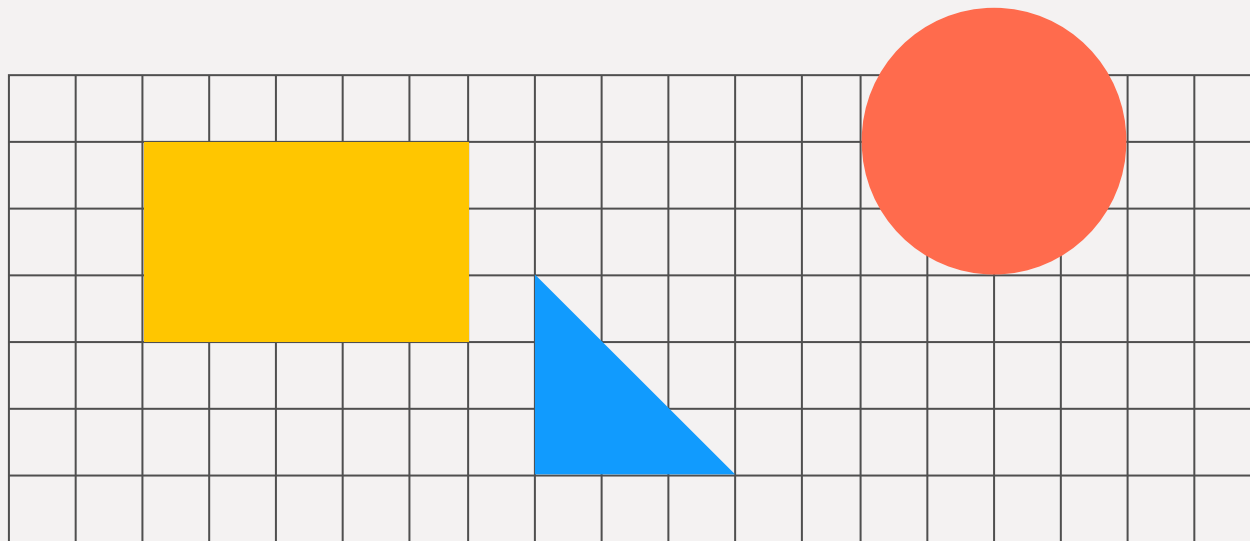


Optimizing Learning Strategies: Evaluating the Impact of Active vs. Passive Learning on Student Engagement and Comprehension

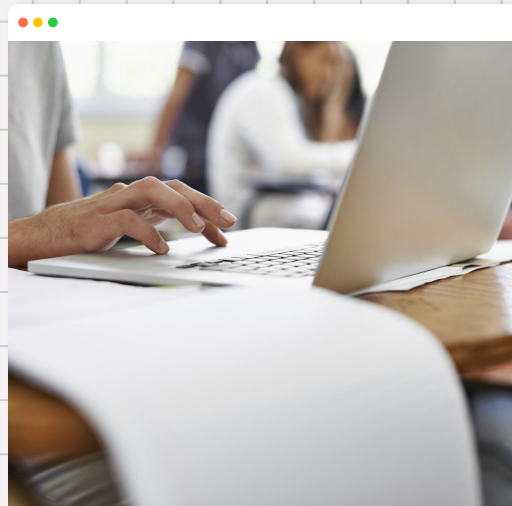
Achinthya Sreedhar, Chaitali Deshmukh,
Kendall Sims, Neha Shastri



Introduction

Motivation

- Optimize educational practices to enhance student learning experiences
- Provide evidence-based insights for educators to determine effective teaching approaches



Goal

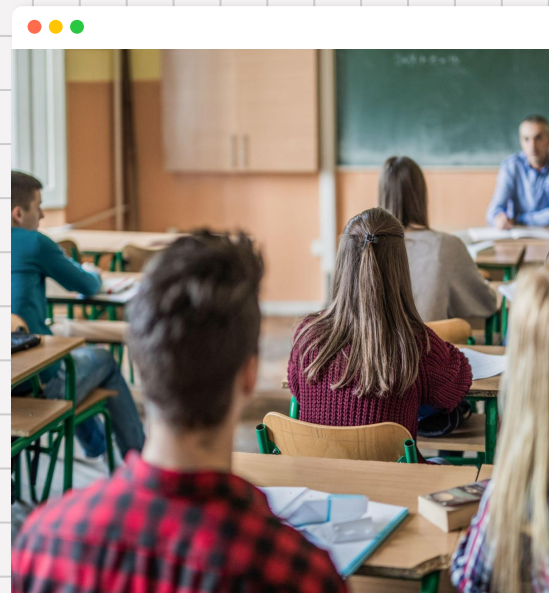
Our experiment seeks to explore how active learning can be applied beyond STEM fields to improve student engagement and learning outcomes in diverse educational settings.

Research Question

Does active learning lead to higher student engagement and perceived preparedness as compared to passive learning?

Null Hypothesis

There is no difference in the effect between active and passive learning: Students who participate in active learning report similar levels of perceived preparedness and classroom engagement as those who participate in passive learning.



Experimental Design

Unit of Randomization: Student-level

Project Timeline:

- Pre-Experiment Survey: Participants completed a survey assessing key covariates
- Learning Experience: Assigned to either passive or active learning
- Post-Experiment Survey: Measured engagement, understanding, and preparedness

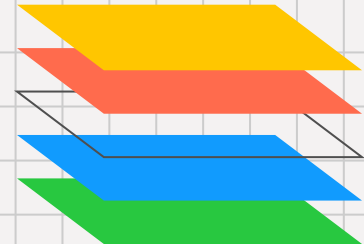
Distribution Channel: Qualtrics survey QR codes were given in class and emailed to participants

Control

Passive Learning
(Notes)

Treatment

Active Learning
(Quiz)



Variables

Covariates

Gender
(Male, Female, Other)

Prior Exposure to Case Study
(Yes/No)

Self-Assessed Knowledge in Causality
(Scale: 0-100)

Self-Assessed Likelihood to Participate in Class
(Scale: 0-100)

Outcome Variables

Post Class Recall

Post Class Participation

Pre Class Understanding of Material

Data Collection



Method of Collection

- Access was restricted to MSBA students and the professor to ensure participant eligibility and prevent external responses
- Collected responses through Qualtrics surveys



Number of Responses

- 92 students participated
- 60% completed the Pre-Class Survey
- Only 40% completed the Post-Class Survey

Randomization Method

Balance Check Using Regression

	Gender	Read Stubhub Case?	Knowledge of Causality	Likelihood to Participate
	(1)	(2)	(3)	(4)
Treatment	-0.052	0.150	0.748	2.507
	(0.179)	(0.119)	(5.078)	(7.772)
Observations	35	35	35	35
R ²	0.003	0.037	0.001	0.003
Adjusted R ²	-0.028	0.008	-0.030	-0.027
Residual Std. Error	0.509	0.381	15.506	23.291
F Statistic	0.086	1.585	0.022	0.104
Note:	*p<0.1; **p<0.05; ***p<0.01			

We used stratified random assignment with gender-based blocking

Z-Test

P-Value = 0.12
Randomization was properly conducted

Power Analysis

The target effect size for our three outcome variables was 10%

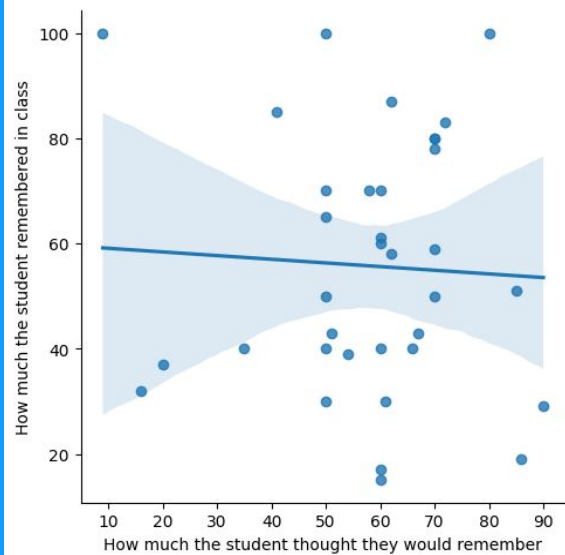
Outcome Variable	Sample Size Used	Sample Size Needed
Post Class Recall	35	128
Post Class Participation	35	183
Pre Class Understanding of Material	55	344



Power analysis revealed that our experiment was **underpowered**, indicating an insufficient sample size to reliably detect the desired effect.

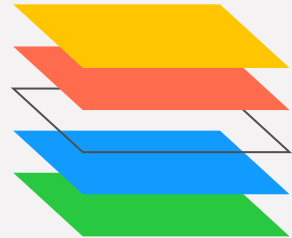
EDA

Response Bias



Comparison of Student Completion Rates for the Initial Survey

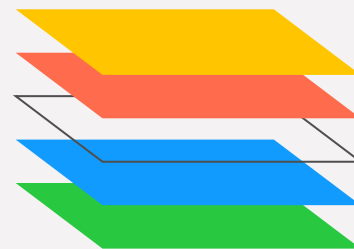
	Percent of Complete Surveys	Percent of Incomplete Surveys
Read the Case	83%	17%
Didn't Read the Case	65%	35%



ATE

Outcome Variable	ATE	P-Value
Post Class Recall	-2.65	0.75
Post Class Participation	4.34	0.71
Understanding of Material	5.03	0.20

The p-values for all outcome variables exceed 0.05, indicating that the ATE is **not statistically significant**.



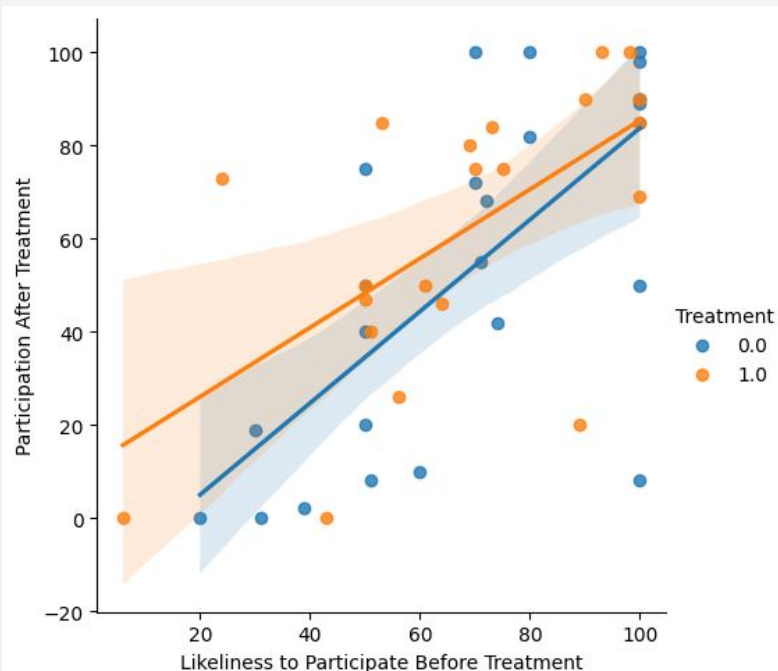
Understanding of Material ~ Treatment + Covariates



**Prior knowledge of the subject
(causality in this case)
significantly enhances
students' understanding**

<i>Dependent variable: Understanding of Material</i>	
	(1)
CVQ2_read_stubhub_case_bool	-5.304 (9.970)
CVQ3_knowledge_causality_val	0.872*** (0.249)
Intercept	17.636 (15.612)
Treatment	5.180 (5.670)
Observations	35
R ²	0.372
Adjusted R ²	0.311
Residual Std. Error	17.255 (df=31)
F Statistic	4.601*** (df=3; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

Class Participation ~ Treatment + Likeliness to Participate



Dependent variable: Post Class Participation	
	(1)
CVQ4_likeliness_participate_val	1.047*** (0.148)
Intercept	-15.124 (11.491)
Treatment	1.715 (8.613)
Observations	35
R ²	0.522
Adjusted R ²	0.492
Residual Std. Error	23.781 (df=32)
F Statistic	24.997*** (df=2; 32)
Note:	*p<0.1; **p<0.05; ***p<0.01

Post Class Recall ~ Treatment * Read StubHub Case

Dependent variable: Post Class Material Recall	
	(1)
CVQ2_read_stubhub_case_bool	-27.529** (12.430)
Intercept	78.000*** (10.898)
Treatment	-35.000*** (10.898)
Treatment:CVQ2_read_stubhub_case_bool	39.529*** (13.957)
Observations	35
R ²	0.156
Adjusted R ²	0.074
Residual Std. Error	23.359 (df=31)
F Statistic	5.150*** (df=3; 31)
Note:	* p<0.1; ** p<0.05; *** p<0.01

**Students who
read the case
beforehand**

performed better
in the treatment
group.

Understanding of Material ~ Treatment * Gender

Dependent variable: Understanding of Material	
	(1)
Gender[T.Male]	-10.632 (10.755)
Intercept	73.556*** (8.970)
Treatment Group	-9.556 (10.595)
Treatment:Gender[T.Male]	26.061** (13.116)
Observations	35
R ²	0.107
Adjusted R ²	0.021
Residual Std. Error	20.575 (df=31)
F Statistic	2.106 (df=3; 31)
Note:	*p<0.1; **p<0.05; ***p<0.01

Heterogeneous Treatment Effect

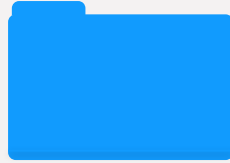
Effect on Female: -9.6

Effect on Male: $-9.6 + 26^{**}$
= 16.4

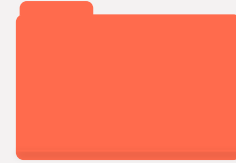
Limitations



Limited Participant Pool



Non-Compliance &
Survey Completion



Low Post-Class Survey
Completion



Time Constraints and Survey
Fatigue



Discrepancy Between
Expected and Actual Recall



Business Insights

- **Educator Insights:** Provide evidence-based recommendations on the most effective teaching approaches.
- **Workplace Training:** Implement interactive learning tools to enhance employee engagement and knowledge retention.
- **Corporate Onboarding:** Use active learning methods, such as quizzes and simulations, to improve new hire training effectiveness.
- **Marketing Strategies:** Leverage interactive content (e.g., quizzes, gamification) to increase customer engagement and brand retention.

Conclusion

Overall Effect

No significant overall effect, but outcomes varied by gender and prior case reading.

Gender Role

Male students benefited more, while those who skipped reading struggled with recall but participated more.

Future Steps

Tailoring interactive methods to **student characteristics** can improve effectiveness.

