

Enhancing Student Belonging with Online Interventions: New Results

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Research Overview

RQ1: What is the impact of the intervention (IOI vs in-person) on students' sense of belonging and achievement in intro physics?

RQ2: To what extent is the impact in RQ1 moderated by student demographics and the use of active learning by the instructor?

Participants: All students enrolled in introductory calculus-based physics (primarily first-year engineering majors)

Data sources: IOI log files; Pre- and post-belonging survey

Understanding Student Behavior within IOIs

1. Analyze written intervention responses

- Compare In-person paper responses with IOI textboxes

2. Examine Video viewing time and choices within IOI

- Analyze log files for behavioral patterns

Use findings to refine IOIs and address research questions.

Week 1: What Worries You?

In-Class Intervention

Questions projected on screen:

1. What are you concerned about?

Write down a few things in terms of college, this course, your major, etc.

2. How do you think these concerns will change over time?

Anonymous

3-5 minutes at End-of-First Class

Provide quarter sheet of blank paper

Submit on way out the door, no credit given

Week 1: What Worries You?

Online Intervention

Questions embedded in IOI:

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

Enter your answer here

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

Enter your answer here

Not Anonymous

Not timed

Typed responses

Submit for completion credit

Analyzing the responses: Paper or Online

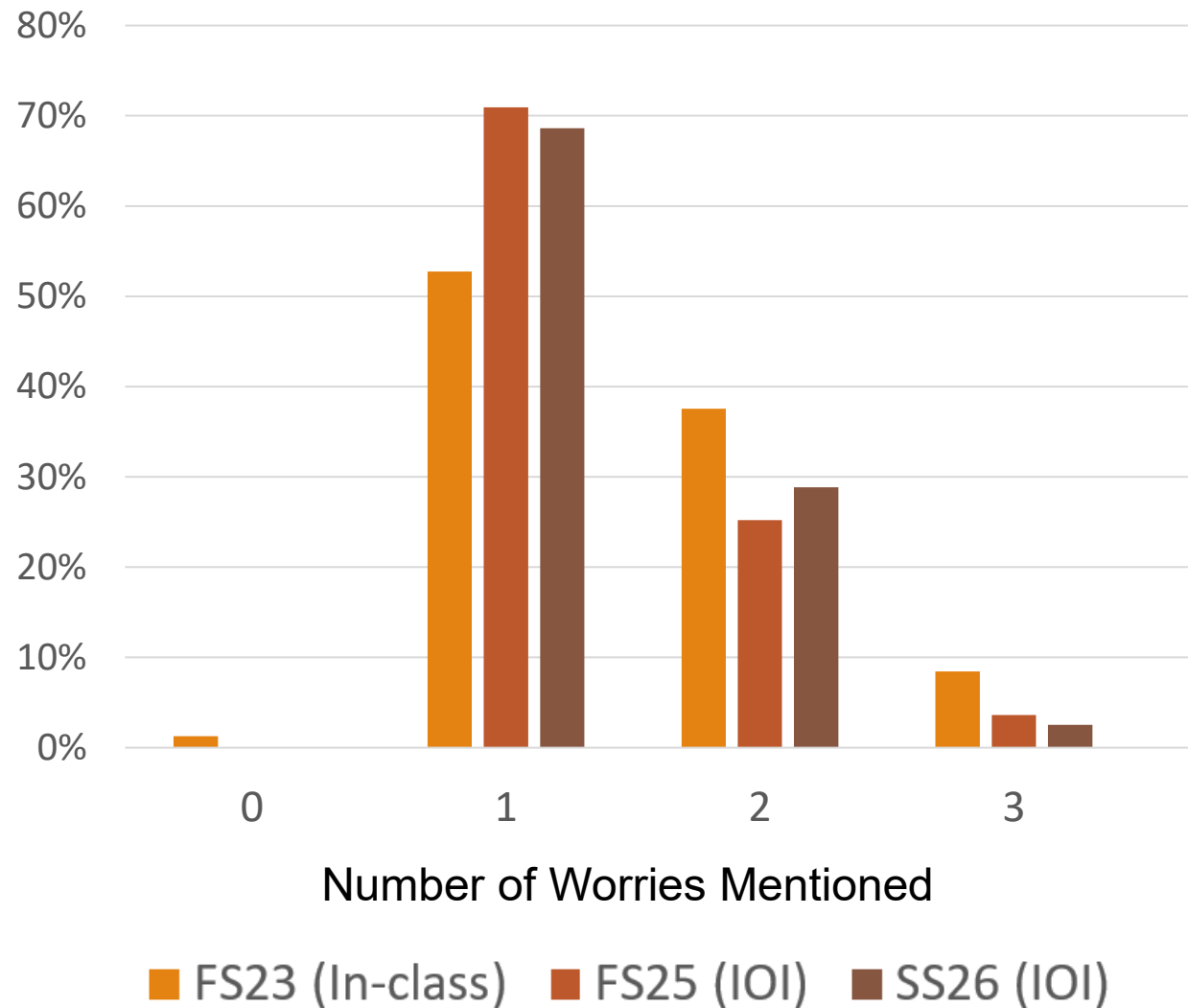
1) I'm scared of failure/inadequacy, burning out, or having taken on more than I can handle. Maybe I'm not cut out for my major, who knows?

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

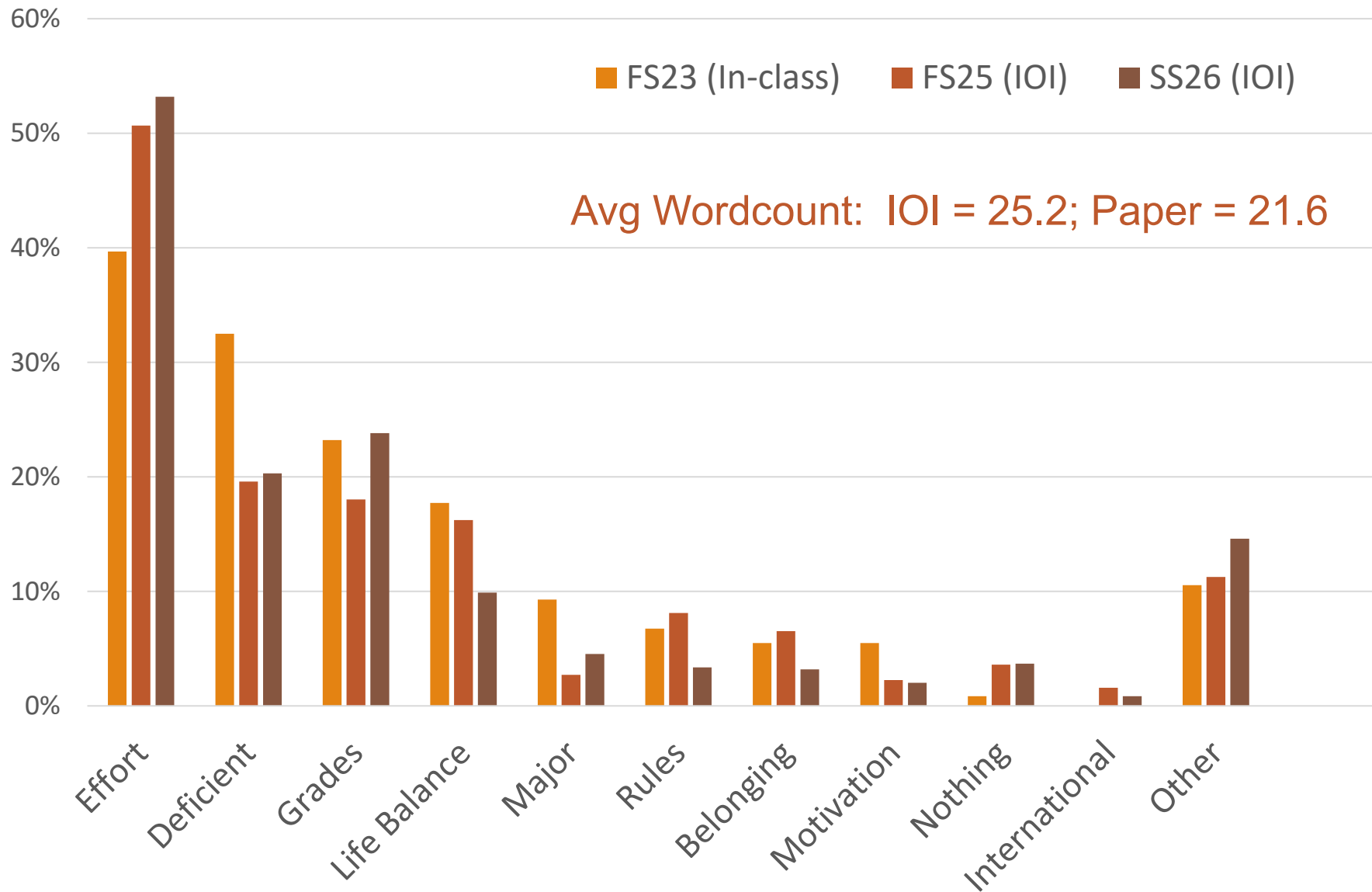
I'm worried about not being able to keep up with everyone else and falling behind even though I put in the work. I also worry that I won't be able to make friends in my classes and I am concerned as to whether I chose the right major.

Number of
Worries Listed:

Similar Pattern
for in-class and
online
intervention



Responses to “What worries you?”

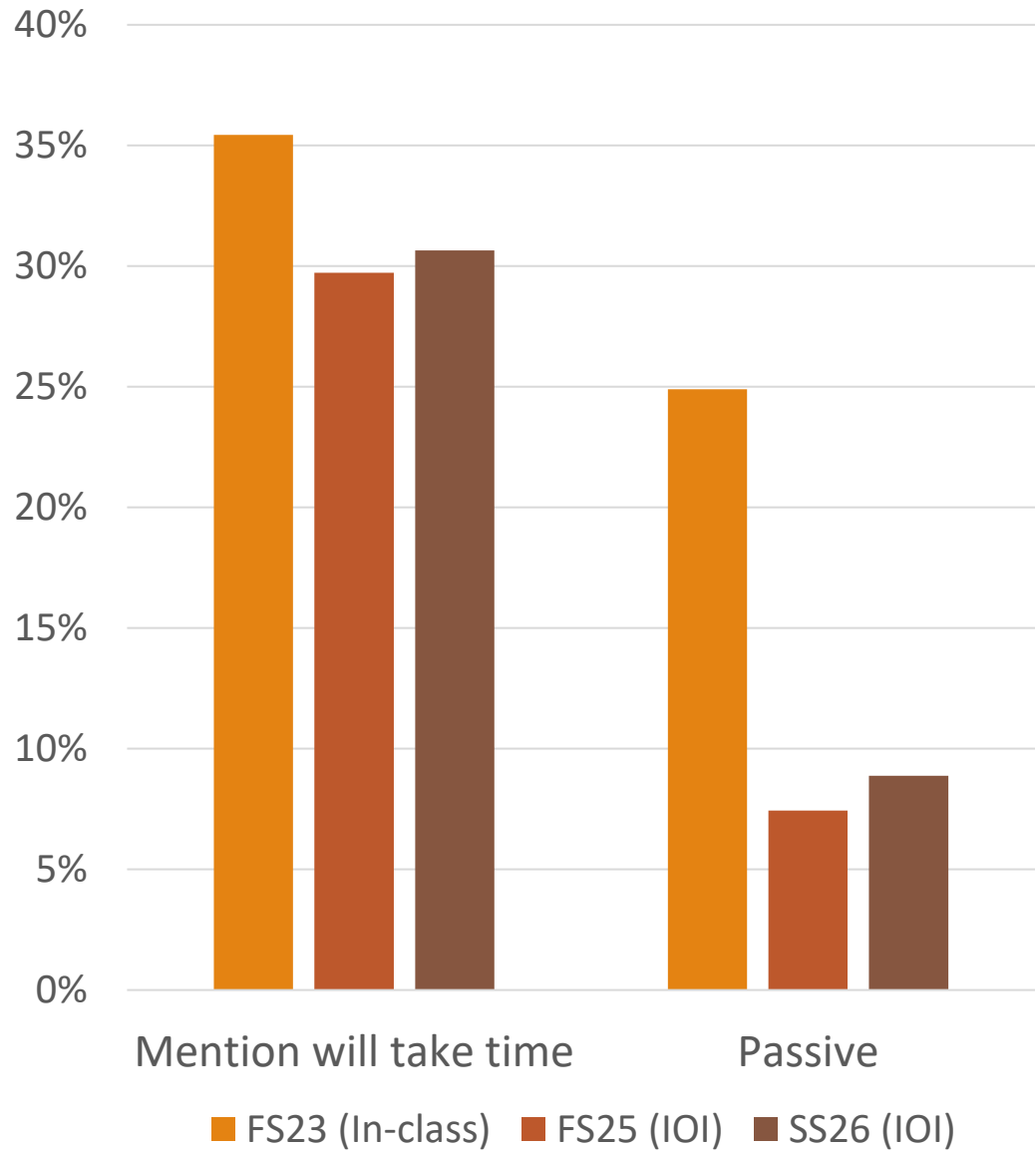


Responses to “How will worries get resolved?”

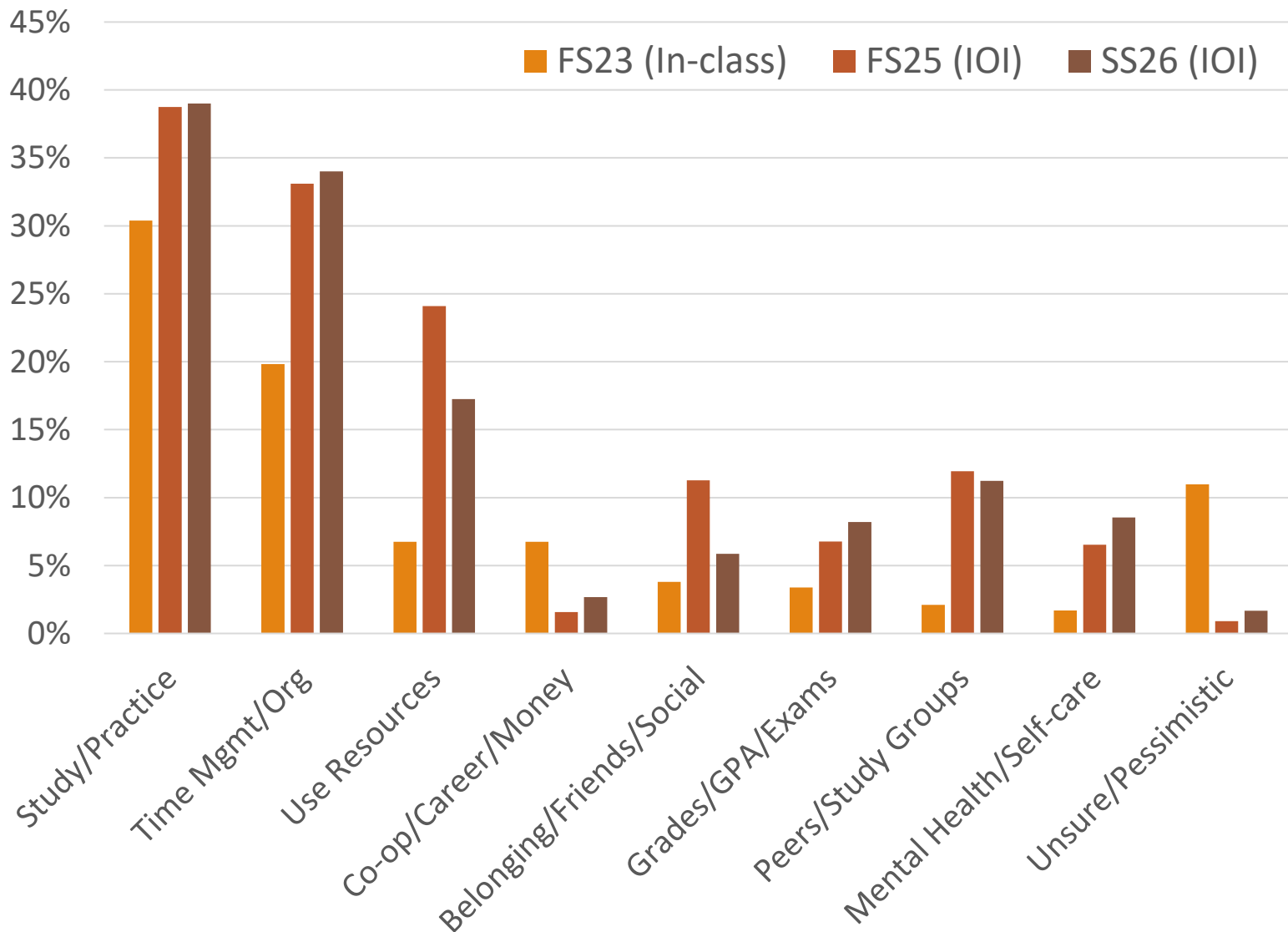
Once I get more used to college, I feel like things will get easier.

I think they will go away as the year progresses.

Finding a rhythm after a few weeks will help make me more familiar and feel at ease.



Responses to “How will worries get resolved?”



Sense of Belonging Survey (Likert-Scale)

I feel like I belong in this class.

I feel like an outsider in this class.

I feel comfortable in this class.

I feel like I can be myself in this class.

Sometimes I worry that I do not belong in this physics class.

Kalendar, Z.Y., et al (2019) PhysRev PER, 15(2), 020119.

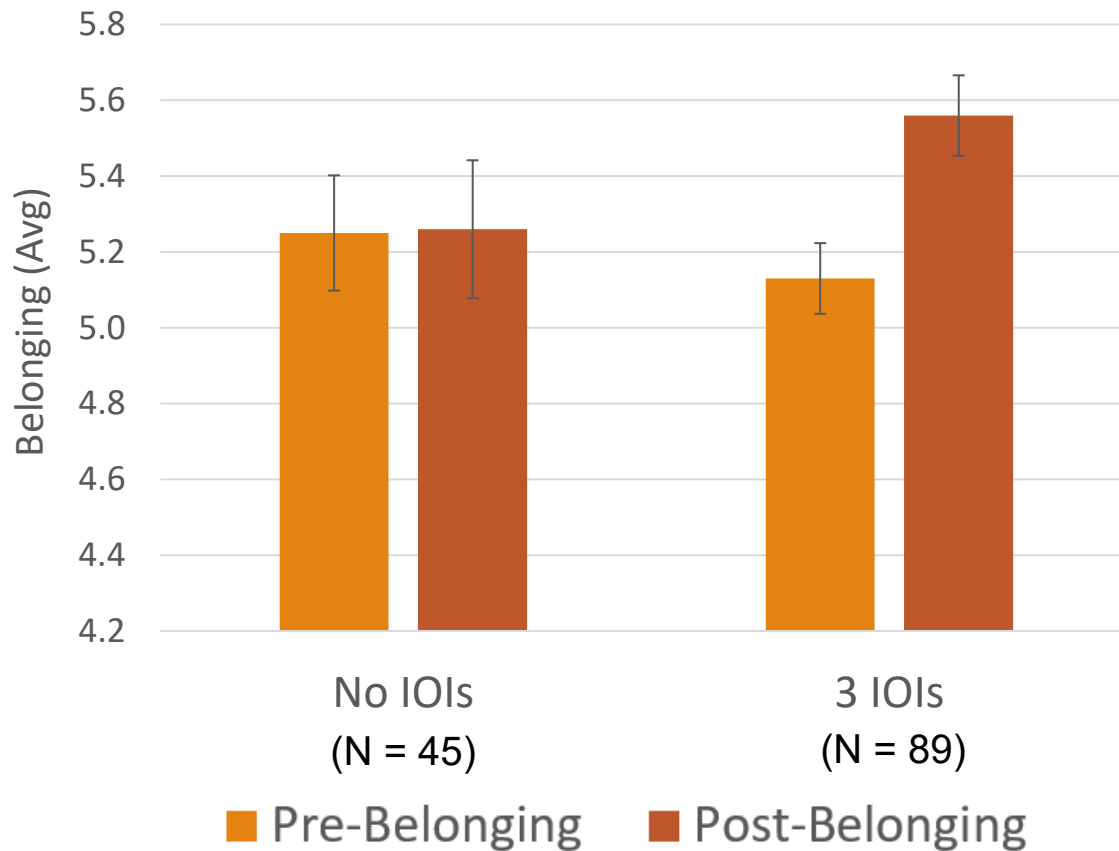
Determine Level of Student Engagement:

Log File Analysis

- ❑ Textbox – Evaluated for meaningful response
- ❑ Videos – Set minimum viewing-time thresholds for videos essential to IOI message
- ❑ For each of the first three IOIs, students received a score:
 - 0 = Did not meet minimum criteria
 - 1 = Limited engagement
 - 2 = High engagement
- ❑ Two groups formed for comparison:
 - **No IOIs** (score of 0 on all IOIs)(~25% of students)
 - **3 IOIs** (score of 1 or 2 on each)(~25% of students)

Students with partial completion were excluded from the analysis.

Fall 2025: Pre-Post-Belonging Survey Results



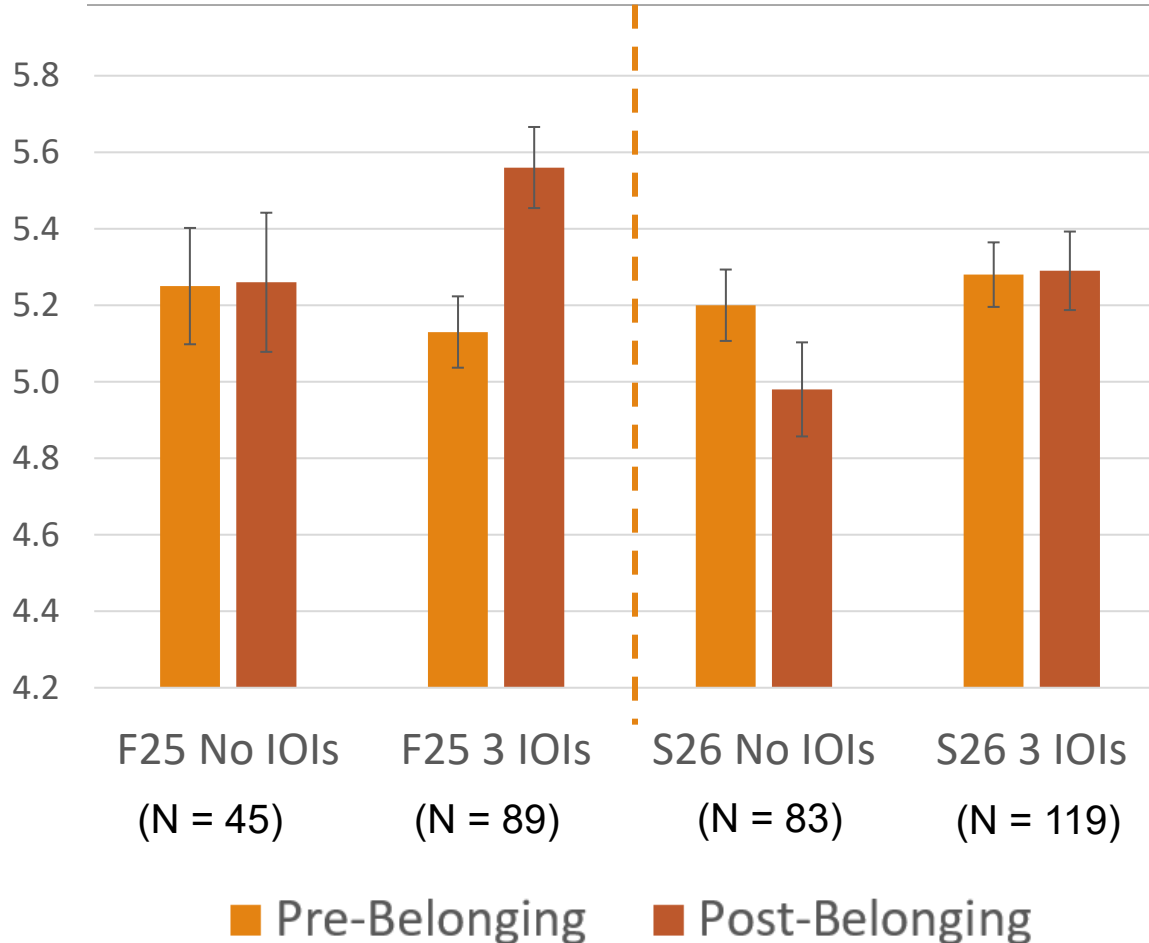
Effect Sizes (Cohen's d)

No IOIs: $d = 0.00$

3 IOIs: $d = 0.46$ ($p < 0.001$)

Moderate effect size indicates IOIs positively impact belonging.

Fall 2025 and Spring 2026 Comparison



Effect Sizes (Cohen's d)

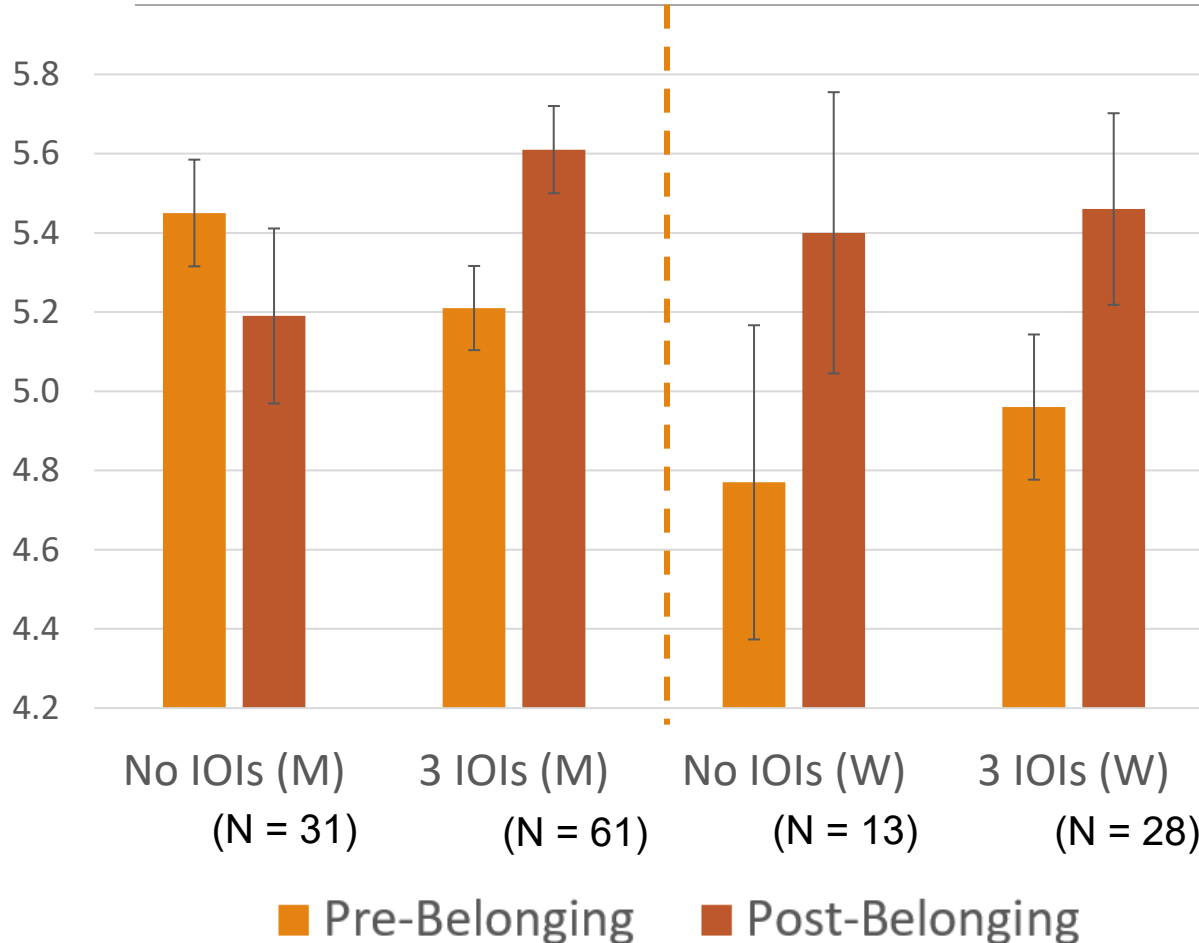
Spring 2026:

No IOIs: $d = -0.22$ ($p > 0.05$)

3 IOIs: $d = 0.01$

Some evidence of positive impact but not statistically significant.

Fall 2025: Comparison of IOI Impact on Men and Women



Effect Sizes (Cohen's d)

No IOIs: *not statistically significant*

3 IOIs: $d_{men} = 0.47$ ($p < 0.001$)
 $d_{women} = 0.44$ ($p = 0.01$)

Moderate effect size indicates IOIs positively impact belonging.

Summary

1. Results suggest the IOIs positively impact the belonging of both male and female students in Fall semester during a transition point for most students.
2. Any impact observed for Spring semester is not significant.

Next Steps for F26/S27

1. Increase Pre-Post Survey Completion

- Administer surveys during recitation

2. Increase IOI Completion and Engagement

- Create Powerpoint slide for instructors to present during class to emphasize purpose and value of IOIs when assigned
- Make minor revisions to IOIs based on log file analysis

<https://ioi.sciencetutorials.net/> (see IOIs in action)

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<https://sciencetutorials.net/trial/EditIOI/> (modify IOIs for local use):

EDITABLE FILES

COURSE DATA

o courseInfo

PAGES

Allison-Quote

Allison2

Cartoon

Final-Reflect

Guess-grade-A

Guess-grade-B

Guess-grade-C

Guess-grade-D

Guess-grade

Intro

Nathan-Quote

Nathan2

Share-data1-A

Share-data1-B

Share-data1-C

Share-data1

Share-data2-A

Share-data2-B

Share-data2-C

Share-data2

Share-data3

Summary

Testimonials-again

Textbox-Resolve

Textbox-Worries

pages/Cartoon.html script block hidden

Replace Images

Replace YouTube Video

Revert

Accept Edits

Wk1 Cartoon

Alexandro Maries



Given what we've learned

Back to Previous Page

Options

Continue to Next Page

PAGE HTML (READ-ONLY)

```
<!-- ////////// Beginning Video option - Do not delete the section below this line ////////// -->
<div class="video container" id="video" style="">
  <div id="videoWrapper" style=" ">
    <div id="player" style=""></div>
  </div>
</div>
<!-- ////////// Ending Video option - Do not delete the section above this line ////////// -->
<!-- ////////// Beginning Text option - Do not delete the section below this line ////////// -->
<div class="container" id="text">
  <br><br>
  Given what we've learned about how common certain concerns are in college, such as worrying about
  falling behind or getting good grades, I think the cartoon points out that whenever you are struggling, chances are
  others are struggling too. Struggles are especially common during transitions, such as moving from high school to
  college.<br><br>
  Another thing that I think the cartoon points out is just how isolating struggling can feel. Just like the people here,
  you can go through it alone because, well, it really does feel like you're the only one struggling and everyone else
```

EDITABLE TEXT

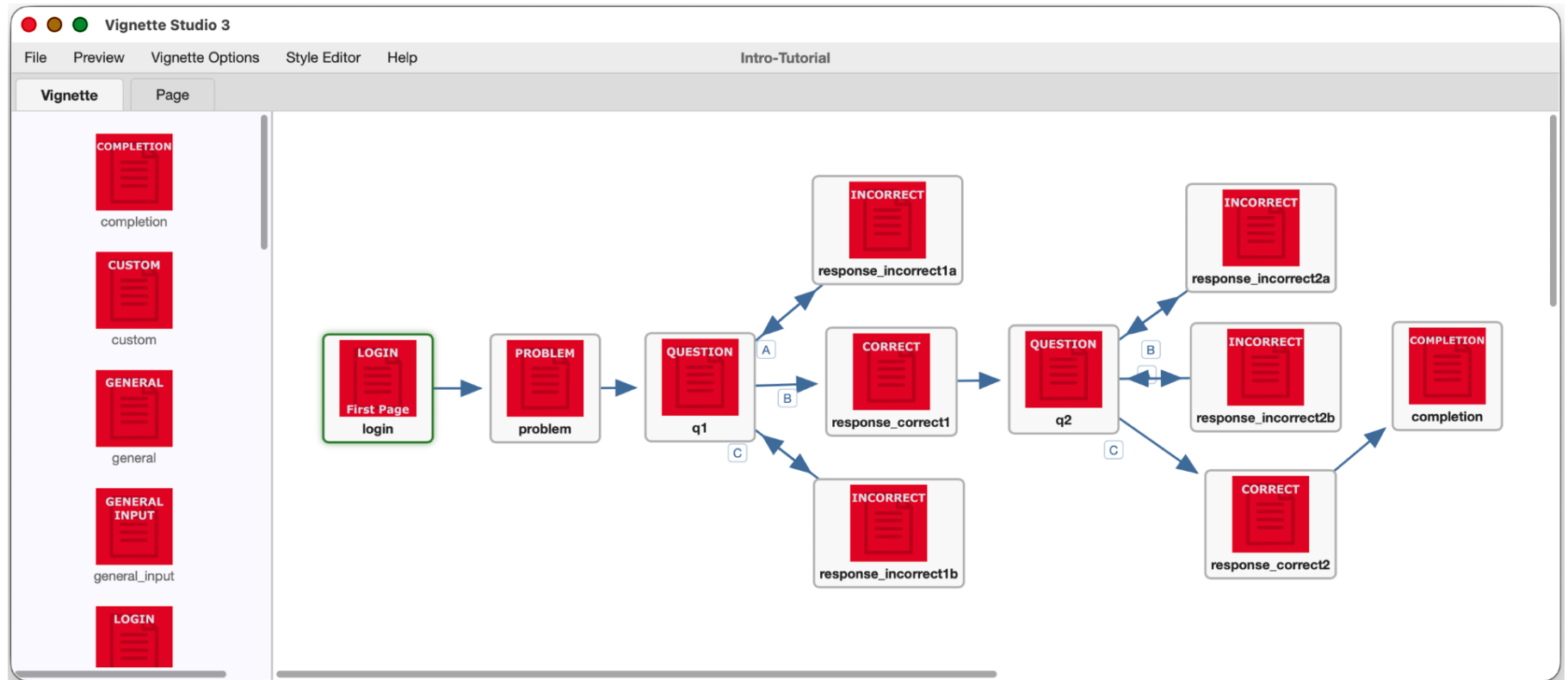
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IVET Project website: compadre.org/IVET/ (30+ problem solving tutorials)

IOI Project website: <https://ioi.sciencetutorials.net/> (see the IOIs in action)

IVET Project website: compadre.org/IVET/ (30+ problem solving tutorials)

- Download the Vignette Studio II software to create your own interactive tutorials



If interested in using or adapting the IOIs, email kathy.koenig@uc.edu