## Failing (in order) to succeed –the benefits of failure in Research-Based courses

Lisa Auchincloss Corwin

**R**esearch on **E**cology and **E**volution **E**d For **A**ction and **Ch**ange Laboratory

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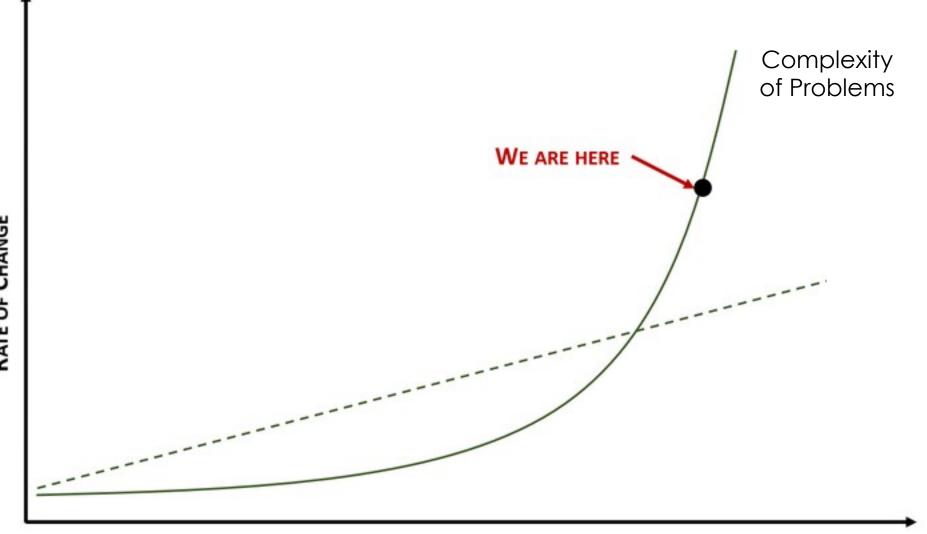
# The Issues

## Thank You for Being Late

AN OPTIMIST'S GUIDE TO THRIVING IN THE AGE OF ACCELERATIONS

THOMAS L. Friedman

AUTHOR OF THE WORLD IS FLAT



**RATE OF CHANGE** 

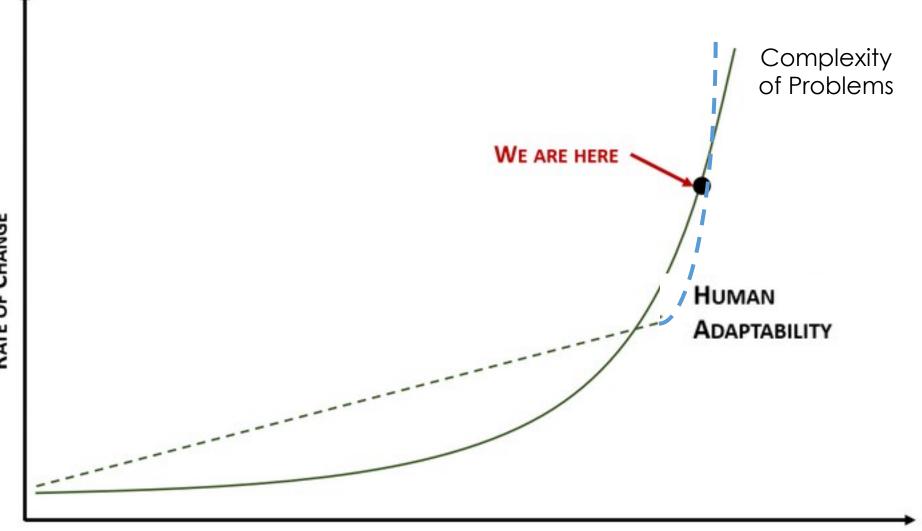




Soldiers disinfected a train station in Daegu, South Korea, the center of the country's coronavirus outbreak. Kim Hyun-Tai/Yonhap, via Associated Press – Feb 29<sup>th</sup>, 2020

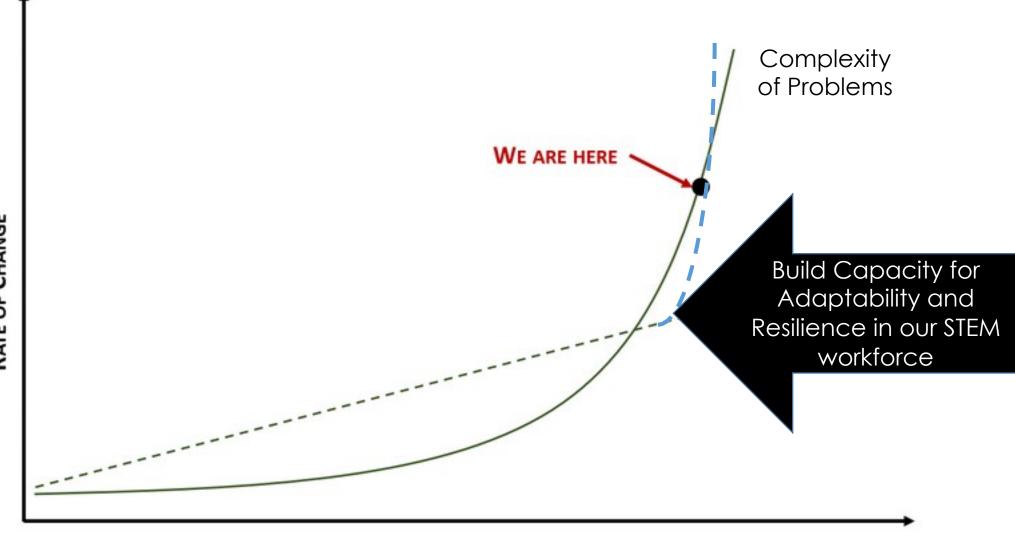


Nurses hug at the Cremona hospital in Lombardy on March 15, 2020 Paolo Miranda/AFP/Getty Firefighters battle a blaze engulfing trees in the town of Nowra in the Australian state of New South Wales on Dec. 31, 2019. Fire conditions worsened into the New Year, with thousands forced to evacuate. Saeed Khan/AFP via Getty Images



**RATE OF CHANGE** 









## Get ready to make some noise!!!!

<u>CLAP your hands if...</u>

you have reached this point in your career with **0 failures or setbacks!** 

How did you become a resilient researcher/teacher/etc.? (enter in the chat)

# The Stories

#### Two stories for today

#### Prior work – A fishy CURE

#### A tale of two courses



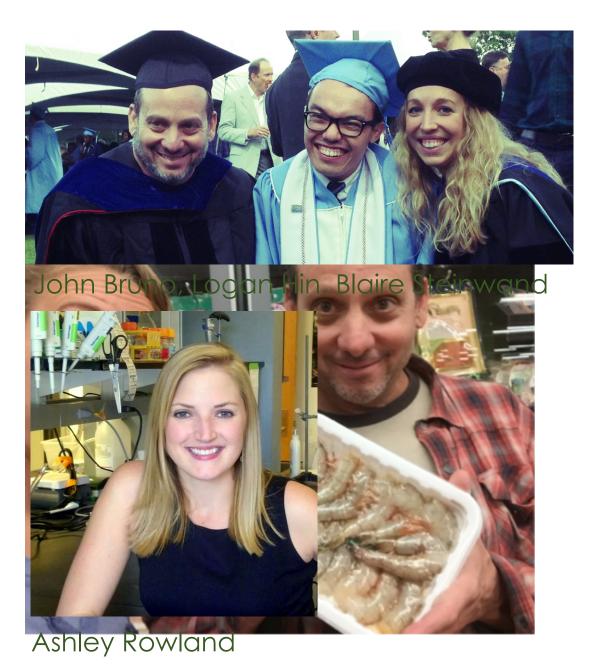


Students who experienced science failures and had an opportunity to iterate reported increased tolerance for scientific obstacles.

Students Who Fail to Achieve Predefined Research Goals May Still Experience Many Positive Outcomes as a Result of CURE Participation

Logan E. Gin,<sup>†</sup> Ashley A. Rowland,<sup>‡</sup> Blaire Steinwand,<sup>§</sup> John Bruno,<sup>§</sup> and Lisa A. Corwin<sup>‡\*</sup>

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#### *FAIL* Is Not a Four-Letter Word: A Theoretical Framework for Exploring Undergraduate Students' Approaches to Academic Challenge and Responses to Failure in STEM Learning Environments

Meredith A. Henry,<sup>†</sup> Shayla Shorter,<sup>†</sup> Louise Charkoudian,<sup>‡</sup> Jennifer M. Heemstra,<sup>†</sup> and Lisa A. Corwin<sup>§</sup>\*

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## Students differ in how they **engage** with challenges...

and this influences how they **respond** to failures.





Meredith Henry

Shayla Shorter





Jen Heemstra

Lou Charkoudian

#### **How** do students **cope** with challenges and failures during research experiences? Does it **vary**?



#### Two stories for today

#### Prior work – A fishy CURE

#### A tale of two courses





## **CURE** Coping Team



Joe Harsh Associate Professor James Madison University Department of Biology



Michael Ramsey Graduate Student University of Colorado, Boulder Applied Math







Bri

Hill





Stevie Ellis

Nina Gustafson Elizabeth Woolner

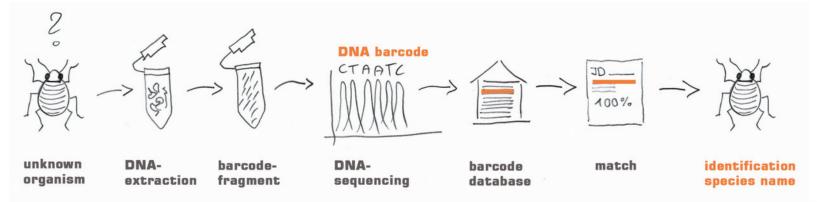
# What are the coping patterns and differences between students in two sequential research-based courses?

#### • Course A:

- First class in introductory sequence
- Longitudinal study of urban biodiversity.

#### • Course B:

- Second class in introductory sequence, following course A
- Students develop and investigate their own research questions with coaching from instructors.





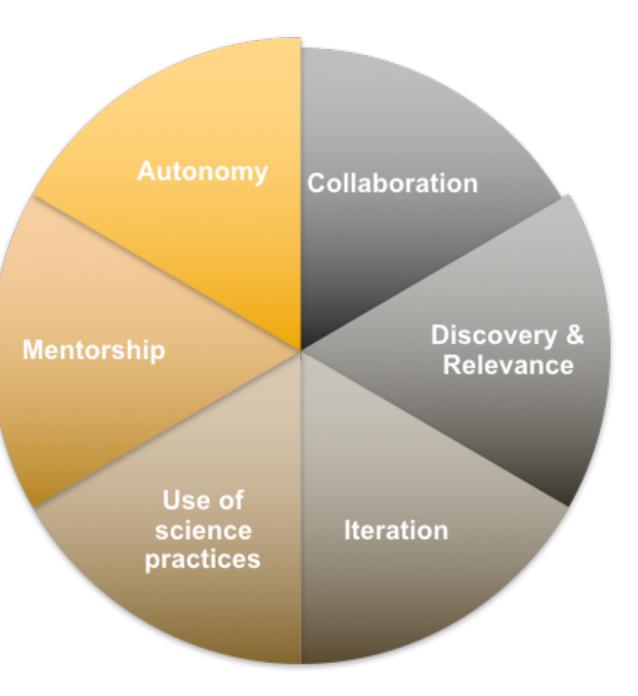
Howard Hughes Medical Institute

C biome -id

## **Course Design**

Students in both courses were given the opportunity to **iterate** when they encountered unexpected researchbased challenges.

Auchincloss et al., 2014 Gin et al., 2018 Hanauer and Dolan, 2014



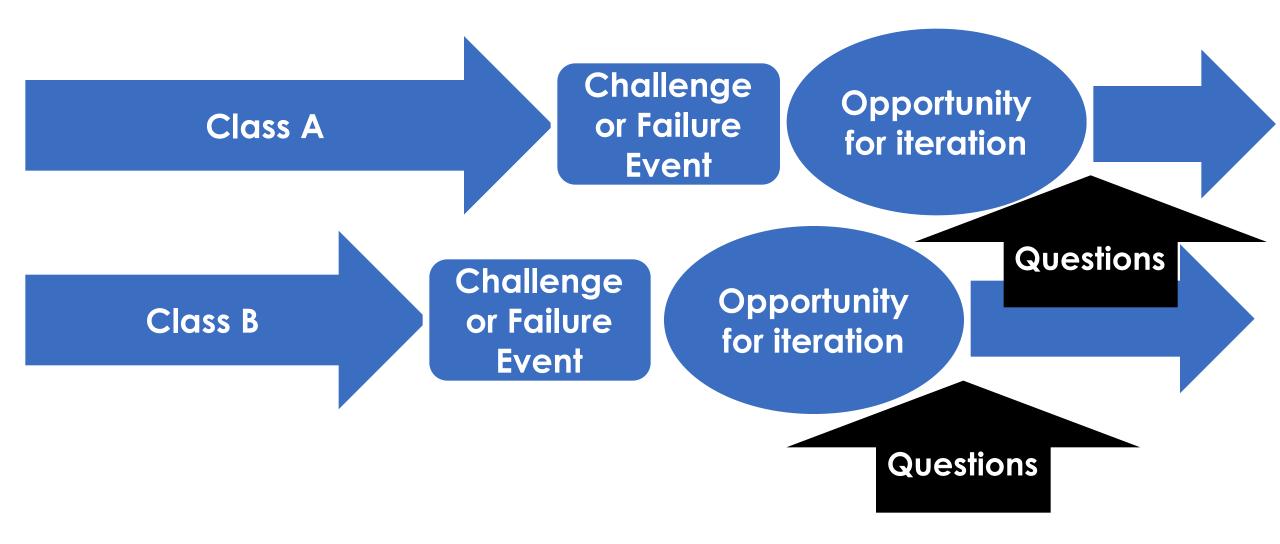
## Population

Recruited a total of 746 students in two research-based courses, 330 completed the entire questionnaire



_	Course A ( <i>n = 161)</i>	Course B ( <i>n = 169</i> )
Sex		
Male	30.8%	28.1%
Female	69.2	63.8
Other	0	8.1
Ethnicity		
Non-White	26.5	20.3
White	73.5	79.7
Educational Standing		
1st Year	53.5	54.9
2nd Year	21	25.5
3rd Year	16.7	16.3
4th Year	6.8	3.1
Major*		
Bio / Health Sci	43	84
Other	58	16
First Gen Status		
FG	22.5	19.3
Non-FG	77.5	80.7

#### Methods: Research Timeline

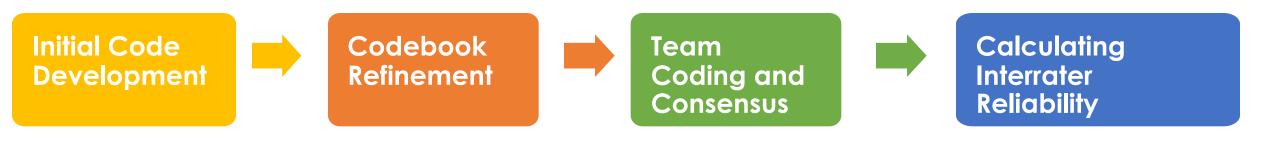


## Methods: Open-Ended Prompts

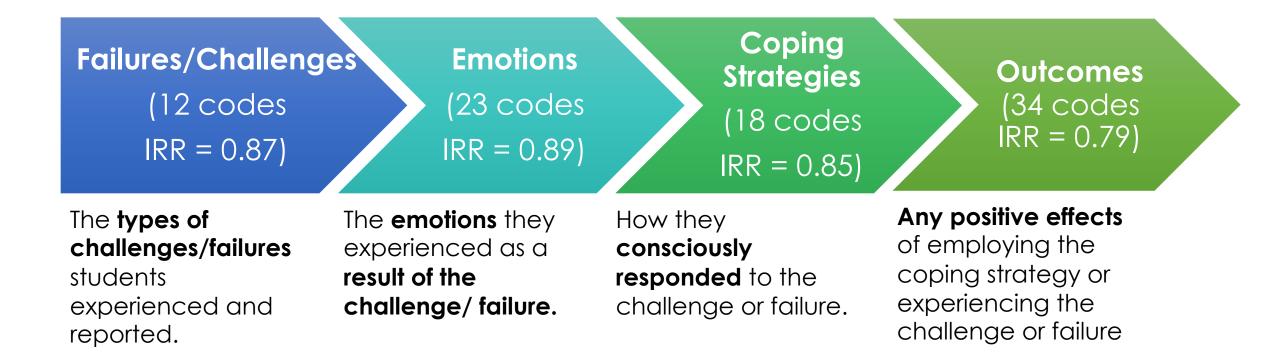
- Please describe any research-related challenges or failures that you have encountered over the past two to three weeks. These can include [research related examples]. Please do not discuss experiences associated with taking quizzes, exams, or non-research lab assignments.
- Please **reflect on how you felt** when these challenges or failures occurred. What was your emotional reaction?
- Please **describe how you acted** in response to these challenges or failures.
- If you feel that dealing with these challenges or failures helped you learn or provided an opportunity for growth, describe what you learned or how you grew as a result of dealing with these challenges or failures.

## Methods: The Coding Process

Open coding **identifies patterns and themes** in text by assigning meaningful chunks of text to "codes". Those codes can then be **explored in depth through further qualitative or quantitative analysis to describe a textual data set** in more detail.



#### Methods: Codebook Development



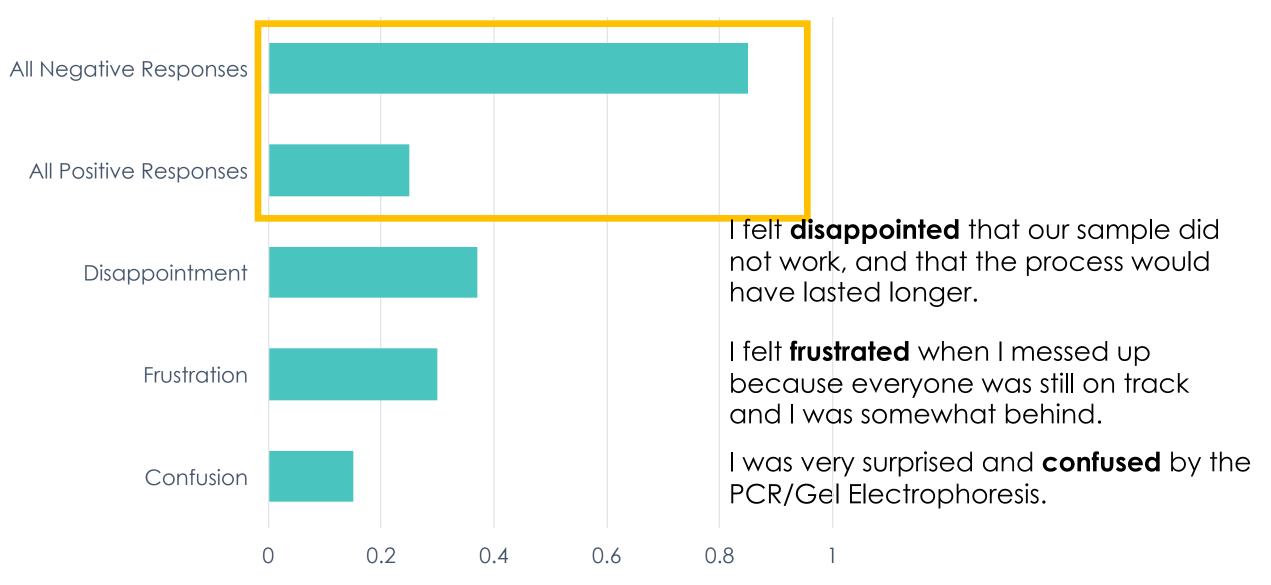
**Coping codes:** Skinner, Altman, & Sherwood, 2003 **Outcomes codes:** Corwin, Graham, & Dolan, 2015

#### **Results:** Questions for today...

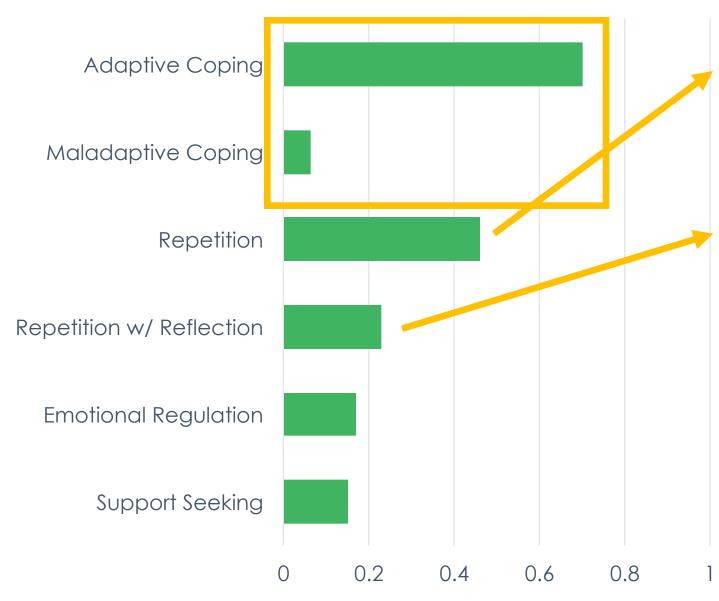


Technical Research Challenges (n = 224)  What are the most prevalent codes?
Are students of different backgrounds more likely to discuss certain codes?
Are students from different courses (A or B) more likely to discuss different codes?

#### **Results:** Prevalent Emotion Codes



## **Results:** Prevalent Coping Codes



My DNA sample did not work the first time in lab **so I had to redo the entire** process.

#### VS

I messed up with the DNA extraction part of lab. My sample was moss **so I needed to add less extraction buffer** since moss retains liquid. So I **had to redo** the extraction process three times.

I kept an open mind and **didn't let it bother me too much** or get me off focus. So I found it to be helpful to **stay light hearted** and just try again.

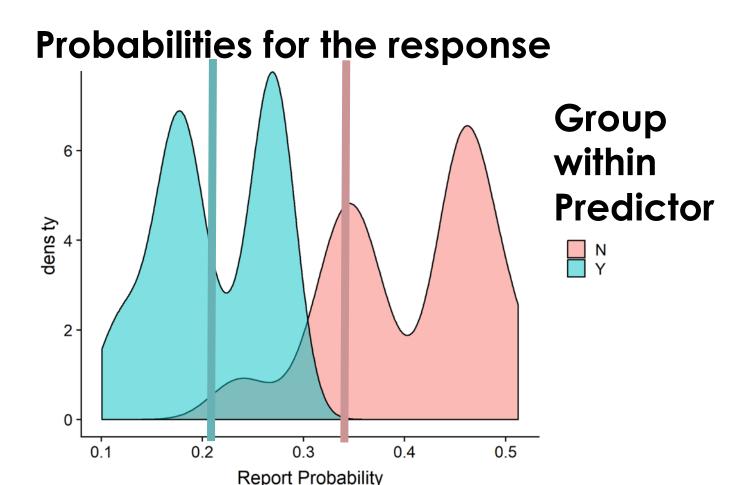
I **sought out help** from someone who had completed it correctly and the teacher.

## Methods: Mixed Effect Logistic Regressions

[Emotion/Coping Strategy] ~ Gender + Race + Class Standing + BioMajor + Course + [section]

#### **Density Plot:**

- "smoothed histogram"
- Probabilities of reporting an emotion or coping mechanism for all students
- Vertical lines indicate the average probability for that group



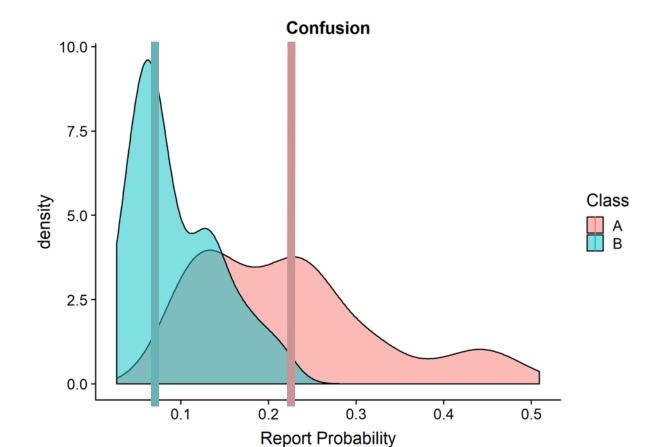
#### **Results:** Two main stories of interest

- **Story 1** -The two sequential courses differ in ways that indicate potential shifts in emotional responses and coping patterns.
- **Story 2** -Students who identify as female are reporting different strategies and emotions than those who identify as male.

#### Story 1 – Course Differences

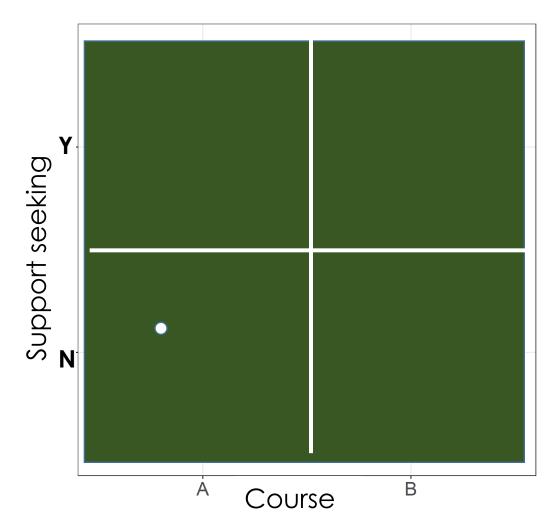
**Confusion** ~ Gender + Race + Class Standing + BioMajor + Course + [section]

Students in **course A** have a 23% chance of reporting confusion, while students in **course B** have only a 7% chance. **P = 0.03** 



#### Story 1 – course differences

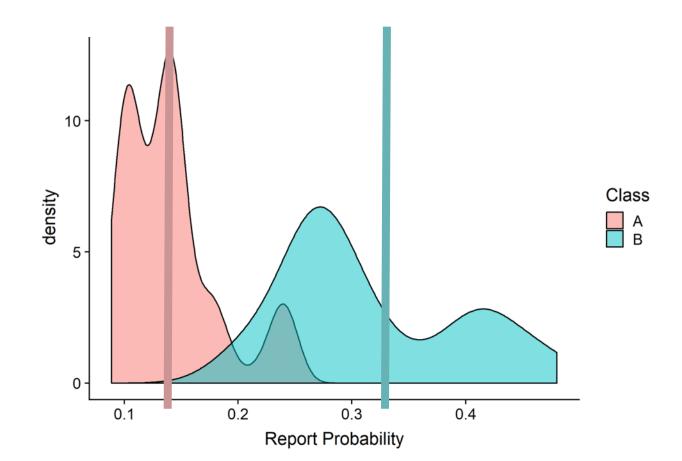
Support seeking could not be analyzed using a mixed model due to data imbalance



#### Story 1 – course differences

#### **Repetition with reflection** ~ Gender + Race + Class Standing + BioMajor + Course + [section]

Students in **course B** have a 33% chance of reporting that they repeated their project while reflecting on what to change or what could have gone wrong. Students in **course A** have only a 14% chance of reporting this code. P = 0.08

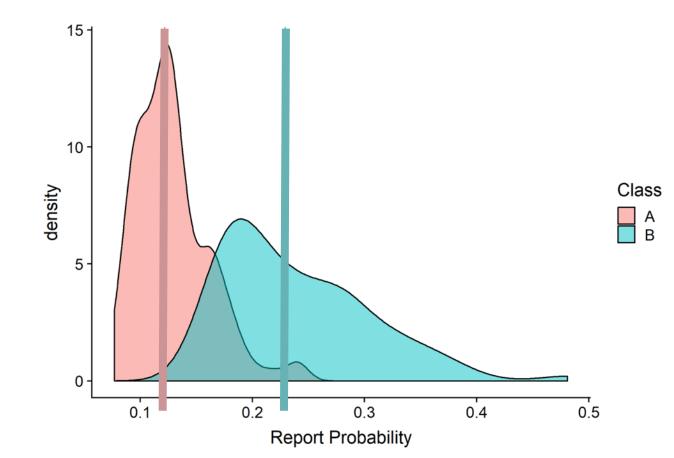


#### Story 1 – course differences

#### **Emotional Regulation**~ Gender + Race + Class Standing + BioMajor + Course + [section]

Students in **Course A** have only a **12%** chance of reporting emotional regulation. Students in **Course B** have a **23%** chance.

 $\mathsf{P} = 0.08$ 



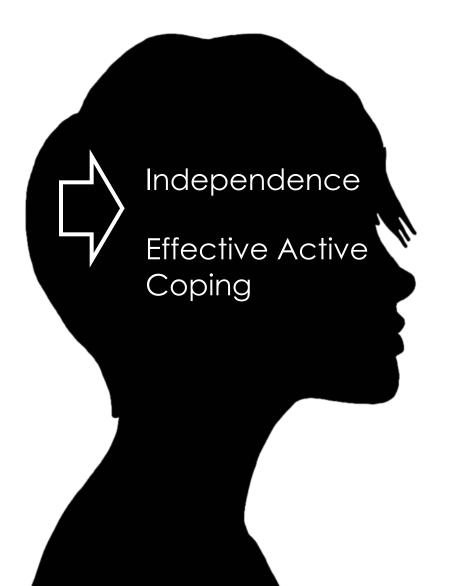
## Story 1 – summary

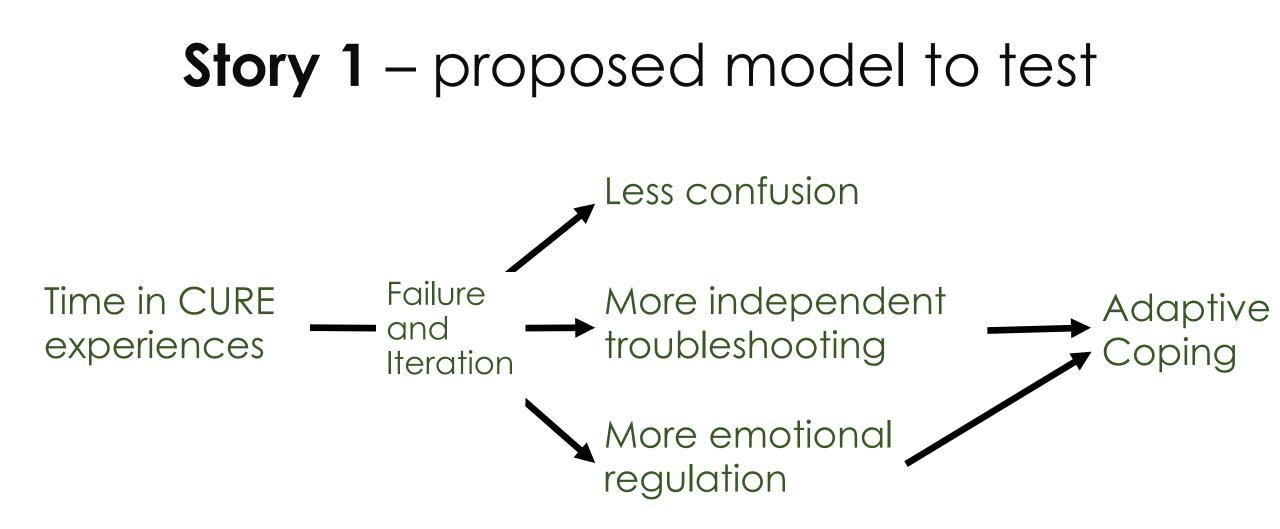
#### • Students in **Course A** report...

- more confusion
- more support seeking

#### • Students in Course B report...

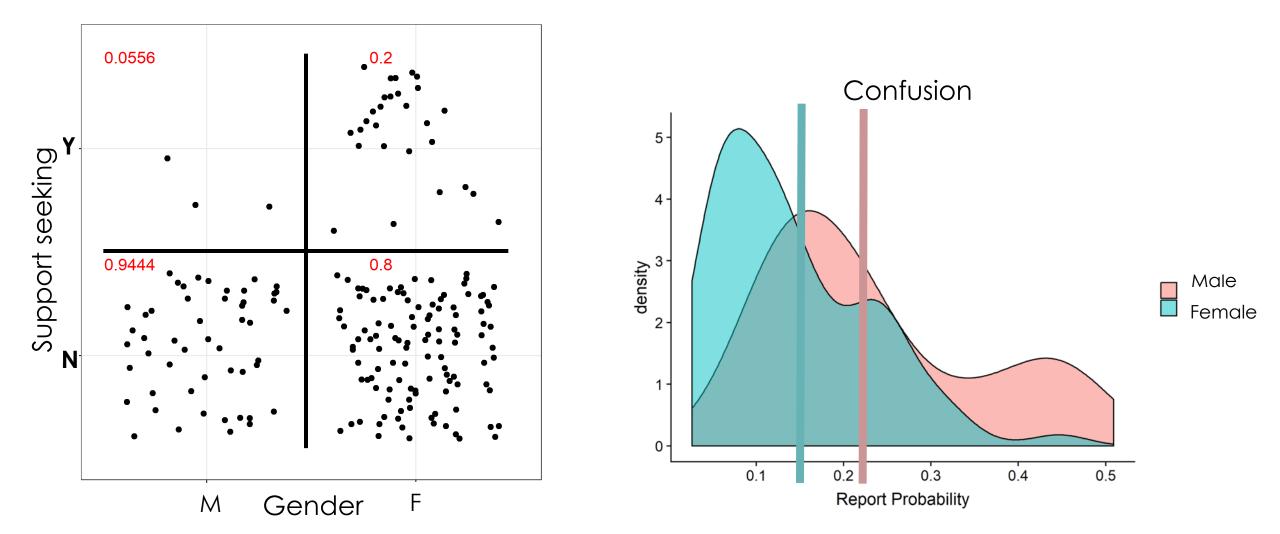
- more emotional regulation
- more repetition with active reflection (i.e., troubleshooting / evaluating)

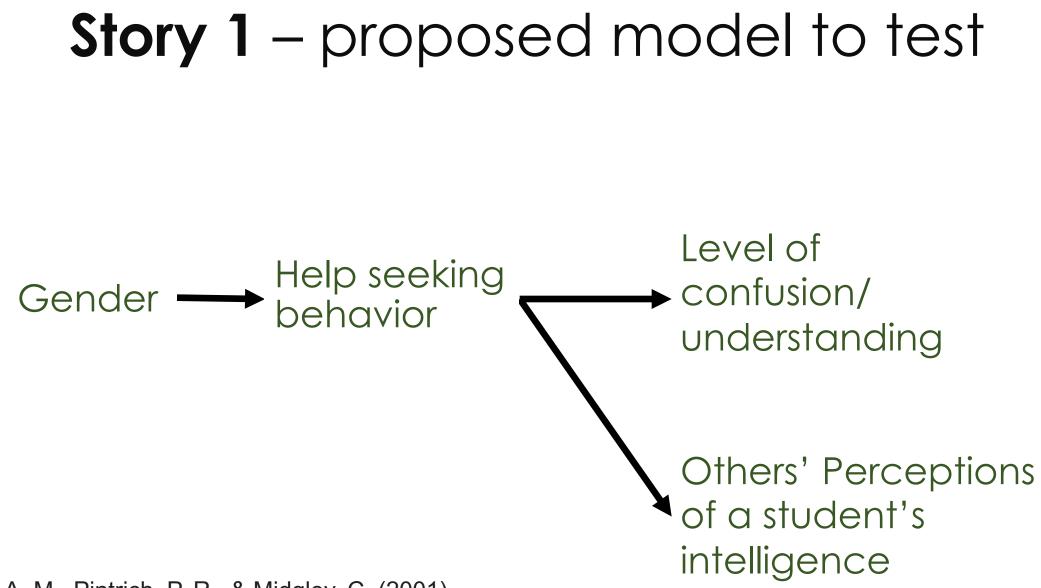




## Story 2 – gender differences

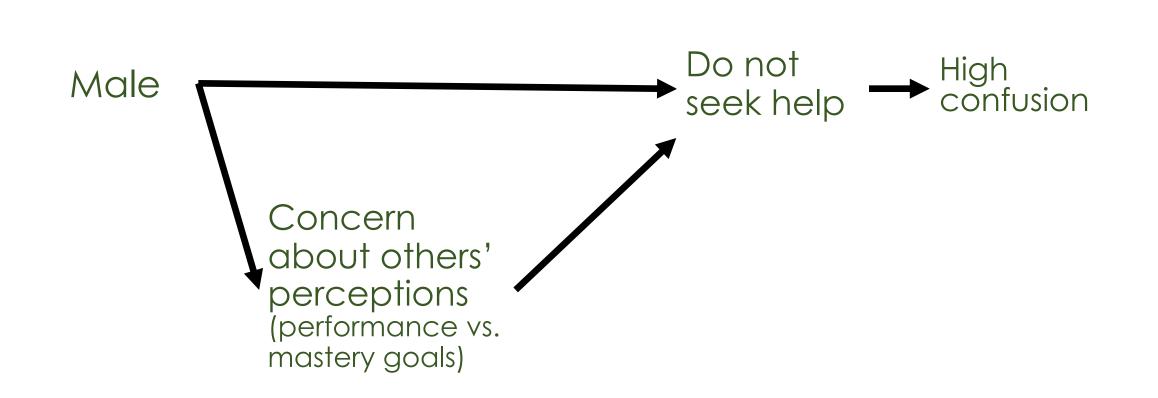
Look at the graphs and think of a one-sentence summary.





Ryan, A. M., Pintrich, P. R., & Midgley, C. (2001).

#### Story 1 – proposed model to test



## **Teaching and Research Implications**

- Results elucidate possible coping models to test.
- Testing of these models will...
  - Have implications for the duration and number of CUREs needed to achieve certain outcomes.
  - Elucidate how differences in coping styles among genders may affect learning and the classroom experience.
- Most importantly, this work will help to build awareness of how we, as instructors, can design research experiences to build students' scientific resilience.

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  - Nancy Emery
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Howard Hughes Medical Institute



University of Colorado Boulder



JAMES MADISON UNIVERSITY

**RE**<sup>3</sup>A

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#### Consider...

How would you design an undergraduate research experience so as to encourage student learning as a result of unexpected challenges or failures?