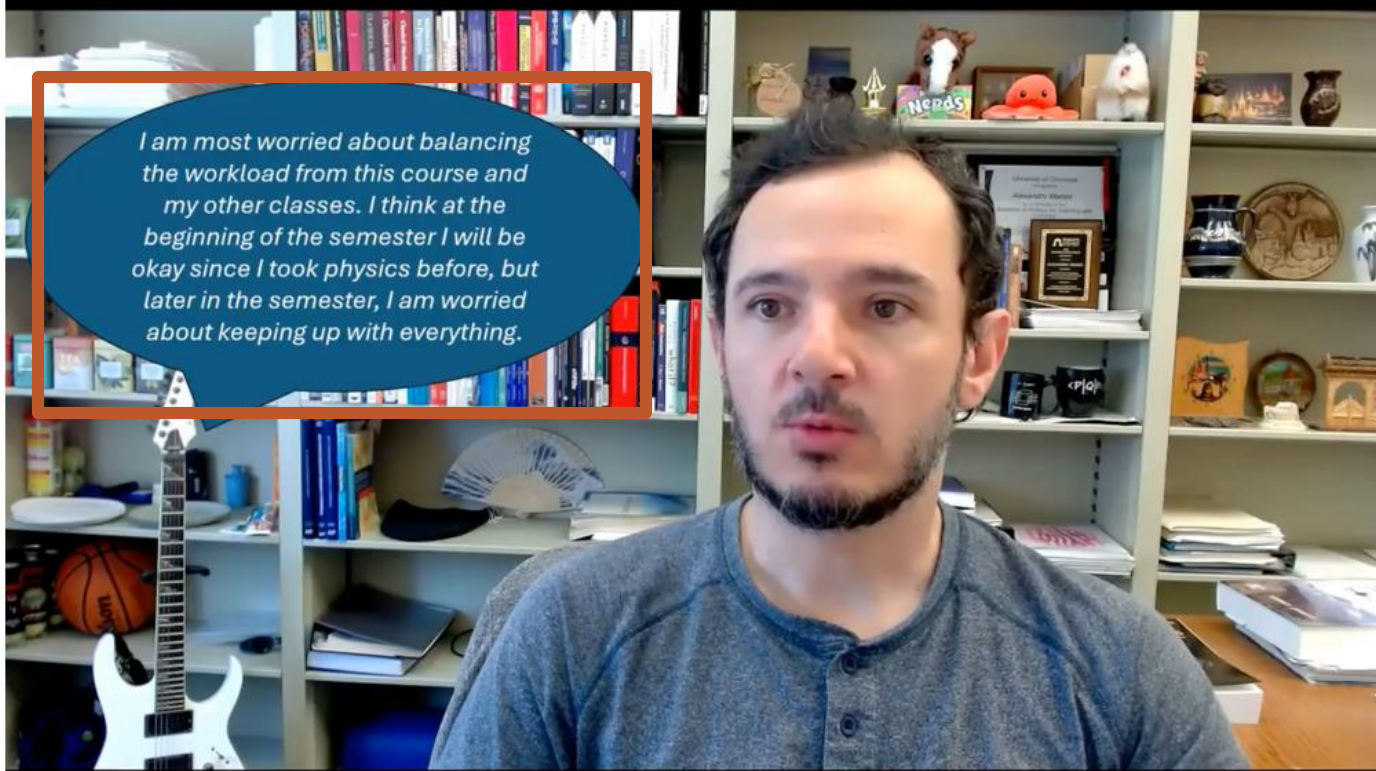
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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



I am most worried about balancing the workload from this course and my other classes. I think at the beginning of the semester I will be okay since I took physics before, but later in the semester, I am worried about keeping up with everything.

What percentage of students do you think expressed a similar concern about time management and keeping up with the workload?

- ☐ 20%
- ☐ 40%
- ☐ 60%

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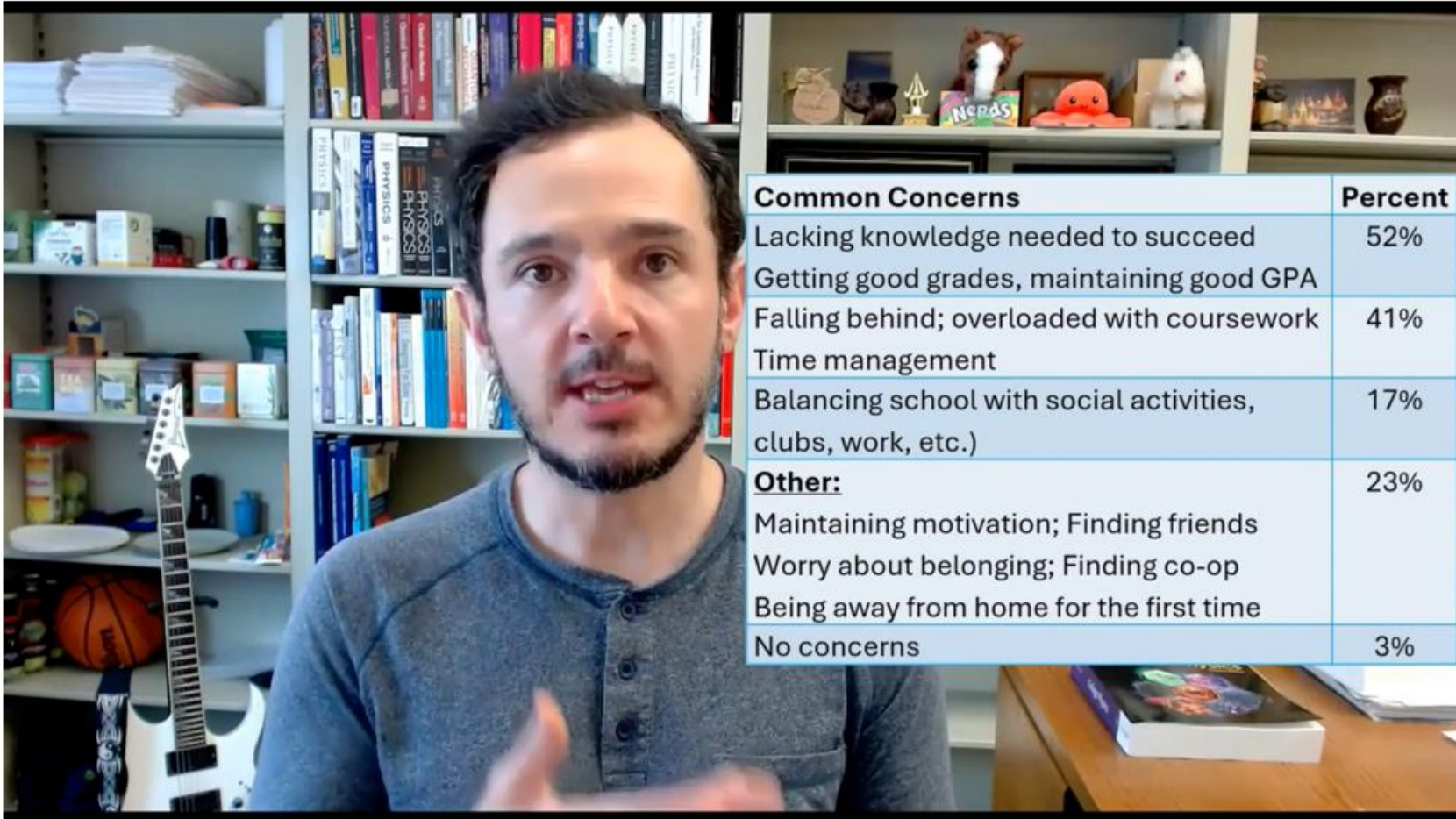
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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



A man with a beard and dark hair is speaking directly to the camera. He is wearing a grey button-down shirt. Behind him is a bookshelf filled with books, including several labeled 'PHYSICS'. To his left, a white electric guitar is leaning against the shelf. To his right, there are various items on the shelf, including a small figurine, a box labeled 'Nerds', and a small orange plush toy. A desk with a book is visible in the lower right corner.

Common Concerns	Percent
Lacking knowledge needed to succeed	52%
Getting good grades, maintaining good GPA	
Falling behind; overloaded with coursework	41%
Time management	
Balancing school with social activities, clubs, work, etc.)	17%
Other:	23%
Maintaining motivation; Finding friends	
Worry about belonging; Finding co-op	
Being away from home for the first time	
No concerns	3%

Take a look at the cartoon in the video or text above. How do you think it relates to what we have been discussing with regards to the concerns students have in college? Type your response in the textbox below.

Enter your answer here

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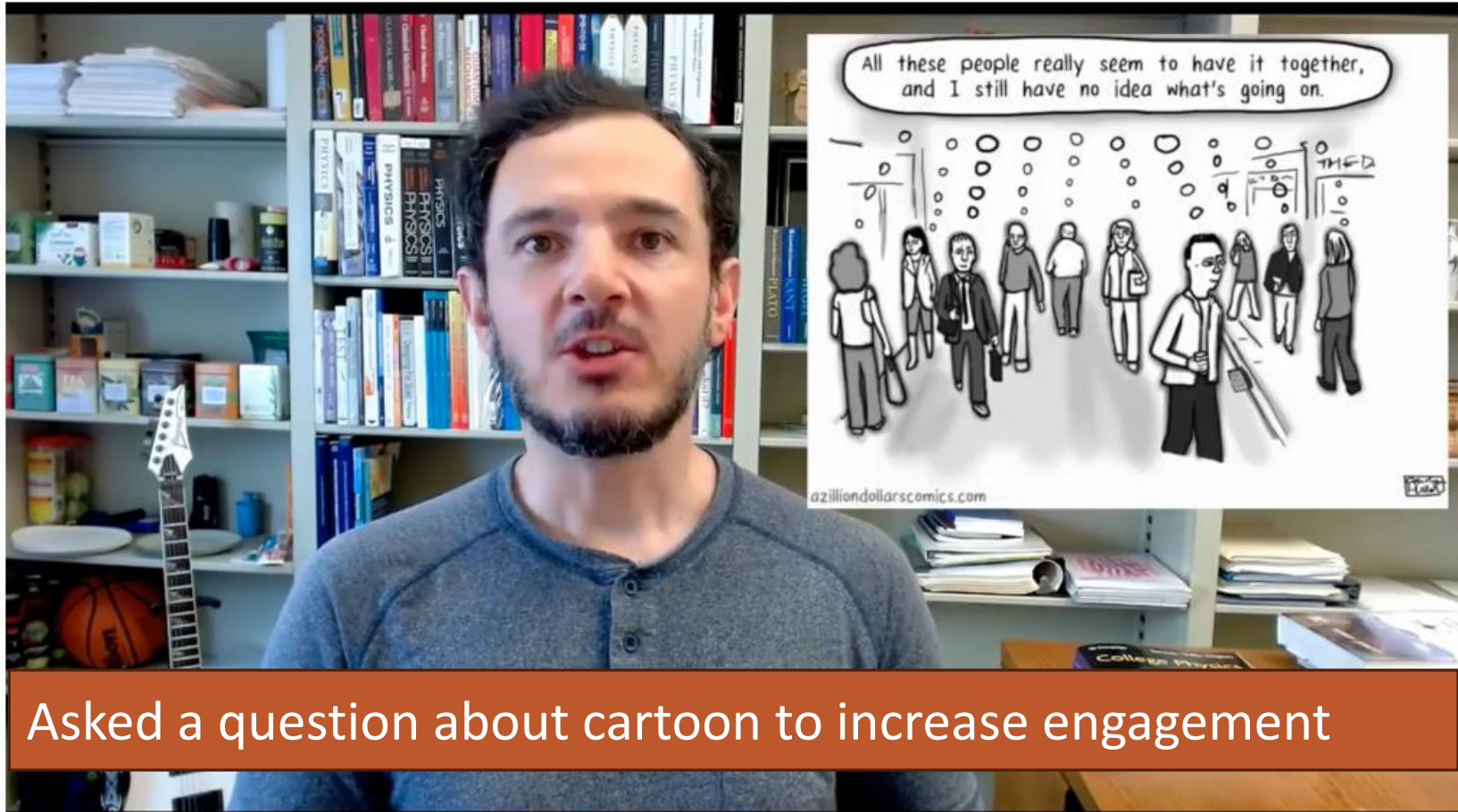
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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Asked a question about cartoon to increase engagement

Take a look at the cartoon in the video or text above. How do you think it relates to what we have been discussing with regards to the concerns students have in college? Type your response in the textbox below.

Enter your answer here

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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Feedback once again normalizing struggle

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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



In the textbox, type a few sentences about how your worries will get resolved over time.

Enter your answer here

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Wk1: What worries you IOI (last year)

What Worries You?

Interactive Online Interventions

Select the video you would like to watch, then click the *Next Page* button



**Meet Nathan,
Computer Sciences senior.**



**Meet Allison,
Mechanical Engineering senior.**

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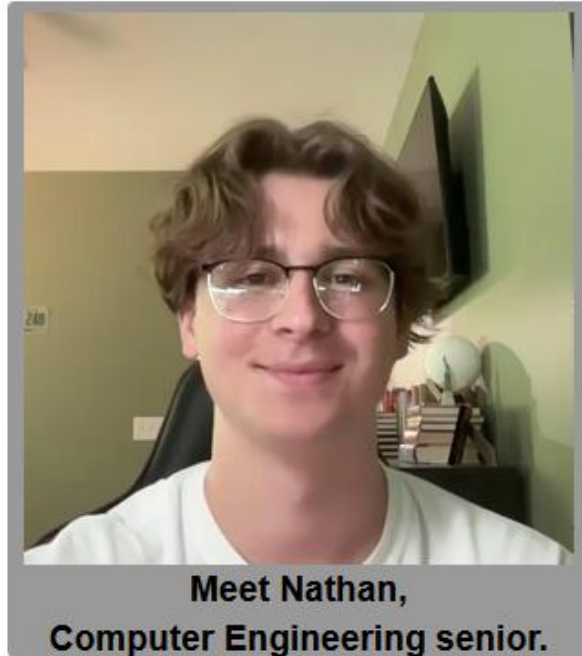
Voiceover: Static picture; quote was read by a student

Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes

Select the video you would like to watch first, then click the *Next Page* button.



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- Testimonials from actual students delivering the same message authentically
- IOI designed such that it encourages watching both testimonials

Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes

Select the video you would like to watch next, then click the *Next Page* button.



**Meet Nathan,
Computer Engineering senior.**



**Meet Allison,
Mechanical Engineering senior.**

**Choose the other student to listen to,
or choose this box and Continue to Next Page.**

You need to answer the
question before proceeding.

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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



school. Before grad school, I went to college and I studied physics and I

What do you think was Prof. Maries' first physics exam grade in grad school?

- ☐ 27%
- ☐ 44%
- ☐ 58%
- ☐ 70%

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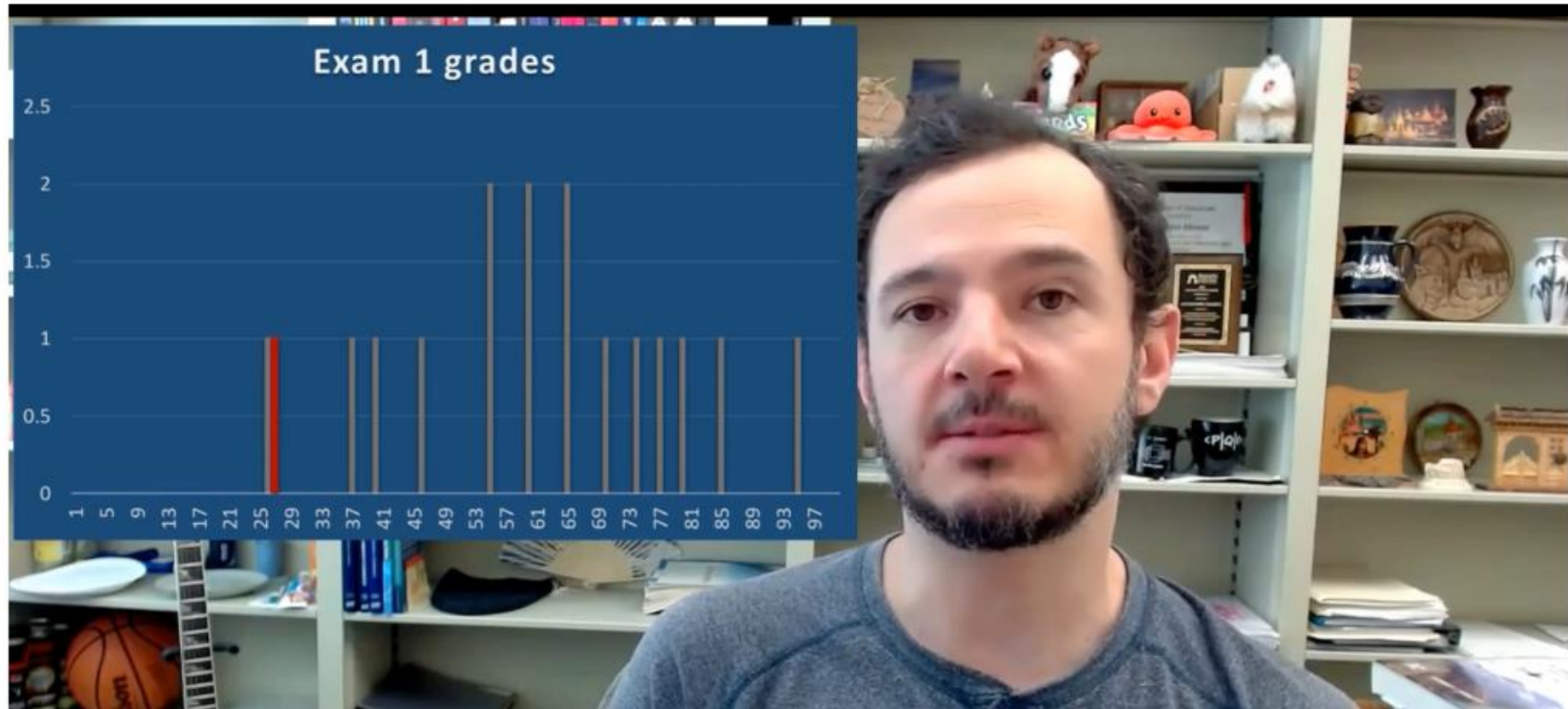
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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



- A new testimonial: My own experience in grad school (27% on first exam)
- Normalize struggle. Path to success isn't linear.

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Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Summary video reiterating that struggles are normal and that there are specific actions we can take to overcome them.

Highlights support and resources provided by the department and university

- Same content as last year, except filmed in office

Wk1: What worries you IOI

What Worries You?

Interactive Video Vignettes



Same as last year, except filmed in office

Think back to the concerns you wrote earlier. In the textbox below, write at least two specific actions you plan to take immediately to help address those concerns.

Enter your answer here

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Wk2: Saying is believing IOI (entirely new)

- Reinforce message from week 1
- Watch student testimonials
- Reflect on own challenges
- Write letter to future student



Grant, Physics Major



Pawan, Chemical Engineering



Anna, Aerospace Engineering



Amit, Biomedical Engineering



Maria, Civil Engineering



Cole, Astrophysics



Michael, Electrical Engineering

Wk2: Saying is believing IOI

Saying is Believing

Interactive Video Vignettes



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Intro video setting up the activity. Mentions that students will write a letter to a future student (submitted on canvas).

Wk2: Saying is believing IOI

Each student below has a story to share about the challenges they experienced as they transitioned to college and how they were able to overcome their struggles. Choose the student whose story you would like to hear first. You will have the option to listen to the others later.



Grant, Physics Major



Pawan, Chemical Engineering



Anna, Aerospace Engineering



Amit, Biomedical Engineering



Maria, Civil Engineering



Cole, Astrophysics



Michael, Electrical Engineering

Wk2: Saying is believing IOI

Testimonials

- Based on literature on psychological interventions
- Wording often taken verbatim, occasionally adapted to physics and/or our institution
- Delivered by real students

Wk2: Saying is believing IOI

Saying is Believing

Interactive Video Vignettes



Which challenges you heard in the testimonials are similar to what you have experienced?

Write the challenges in the textbox below and in your notes. They will be useful when you write your letter to a future student.

Enter your answer here

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Wk2: Saying is believing IOI

Saying is Believing

Interactive Video Vignettes



Write tips to a future student.
(Note that each of the testimonials discussed both challenges and what the students did to overcome them.)

Write your tips to a future student in the textbox below. Be sure to also include them in your notes.

Enter your answer here

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Wk2: Saying is believing IOI

Tips for Success in College Courses

1. Grow Your Brain Stronger with Practice

- Your brain is like a muscle: it grows stronger when challenged.
- Learning new and difficult material creates new brain connections.
- Struggle is a sign of growth, not failure!



2. Develop Smart Study Habits

- Use SQ3R method for reading (Survey, Question, Read, Recite, Review).
- Review notes after class and before starting homework.
- Study for quizzes and exams when you think best:
 - Study in 30-minute chunks with short breaks in between.
 - Practice actively: Test yourself with new problems or teach someone else.

Summary video providing tips for college success. Some of these have been discussed in the testimonials, others have not.

Wk6: Exam wrapper (prev. lit.)

- Self-assessment after exam 1
- Successfully implemented in 10 different academic disciplines
- Changes in study habits
- Improvements in exam and course grade
- Metacognition



K. Sehtares and M. Asselin, Use of Exam Wrapper Metacognitive Strategy to Promote Student Self-assessment of Learning: An integrative review, *Nurse Educator* **47**(1), 37-41 (2022)

Wk6: Exam wrapper (last year)

Exam Wrapper

Interactive Video Tutorials



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Wk6: Exam wrapper

Exam Wrapper

Interactive Video Tutorials



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Wk6: Exam wrapper

Exam Wrapper

Interactive Video Tutorials

Select the video you would like to watch, then click the *Next Page* button



Meet Elijah, a 3rd year
aerospace engineering major.



Meet Camila, a 3rd year
chemical engineering major.

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Wk6: Exam wrapper

Select the video you would like to watch, then click the *Next Page* button



Meet Elijah, a 3rd year
aerospace



Meet Camila, a 3rd year
major.

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Testimonials both discuss struggling at first and adjusting study habits to improve.

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Wk6: Exam wrapper

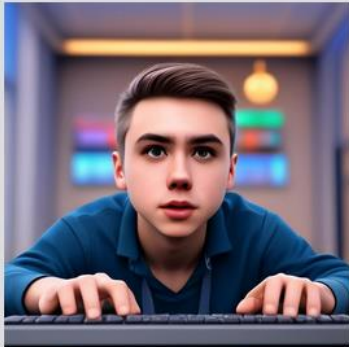
Choose from the following to explore research-backed learning strategies that have been shown to enhance comprehension and retention. The strategies have been organized into four key areas. You will have the opportunity to learn about more than one, if desired.



Before class preparation



During class engagement



After class review and approach
to homework



Exam preparation

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Wk6: Exam wrapper

Exam Wrapper

Interactive Video Tutorials

Choose from the following to explore research-backed learning strategies that have been shown to enhance comprehension and retention. The strategies have been organized into four key areas. You will have the opportunity to learn about more than one, if desired.



Emphasis that it's not just exam preparation, it's how you approach learning in the class as a whole



After class review and approach to homework



Exam preparation

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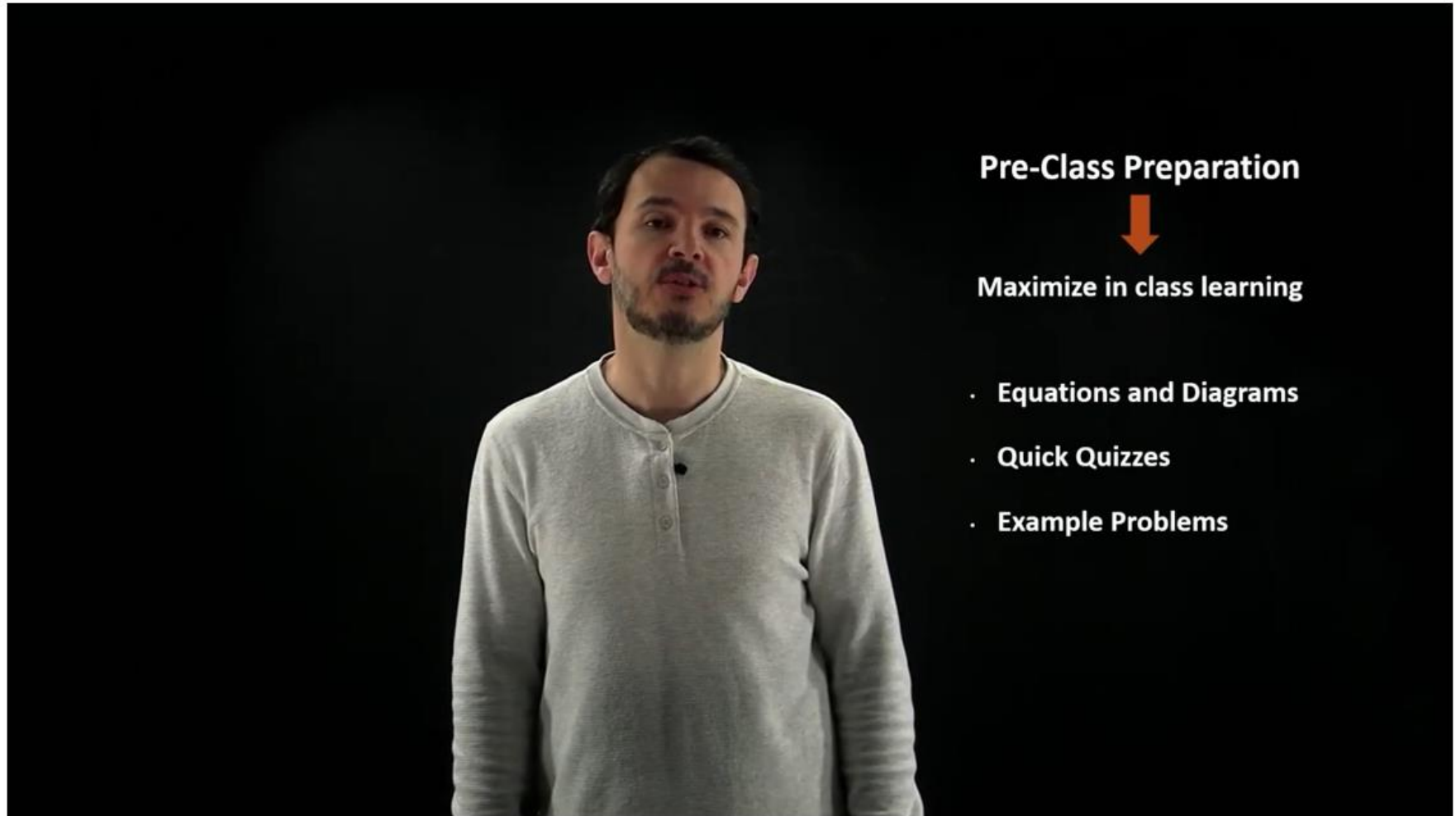
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Wk6: Exam wrapper (last year)

Exam Wrapper

Interactive Video Tutorials



Pre-Class Preparation

↓

Maximize in class learning

- Equations and Diagrams
- Quick Quizzes
- Example Problems

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Wk6: Exam wrapper

Exam Wrapper

Interactive Video Tutorials



1. Equations and diagrams

2. Checkpoints

3. Example problems

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Wk6: Exam wrapper

Exam Wrapper

Interactive Video Tutorials



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Wk15: End reflection: No changes

End of Course Reflection

Interactive Online Interventions



	What I typically did	What I wish I had done
Before Class		
During Class		
After Class		
Preparing for Exams		

Grid to guide self-reflection.
Submitted to canvas

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Wk15: End reflection: No changes

Let's begin!



What did you usually do to prepare before each class?

In the first empty space in your table, write down any strategies from the list below that reflect what you actually did before each class.

In the next column, write down any strategies you wish you had used to better support your learning.

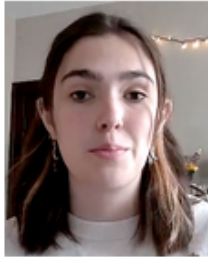
- A. Nothing
- B. Skimmed the relevant textbook sections.
- C. Read the textbook sections and tried to understand them.
- D. Took notes while reading.
- E. Skimmed example problems without trying to understand them.
- F. Read example problems and tried to understand the solutions.
- G. Tried solving example problems before checking the answers.

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Wk15: End reflection: No changes



What did you usually do during each class?

In your table, write down how you typically engaged during each class using the list below.

In the next column, write down what you wish you had done to better support your learning and success in the course.

- A. Not much. I mostly attended class for the attendance points.
- B. Took notes to refer to later.
- C. Focused on understanding the material as it was taught.
- D. Did my best to learn the problem-solving strategies taught in class.
- E. Worked with students around me.
- F. Asked the teaching team for help when confused or stuck on a problem.

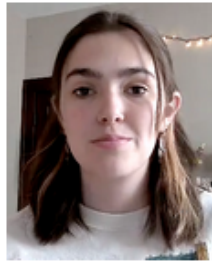
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Wk15: End reflection: No changes

We are almost finished!



How did you typically prepare for exams?

In your table, use the list below to describe your typical study habits.

In the next column, note any strategies you wish you had used to improve your exam performance.

- A. Studied in one day instead of spreading it out.
- B. Broke the material into chunks and studied different sections on different days.
- C. Skimmed problem solutions to be sure I understood the steps.
- D. Solved problems on my own before checking the solutions.
- E. Practiced additional problems beyond the assigned homework.
- F. Took a practice exam before studying to identify areas to focus on.
- G. Took a practice exam after studying and treated it like a real exam.
- H. Studied with other students.
- H. Asked questions to clear up confusion (e.g., classmates, office hours, or learning center).

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Wk15: End reflection: No changes

End of Course Reflection

Interactive Online Interventions



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Personal story about her own experience in undergrad

Thank you! alexandru.maries@uc.edu

4 IOIs available on <https://ioi.sciencetutorials.net/>:

- Week 1: What worries you
- Week 2: Challenges
- Week 6: Exam wrapper
- Week 15: End of term reflection

Design of IOIs based on:

- Students answer questions, meaningfully engage with writing prompts
- Students find testimonials with real students engaging
- Short videos
- Engagement with each meaningful video

Thank you! alexandru.maries@uc.edu

4 IOIs available on <https://ioi.sciencetutorials.net/>:

- Week 1: What worries you
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Design

More detailed results: Kathy Koenig's talk
(next)

- Stud
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- Engagement with each meaningful video