# EXPLORING THE RELATIONSHIP BETWEEN THE USE OF LEARNING TECHNOLOGIES AND STUDENT SUCCESS IN THE ENGINEERING CLASSROOM

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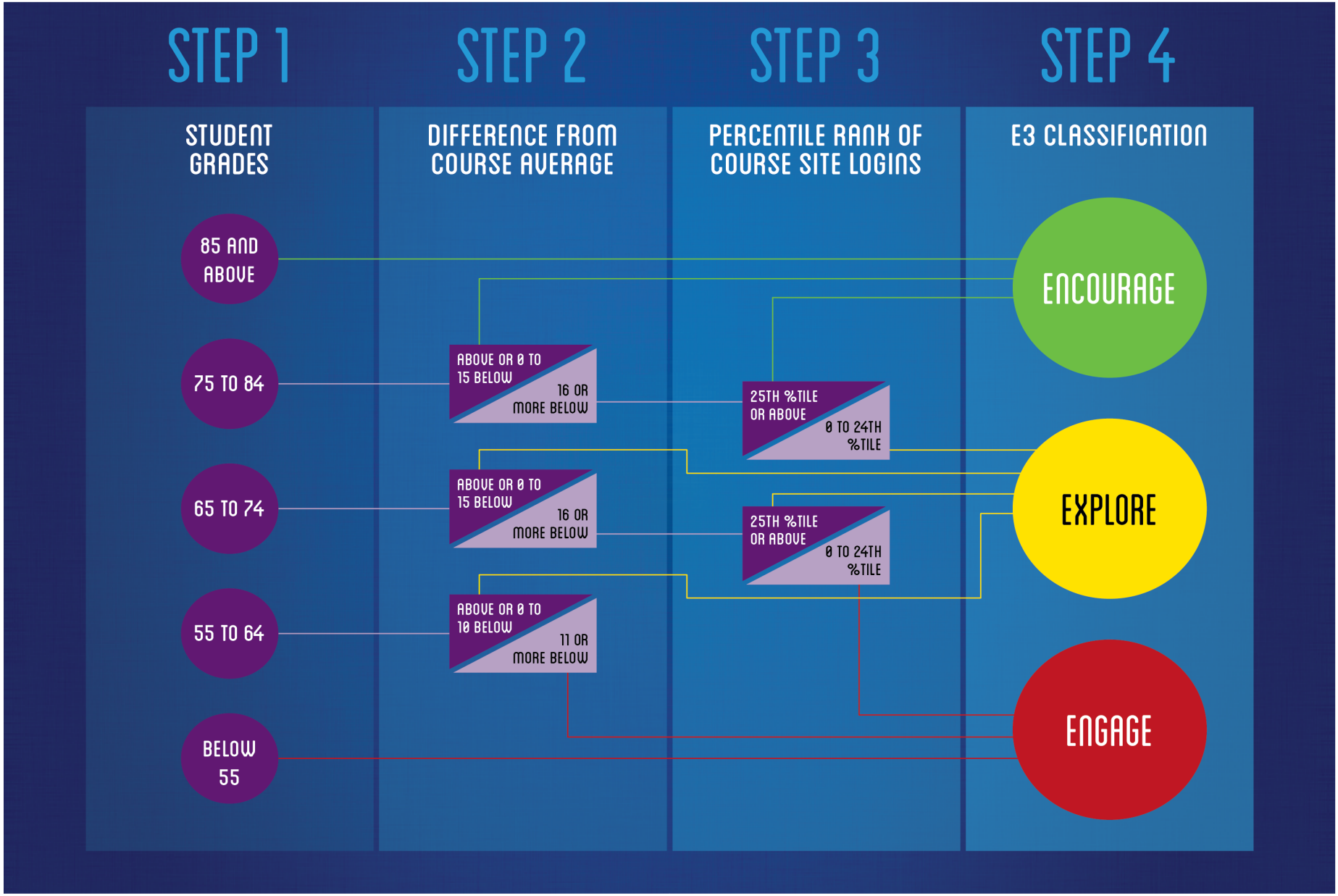
# INTRODUCTION

- A large portion of students who are classified as academically struggling never recover from these failures
- Many analyses only focus on end of course grades to investigate student failure
  - Fails to account for the types of behaviors that might occur during the semester
- This research paper presents findings from a study on the impact of Learning Management Systems (LMSs) on student success in the classroom
  - Allows us to examine student performance on a week-to-week basis

# STUDENT EXPLORER

- Our LMS, titled ”student explorer,” gives users a weekly categorization of each student’s performance for each course and designation:
  - “Encourage” (green – student performing at or above the course mean),
  - “Explore” (yellow - students performing below the course mean), or
  - “Engage” (red - students in the lowest quartile of performance)


STEP 1
STEP 2
STEP 3
STEP 4
STUDENT GRADES
DIFFERENCE FROM COURSE AVERAGE
PERCENTILE RANK OF COURSE SITE LOGINS
E3 CLASSIFICATION
85 AND ABOVE
75 TO 84
65 TO 74
55 TO 64
BELOW 55
ABOVE OR 0 TO 15 BELOW
16 OR MORE BELOW
ABOVE OR 0 TO 15 BELOW
16 OR MORE BELOW
ABOVE OR 0 TO 10 BELOW
11 OR MORE BELOW
25TH %TILE OR ABOVE
0 TO 24TH %TILE
25TH %TILE OR ABOVE
0 TO 24TH %TILE
ENCOURAGE
EXPLORE
ENGAGE



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# RESEARCH QUESTIONS

1. (a) Which instructional technologies, if any, help to predict the likelihood of students entering *explore* or *engage* classifications? (b) Which instructional technologies, if any, help to predict the likelihood of students exiting *explore* or *engage* classifications?
2. Does the timing of students' use of these technologies precede, coincide with, or lag their experience of academic difficulty? In other words, do students use these tools throughout the duration of the semester, or only when they experience academic difficulty?

# SAMPLE

- Introductory programming course in the Electrical Engineering and Computer Science program
- Redesigned using the LMS to encourage students to use strategies that promote academic success in the course and correct risky academic behaviors early in the semester.
- Sample includes 695 students who took this course in the Winter 2016 academic semester

# DEPENDENT VARIABLE

- Dichotomous variable measuring the change in level for each student's weekly classification (1=change in classification; 0=no change in classification)
- Created variables for both entering into and exiting out of either the "explore" or "engage" classifications

# INDEPENDENT VARIABLES

- Exam Preparation: A tool providing resources and strategies for preparing for exams
- Exam Reflection: A tool providing resources and strategies for reflecting on exams.
- Grade Calculator: An interactive tool that students can use to estimate their grade based on current and future performance.

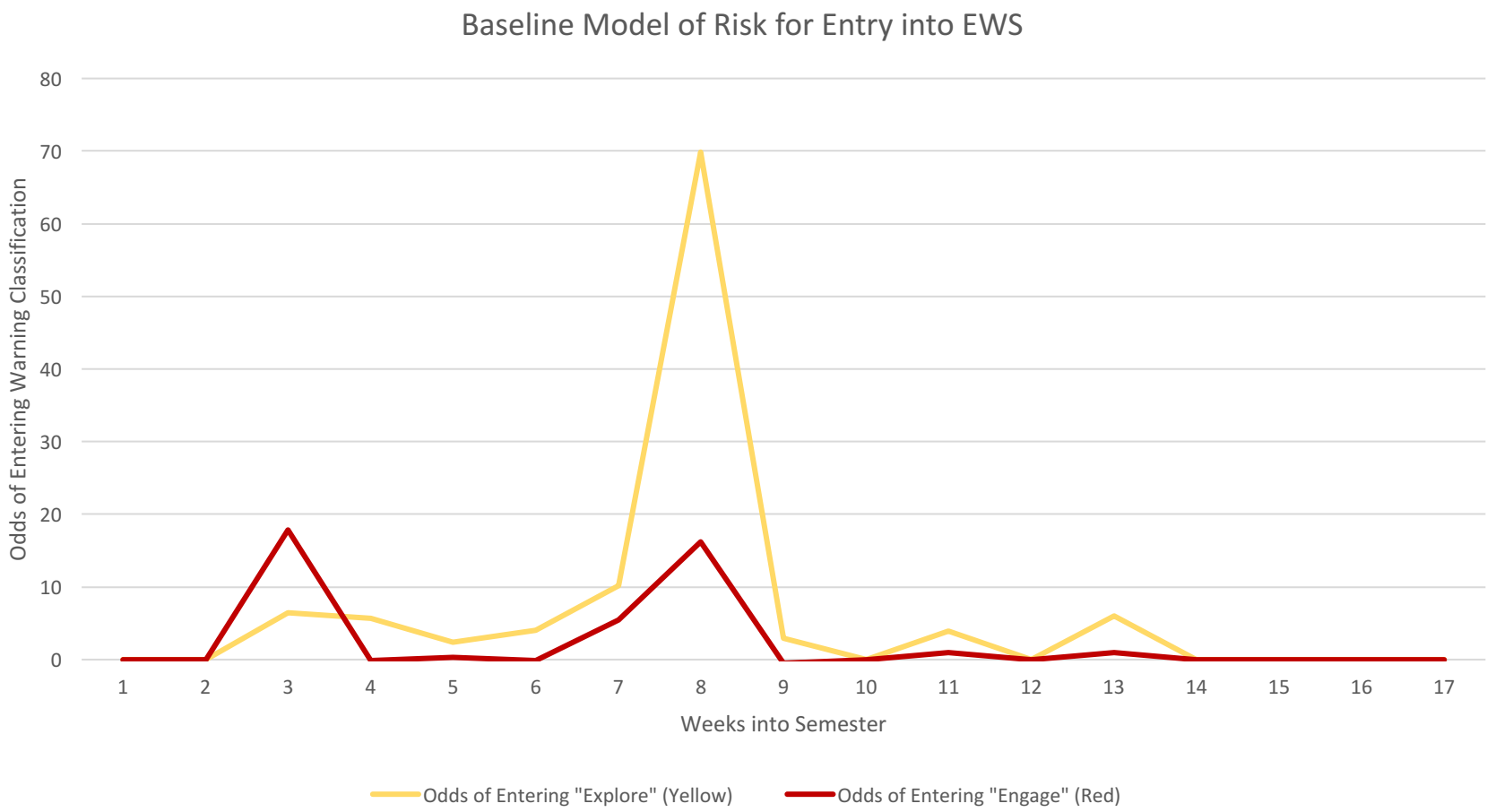
# INDEPENDENT VARIABLES

- Assignment 2 – First Submission: Represents whether or not their first draft submission of this assignment was in a given week.
- Assignment 2 – Last Submission: Represents whether or not their final draft submission of this assignment was in a given week.

# ANALYSIS

- Event history (or hazard) modeling: probability that students will either enter or exit the “explore” or “engage” classification in a given week
- Four models were estimated for our analysis:
  - Entering the “explore” classification
  - Entering the “engage” classification
  - Exiting the “explore” classification
  - Exiting the “engage” classification

# RESULTS



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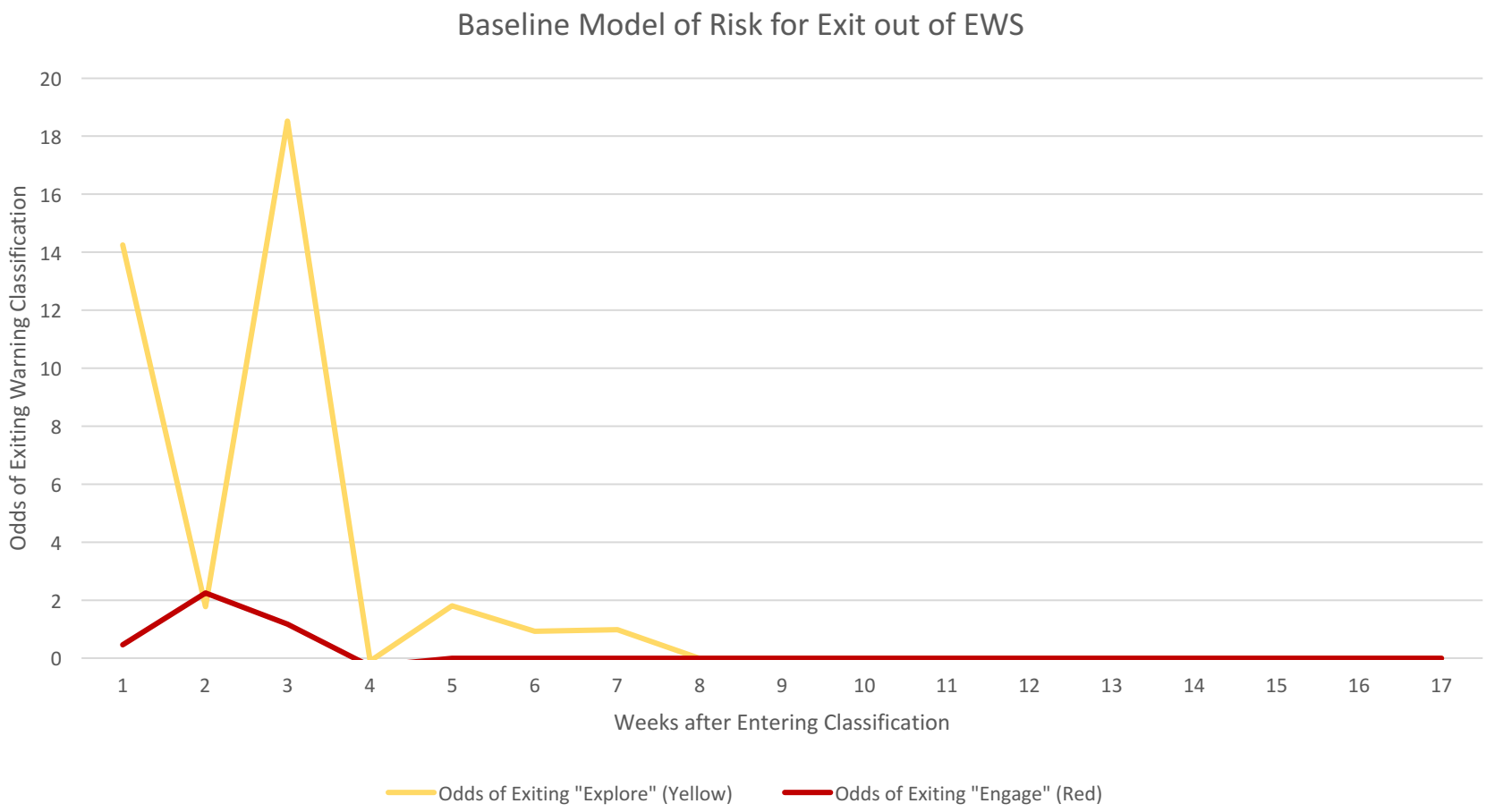
# RESULTS



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# RESULTS

Table 2

*Odds Ratios of Predictors for Entering and Exiting EWS Classifications*

| | Entry | | Exit | |
|---|---|---|---|---|
| | Yellow | Red | Yellow | Red |
| *Gender (vs. Male)* | | | | |
| Female | 1.17 | 1.16 | 0.90 | 0.66 |
| *Race (vs. White)* | | | | |
| Black | 0.19 | 0.86 | 1.00 | 1.00 |
| Hispanic | 0.76 | 1.00 | 5.94 | 1.00 |
| Asian | 1.28 | 0.57 | 0.53 | 10.49 |
| Other | 1.11 | 0.36 | 5.33 | 0.79 |
| *Academic Characteristics* | | | | |
| HS GPA | 1.00 | 1.55 | 5.14 | 0.23 |
| ACT | 0.86* | 1.06 | 1.16 | 0.72 |
| Math Placement | 1.00 | 0.96 | 1.12 | 0.91 |
| College GPA | 0.46** | 0.27** | 3.55* | 0.63 |
| # of Units Taken | 0.93 | 1.09 | 1.00 | 2.06 |
| *Instructional Tools* | | | | |
| Exam Prep | 0.98* | 1.00 | 1.03 | 1.02 |
| Grade Calculator | 1.00 | 1.00 | 1.03 | 0.97 |
| Exam Reflection | 1.00 | 0.99 | 1.01 | 1.06 |
| Assn #2 - First Submission | 0.94 | 2.10* | 1.19 | 0.31 |
| Assn #2 - Last Submission | 1.56* | 0.77 | 0.70 | 4.34 |

*p<0.05; **p<0.01; ***p<0.001

# RESULTS

*Impact of Use of Instructional Tools on Weekly Risk of Entering EWS Classification*

| | Week 3 | | Week 4 | | Week 5 | | Week 6 | | Week 7 | | Week 8 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Y | R | Y | R | Y | R | Y | R | Y | R | Y | R |
| Assn2 - First Submission | 1.58 | 1.06 | 1.00 | 1.71 | 3.07 | 1.25 | 8.94* | N/A | 0.73 | 3.46* | 1.00 | 1.51* |
| Assn2 - Last Submission | 0.69 | 1.17 | 1.29 | 0.54 | 0.58 | 1.13 | 0.15 | 0.00 | 1.70* | 0.48 | 1.30* | 1.21 |
| Exam Prep | 1.00 | 0.97** | 0.99 | 0.92 | 1.02 | 0.96 | 0.97 | 1.01 | 0.94* | 0.98 | 0.99 | 0.96** |

Y = "Explore" Classification; R = "Engage" Classification
*p<0.05; **p<0.01; ***p<0.001

*Impact of Use of Instructional Tools on Weekly Risk of Exiting EWS Classification*

| | Week 1 | | Week 2 | | Week 3 | | Week 4 | | Week 5 | | Week 6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Y | R | Y | R | Y | R | Y | R | Y | R | Y | R |
| Exam Reflection | 1.89 | 1.65 | 1.49 | 2.16 | 5.04* | 0.88 | 1.00 | 0.34 | 1.36 | 1.24 | 0.57 | 1.00 |
| Grade Calculator | 0.60 | 0.87 | 3.16 | 0.93 | 1.59 | 4.81* | 1.00 | 9.21* | N/A | 10.82* | N/A | 1.00 |

Y = "Explore" Classification; R = "Engage" Classification
*p<0.05; **p<0.01; ***p<0.001

# DISCUSSION

- Week 8 encompassed the greatest risk for entering either of our classifications
- After the fourth week in the “explore” and “engage” models, students’ probability of exiting either of these classifications drops significantly
- The instructional tools were also extremely valuable in mitigating the risk of entering the model, or helping students after they entered the model to exit quickly

# DISCUSSION

- Use of the exam preparation, exam reflection, and grade calculator tools were significant in either helping students stay out of the LMS classifications, or making a successful exit out of the system
  - Exam preparation tool appeared to assist students in thinking ahead about the first exam
  - Exam reflection and grade calculator tools helped to pull them out of trouble

# FUTURE RESEARCH

- Investigating the underlying *how* and *why* these instructional tools assist students in course success
- Capturing (and controlling for) students' individual motivation to perform well in the course
- Major vs. non-major comparison models
- Wide-scale implementation of these analyses to examine consistency

# THANK YOU!

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