

STATS 112 FINAL

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RESEARCH QUESTION:

Our research question is: **Can we predict a student's Sense of Belonging at UCLA from their Major, Stress level, and Ethnicity?**

Additionally, what is the effect of an interaction between ethnicity and stress on the prediction model?



ABSTRACT:

The purpose of this project is to predict a student's Sense of Belonging at UCLA from their Major, Ethnicity, and Perception of Stress. Additionally, an interaction will be used to examine the combined effect of Ethnicity and Stress on Sense of Belonging at UCLA.

Outcome: Belonging: Indicator for “sense of belonging” (continuous variable from 0 to 1, 0= Low level of sense of belonging, 1=High level of sense of belonging) [*Item Reliability: Cronbach's $\alpha=0.67$*]

Predictors: (1) Major- Major of the Participant (2) Stress- Indicator for “Stress” (continuous variable from 0 to 1, 0= Low level of stress, 1=High level of stress) [*Item Reliability: Cronbach's $\alpha=0.61$*] (3) Ethnicity- Ethnic background (Factor: African American, Asian, Caucasian, Latino/Hispanic, Mixed, Other)

Methods: The sample size is 866 students at the University of California, Los Angeles. The project uses statistical analysis methods like multiple linear regression, correlation, interaction effect, to illustrate the relationship between the student's sense of belonging, major, ethnicity and stress level. Programming technique through R studio is used to show the relationship between the variables and predict the student's Sense of Belonging from Stress, Major and Ethnicity.



VARIABLES AND DATA COLLECTION:

	Variable Name	Method of Measurement	Transformation (If applicable)
Outcome Variable	Sense of Belonging	continuous variable with scale 0 (low) to 100 (High)	
Predictor 1	Major	5 levels Life Science; Physical Science Social Science; Mixed	Students' frame of their majors are varied, so we recategorize answers to 5 levels
Predictor 2	Stress Level	continuous variable with scale 0 (low) to 100 (High)	
Predictor 3	Ethnicity	Original Data: 5 levels Asian; Caucasian; Latino/ Hispanic; Mixed Race; Other After Recoded: 3 levels. Asian; Caucasian; Other	We combine Latino/Hispanic & Mixed Race to "other" group since each of these three has smaller observations compared to Asian and Caucasian.

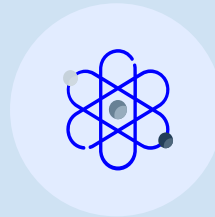
SUMMARY TABLE FOR OUR LINEAR MODEL:

	Coefficient	Standard Error	t	p
Intercept	85.75837	1.33882	64.055	<2e-16 ***
MajorrMixed	-1.77803	1.56950	-1.133	0.257608
MajorrPhysical science	-2.66150	0.79642	03.342	0.000871 ***
MajorrSocial science	0.10874	1.42968	0.076	0.939390
Stress	-0.49833	0.02326	-21.421	<2e-16 ***
EthnicrCaucasian	2.58700	2.84257	0.910	0.363045
EthnicrOther	-0.15041	2.79826	-0.054	0.957147
Stress: EthnicrCaucasian	0.05280	0.05199	1.016	0.310064
Stress: EthnicrOther	-0.04854	0.05006	-0.970	0.332559

- Multiple R-Squared = 0.4857
- Adjusted R-Squared = 0.4807

INTERPRETATION OF OUR LINEAR MODEL:

- Due to Physical Science Majors and Stress Levels variables' significance levels, we are able to use them to predict our outcome variable.
- We can see that for Physical Science Majors the p-value is close to zero (0.000871), which is statistically significant. For those students who are in the Physical Science Major, we see, ON AVERAGE, a 2.66150 decrease in Sense of Belonging.
- We can see that for Stress levels the p-value is close to zero ($< 2e-16$), which is statistically significant. For every 1 unit of increase for sense of Stress levels, we see, ON AVERAGE, a 0.49833 decrease in Sense of Belonging.
- The other Variables are NOT statistically significant, and therefore, we are unable to draw any conclusions from them.



Physical Science



Stress

Interaction Effect Questions

Is the students' sense of belonging at UCLA related to their ethnicity, perception of stress, and the combined effect of ethnicity and perception of stress?

- 1) Is a students' ethnicity related to their sense of belonging at UCLA?
- 2) Is perception of stress related to students' sense of belonging at UCLA?
- 3) Is the effect of perception of stress on sense of belonging similar for students of different ethnicities?



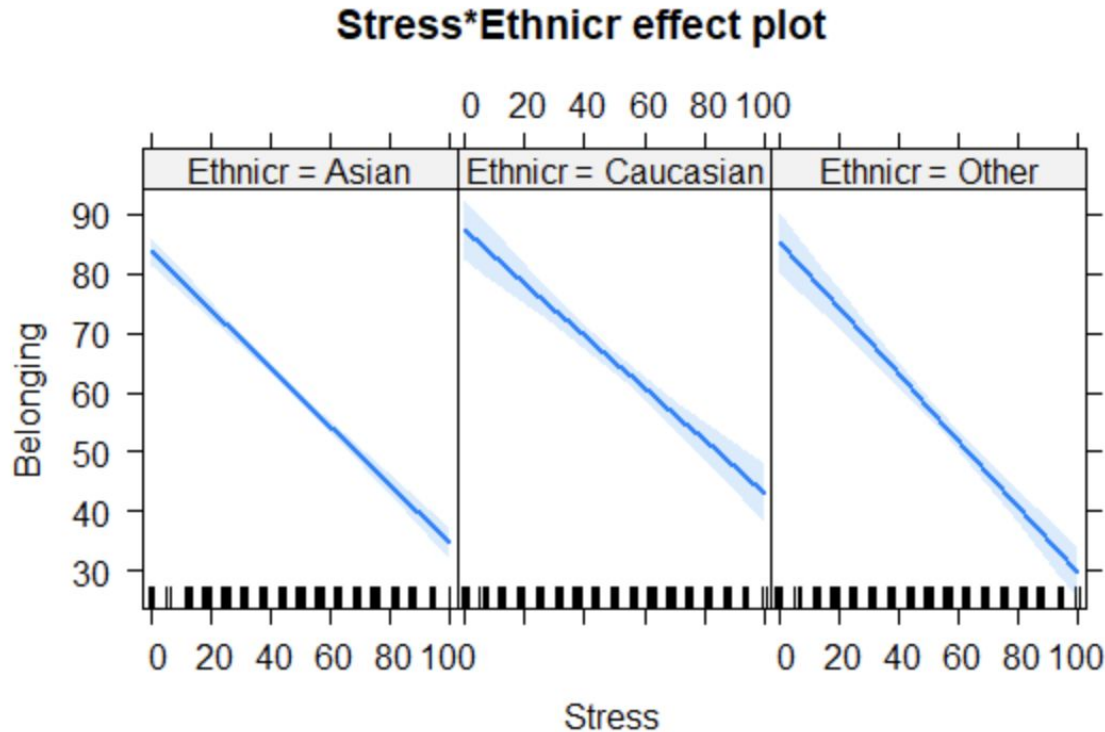
INTERACTION EFFECT TABLE

	coefficient	standard error	t	p
Intercept	83.65224	1.19229	70.161	<2e-16***
Stress	-0.48894	0.02325	-21.031	<2e-16***
EthnicityCaucasian	3.60619	2.84766	1.266	0.206
EthnicityOther	1.47355	2.78665	0.529	0.597
Stress: Caucasian	0.04729	0.05227	0.905	0.366
Stress: Other	-0.06380	0.05023	-1.270	0.204

- Multiple R-Squared = 0.4740
- Adjusted R-Squared = 0.4707



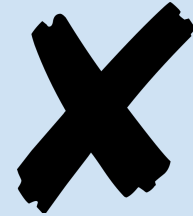
INTERACTION EFFECT PLOT:



- As indicated by the plot, as Stress increases, Sense of Belonging decreases and this pattern is true for all three levels of ethnicity (Asian, Caucasian, Other).
- The interaction effect is not statistically significant, indicating that the effect of Stress on Belonging is similar for different levels of Ethnicity.

Interpretation of Our Interaction Effect:

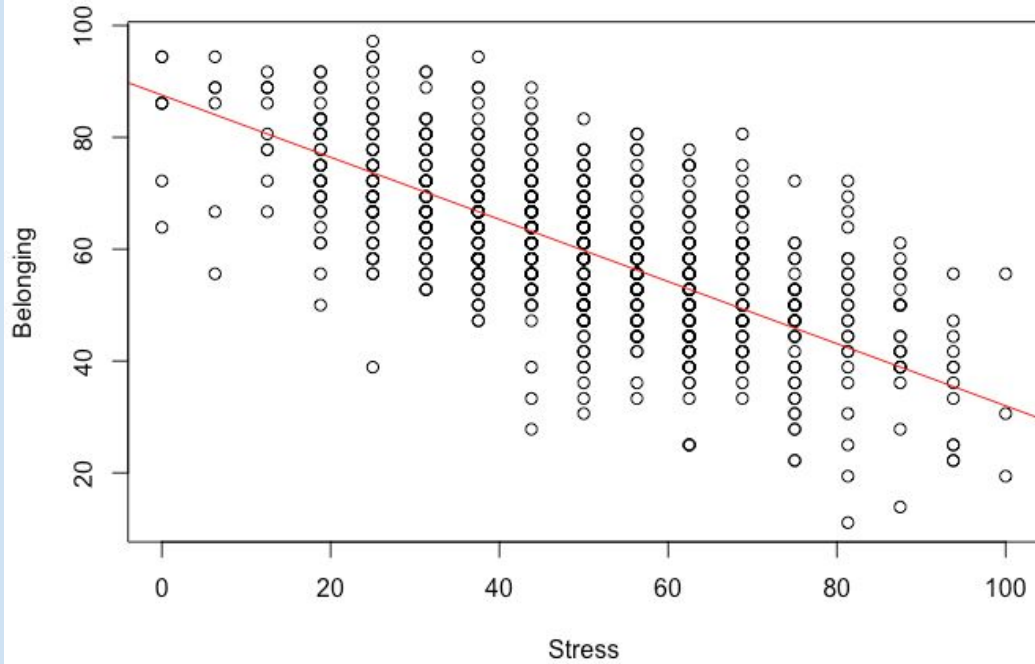
- For Ethnicity, our baseline is "Asian" Ethnicity. On average, the respondents who are of Caucasian Ethnicity score 3.60619 points higher on their sense of Belonging here at UCLA. This difference is not statistically significant ($p = 0.206$). Thus, we can say that being of Caucasian ethnicity is not related to their sense of Belonging here at UCLA.
- On average, the respondents who are of Other Ethnicity score 1.47355 points higher on their sense of Belonging here at UCLA. This difference is not statistically significant ($p = 0.597$). Thus, we can say that those categorized as Other Ethnicity is not related to their sense of Belonging here at UCLA.
- For the Interaction Effect, we can say they are NOT related to their Belonging because Asian, Caucasian, Other are NOT statistically significant. We are unable to draw any conclusions due to the high p-value and NOT being statistically significant.



Two Way Table of Categorical Predictors' Frequency

	Asian	Caucasian	Others	Row Sum
Life Science	162	77	90	329
Mixed	40	7	3	50
Physical Science	311	39	45	395
Social Science	40	11	10	61
Column Sum	553	134	148	835

Scatterplot of Students' Stress and Sense of Belonging to UCLA



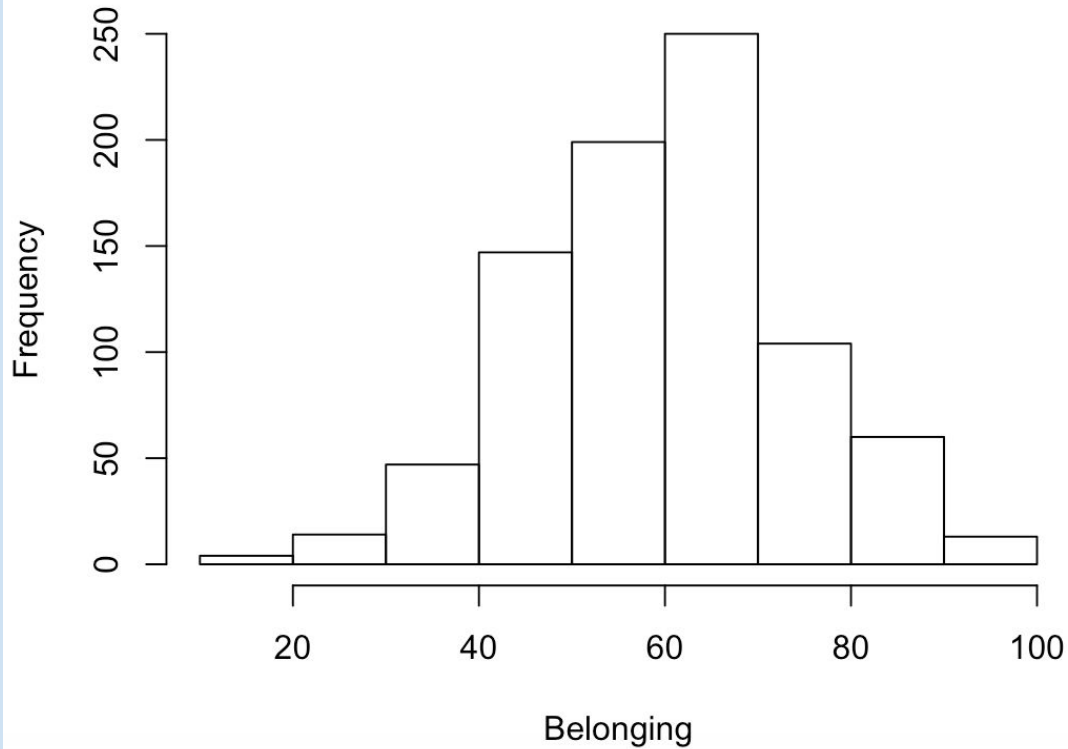
The standard deviation of Belonging and Stress are 13.952 and 18.837 respectively.

Correlation Matrix for Numerical Variables

	Stress	Belonging
Stress	1.0000000	-0.6613278
Belonging	-0.6613278	1.0000000

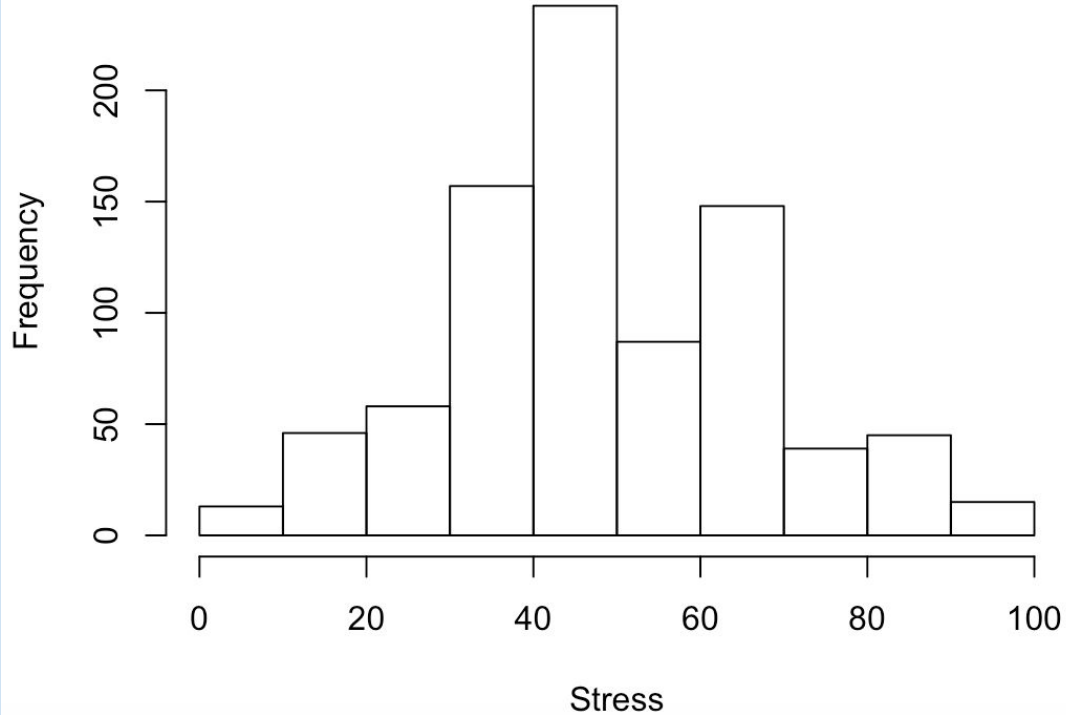
Therefore, we want to have predictors that are correlated to the outcome but not to each other.

Histogram of Belonging



The graph has a bell-curved shape, which indicates the frequency of Sense of Belonging is normally distributed.

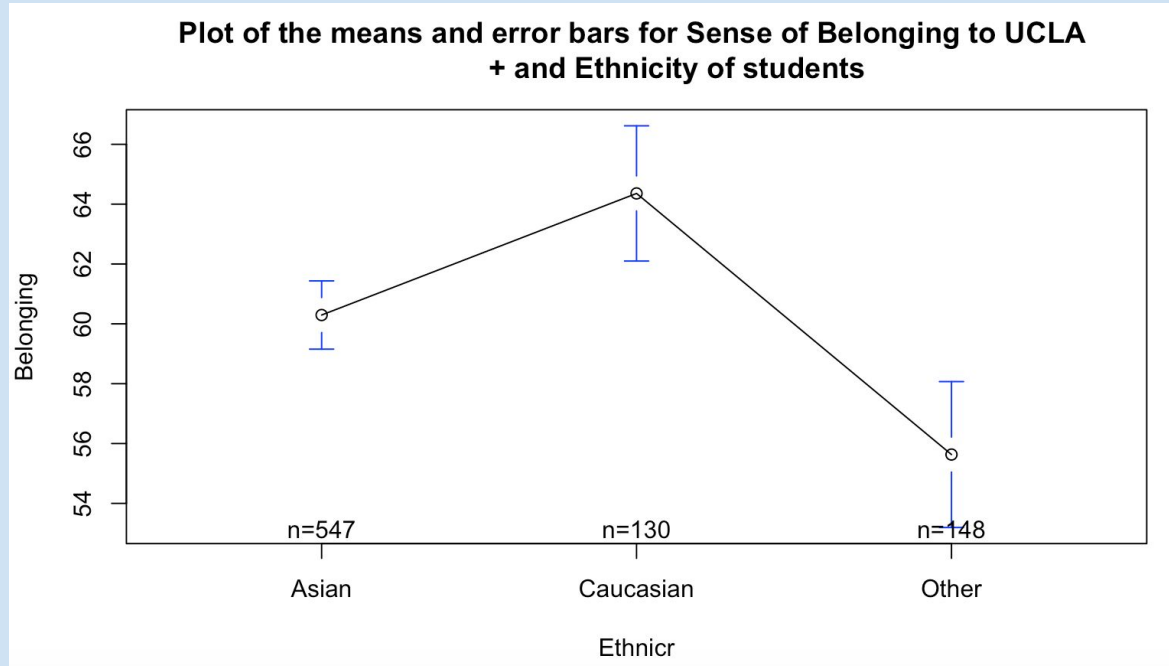
Histogram of Stress



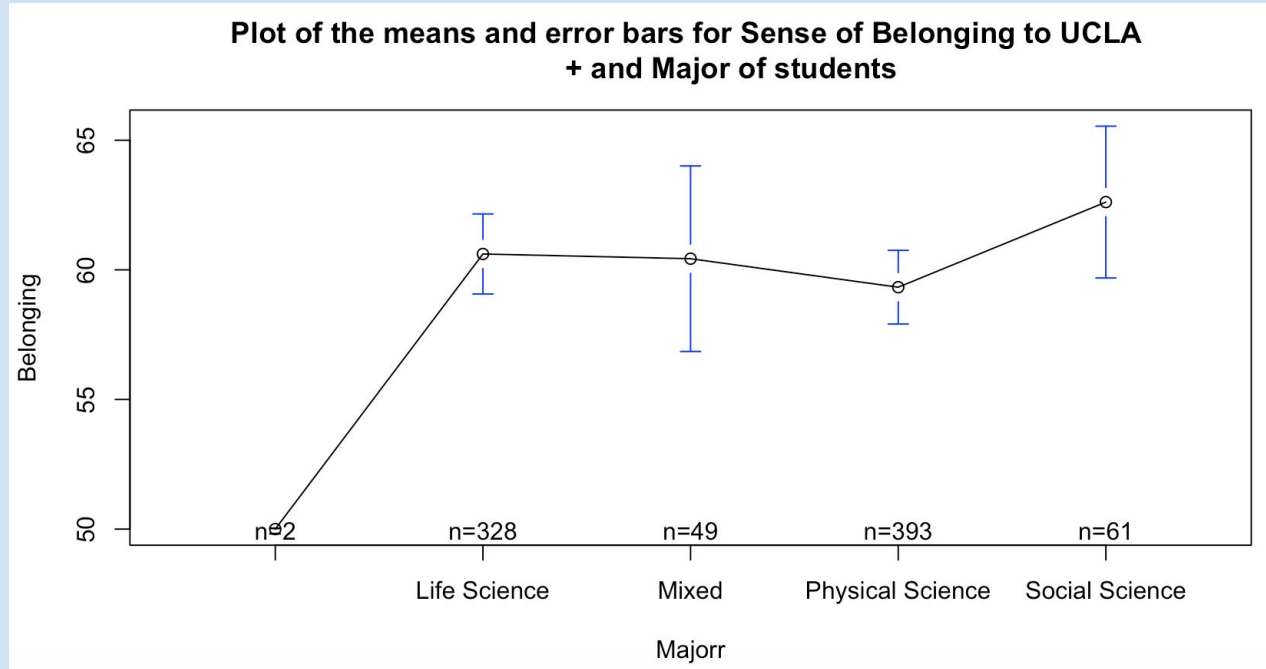
The Histogram of Stress alone follows a relatively Normal Distribution.

This graph also follows a bell-curve shape.

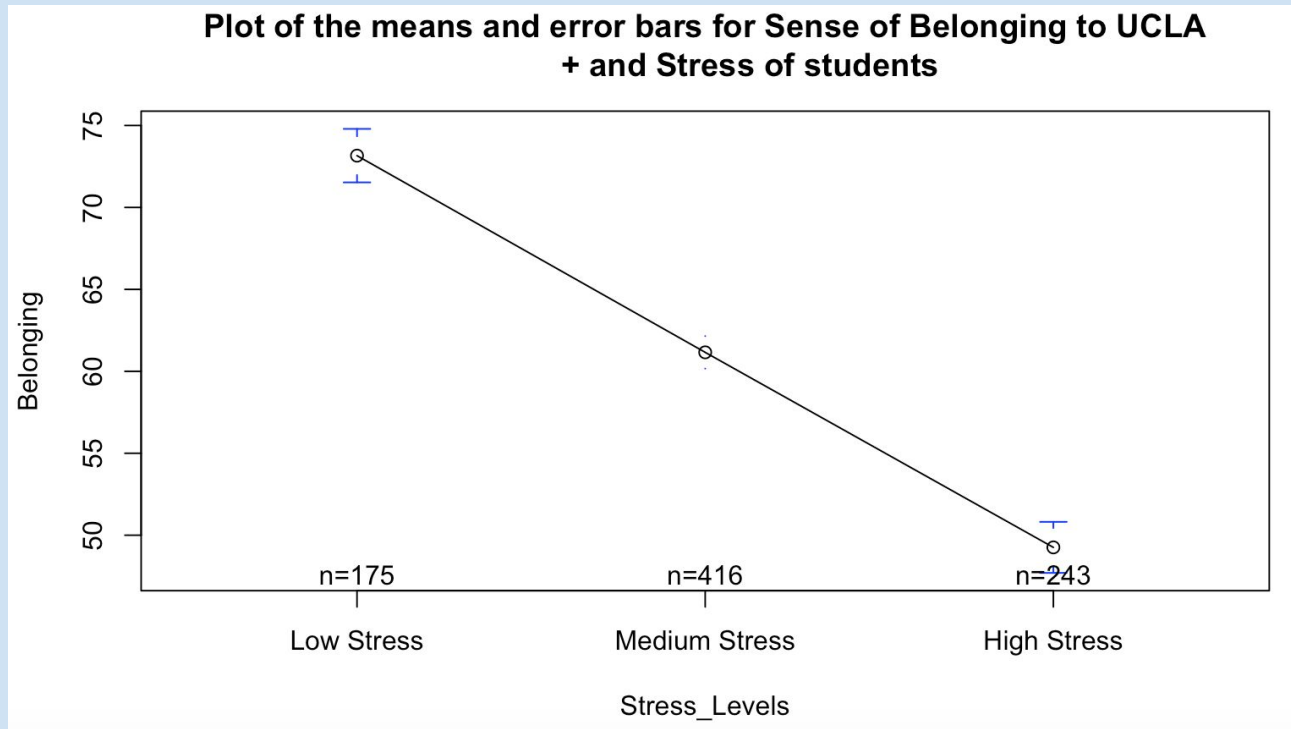
Table of means



The center of each interval is the mean score of sense of belonging with respect to students to with different ethnicities. The ethnicity variable was re-coded into three main categories, Asian, Caucasian and other. Ethnic minorities in the sample are combined into Other (e.g. African American and Latino/Hispanic) to make comparisons. This plot shows that caucasians have the highest sense of belonging, Asian seconds in sense of belonging, while Other has the least sense of belonging to UCLA. The average mean difference between the Caucasian and Other is around 10. This plot illustrates that ethnic majorities have higher sense of belonging in comparison to ethnic minorities.

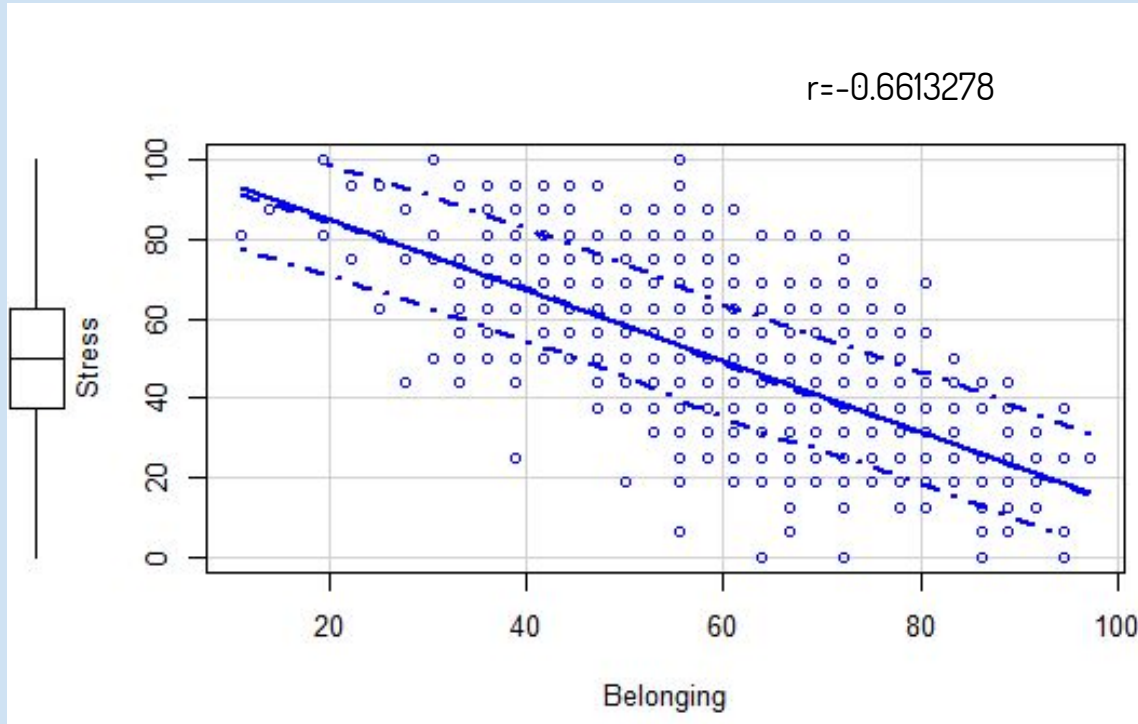


The center of each interval is the mean score of sense of belonging to UCLA with respect to students with different majors. The major variable was recoded into four main categories (i.e. Life Science, Mixed, Physical Science and Social Science). Two of the observation was not sent to any categories. However, with a large sample size for each category, it does not affect our interpretation. Students with social science major has the highest sense of belonging to UCLA, while students with Physical Science has the least sense of belonging to UCLA. Students with Life Science or Mixed have similar mean score of sense of belonging to UCLA.



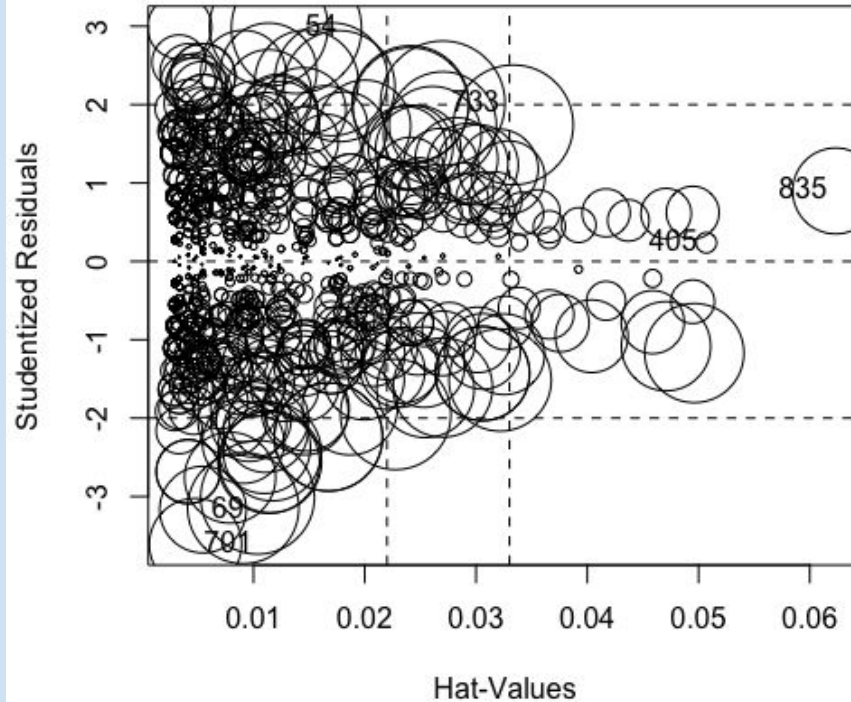
The center of each interval is the mean score of stress level. This plot shows that the higher the stress level of students, the lower their sense of belonging to UCLA. The stress level was recoded, from a numerical variable to a categorical variable with three levels (i.e low, medium, and high), to make comparisons. From the previous slide, we have illustrated that stress is statistically significant. We can see that Stress plays an important role in a students' Sense of Belonging. This graph helps us to reach our conclusion that Stress is a significant variable in determining Sense of Belonging.

Relevant Assumptions



There is a strong negative correlation between Stress and Sense of Belonging. This suggests that the less stress each student feels, the more they feel like they belong to the campus.

Influential Plot Analysis Part 1



Influential Plot Analysis Part 2

Observation (n=866)	StudRes	Hat Value	Cook's Distance	High Leverage (> 4/866)	High Standardized Residuals Assuming Small Data Set (> + or - 2)	High Standardized Residuals Assuming Large Data Set (> + or - 4)
54	2.9718645	0.013861338	0.0136615023	Yes	Yes	No
69	-3.1671126	0.005460594	0.0060517555	Yes	Yes	No
405	0.2375267	0.050697392	0.0003351737	Yes	No	No
701	-3.6108650	0.004783156	0.0068605966	Yes	Yes	No
733	2.0179724	0.027013104	0.0125143796	Yes	Yes	No
835	0.8984351	0.062323826	0.0059625994	Yes	No	No

Influential Plot Analysis Part 3

Before Removing Observations: 54, 69, 701, 733

Multiple R-squared: 0.4857

Adjusted R-squared: 0.4807

After Removing Observations: 54, 69, 701, 733

Multiple R-squared: 0.4992

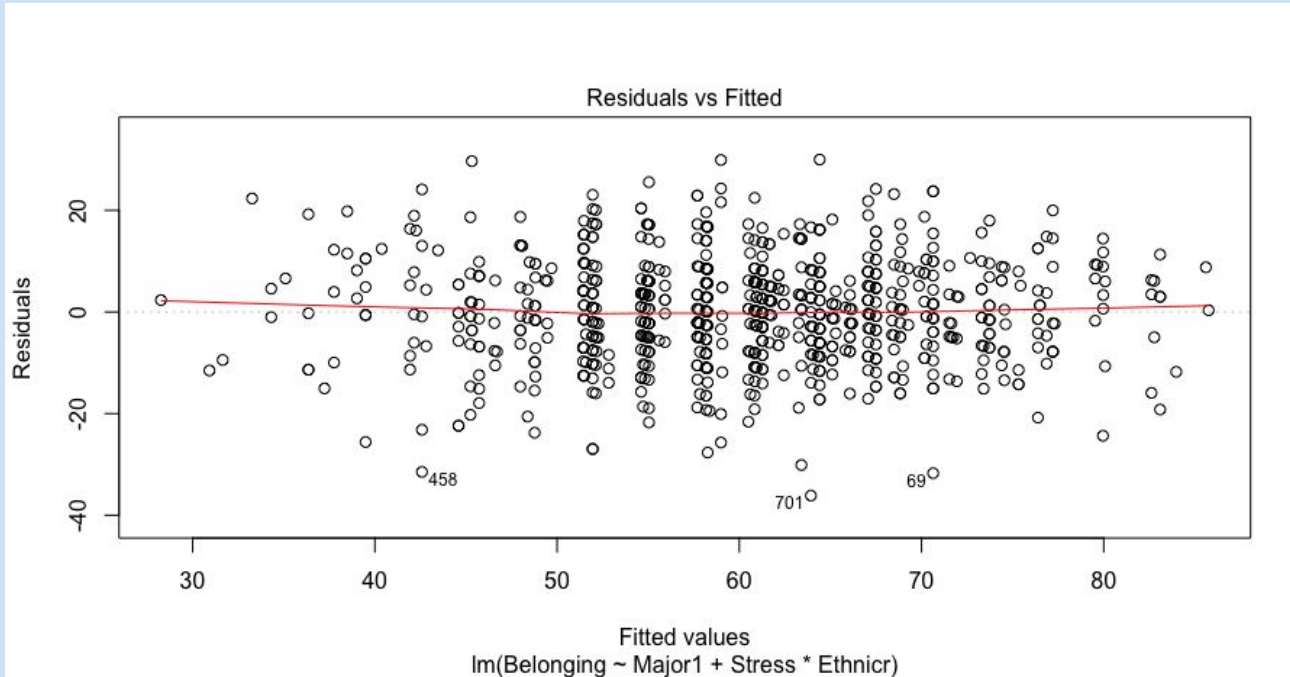
Adjusted R-squared: 0.4942

VIF Check

Old VIF	GVIF	Df	$GVIF^{1/(2 \cdot Df)}$
Major1	1.104879	3	1.016762
Stress	1.555892	1	1.247354
Ethnicr	73.968883	2	2.932664
Stress:Ethnicr	81.281059	2	3.002599

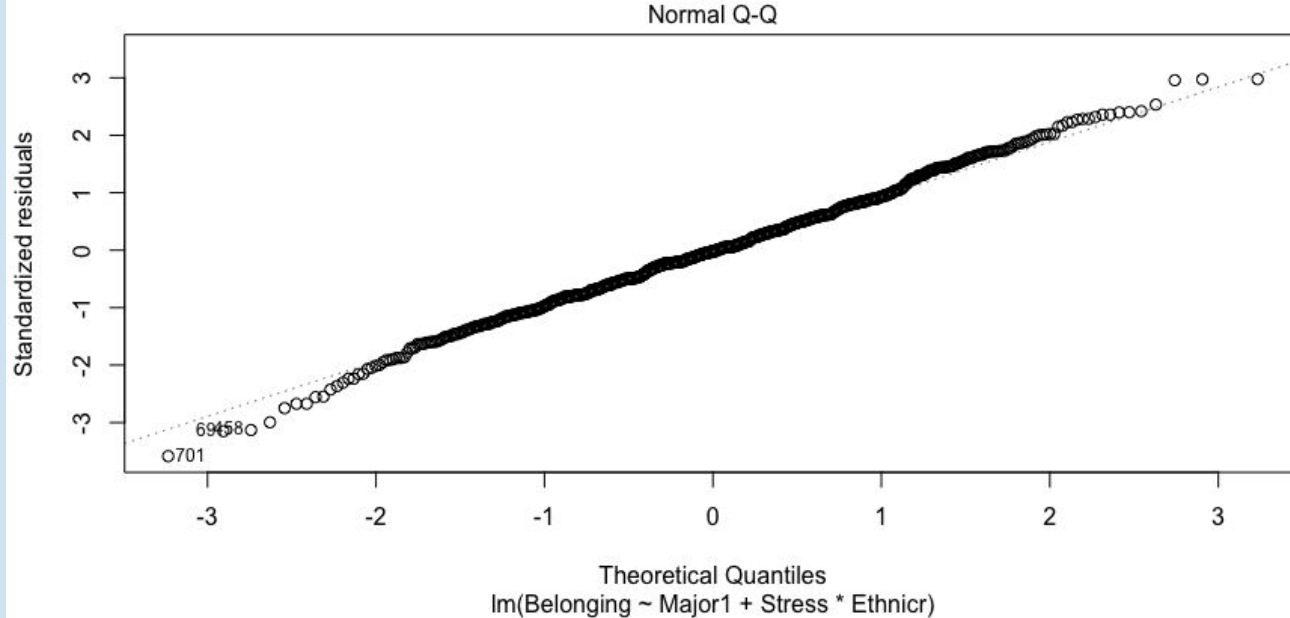
New VIF	GVIF	Df	$GVIF^{1/(2 \cdot Df)}$
Major1	1.098380	3	1.015762
Stress	1.019345	1	1.009626
Ethnicr	1.106090	2	1.025528

Residuals vs Fitted Graph



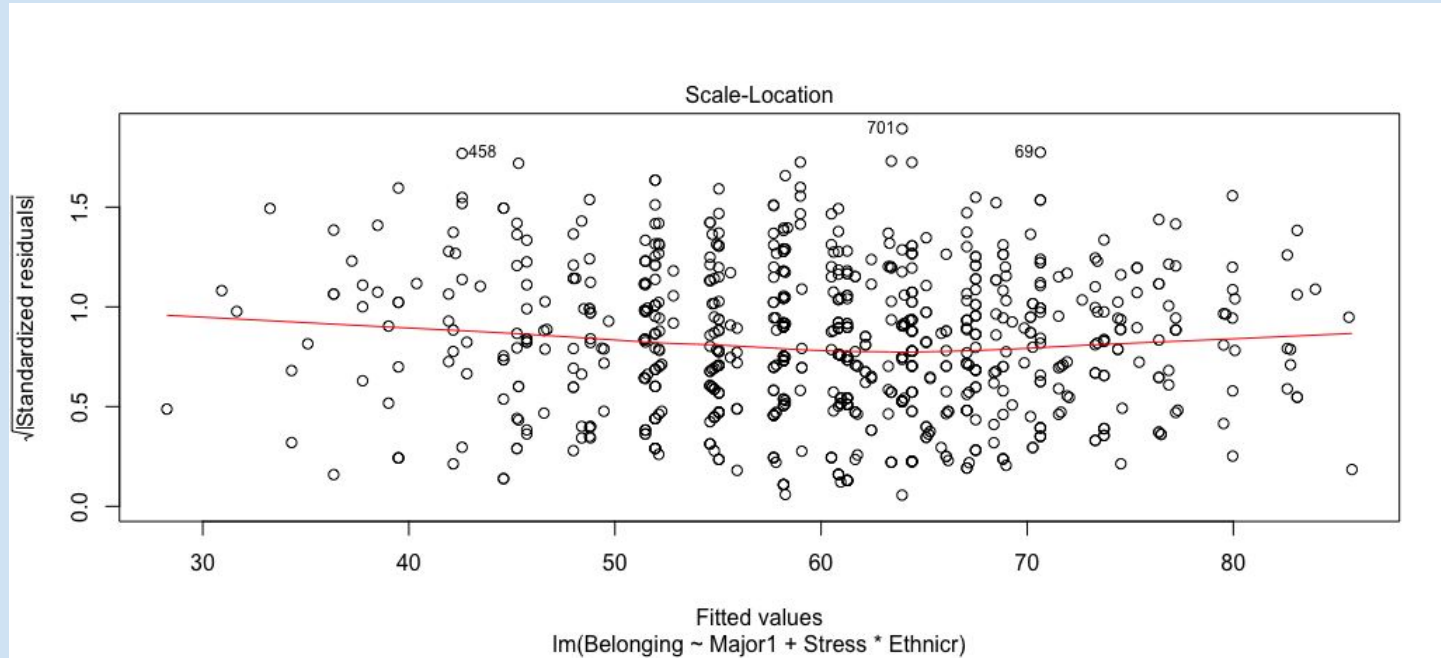
The residuals seem to be equally spread around the horizontal line. Suggests that there is a lack of non-linear relationship between the predictor variables and the outcome variables.

QQ Plot Analysis



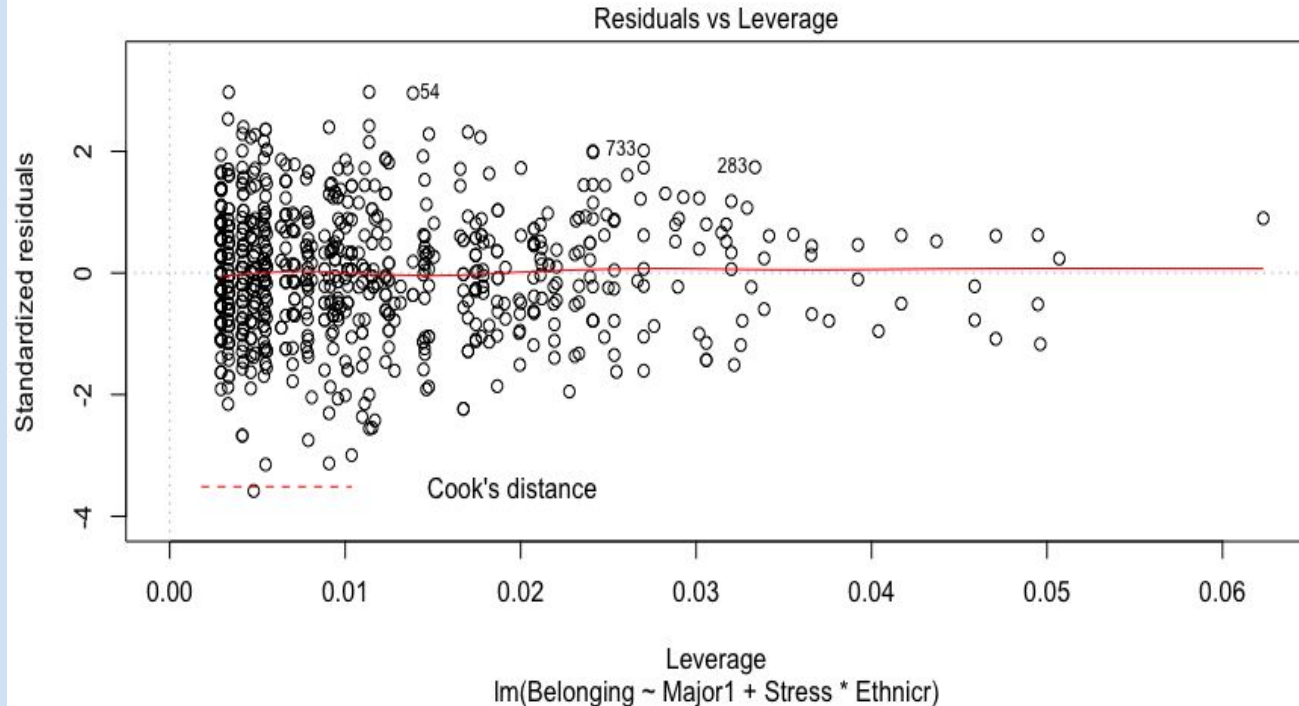
The qq line seems to be straight, so it suggests that the residuals are normally distributed.

Scale-Location Analysis



The residuals seem to be spread equally and randomly around the red line. This suggests that there is equal variance, or homoscedasticity.

Residuals vs Leverage



All of the residuals are within Cook's Distance, which means that there aren't any points that could influence the regression line.

CONCLUSION:

- We can predict a students' sense of belonging from Physical science major and stress level. They are the only two statistically significant predictors in our test.
- Around 49% of the variance in Students' Sense of Belonging at UCLA is explained by Stress and Physical Science Majors
- For every one unit increase in levels of Stress, on average, there is a 0.49833 unit decrease in students' sense of belonging
- For those who are physical science majors, on average, they experience 2.6615 unit decrease in sense of belonging
- There is no statistically significant collinearity between predictor variables
- Additionally, The interaction between Stress and Ethnicity are not statistically significant



Recommendations for Stress:

MEDITATION

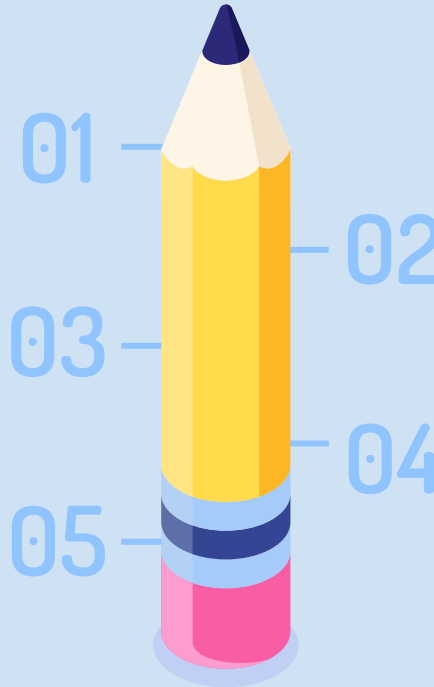
5 minutes a day spent practicing meditation is proven to improve focus, self-compassion, mood, immune function and quality of sleep

FRIENDS

Take a break from studying.
Go out with friends or classmates

ART

Release built-up stress through creativity and self-expression



COUNSELING

CAPS provides workshops on self-management and stress management skills

MASSAGE

Relax and Unwind

Recommendations for Physical Science Majors:



1- GROUP PROJECTS

Promotes interaction,
exchanging of ideas and
concepts

2- CAMPUS ORGANIZATIONS

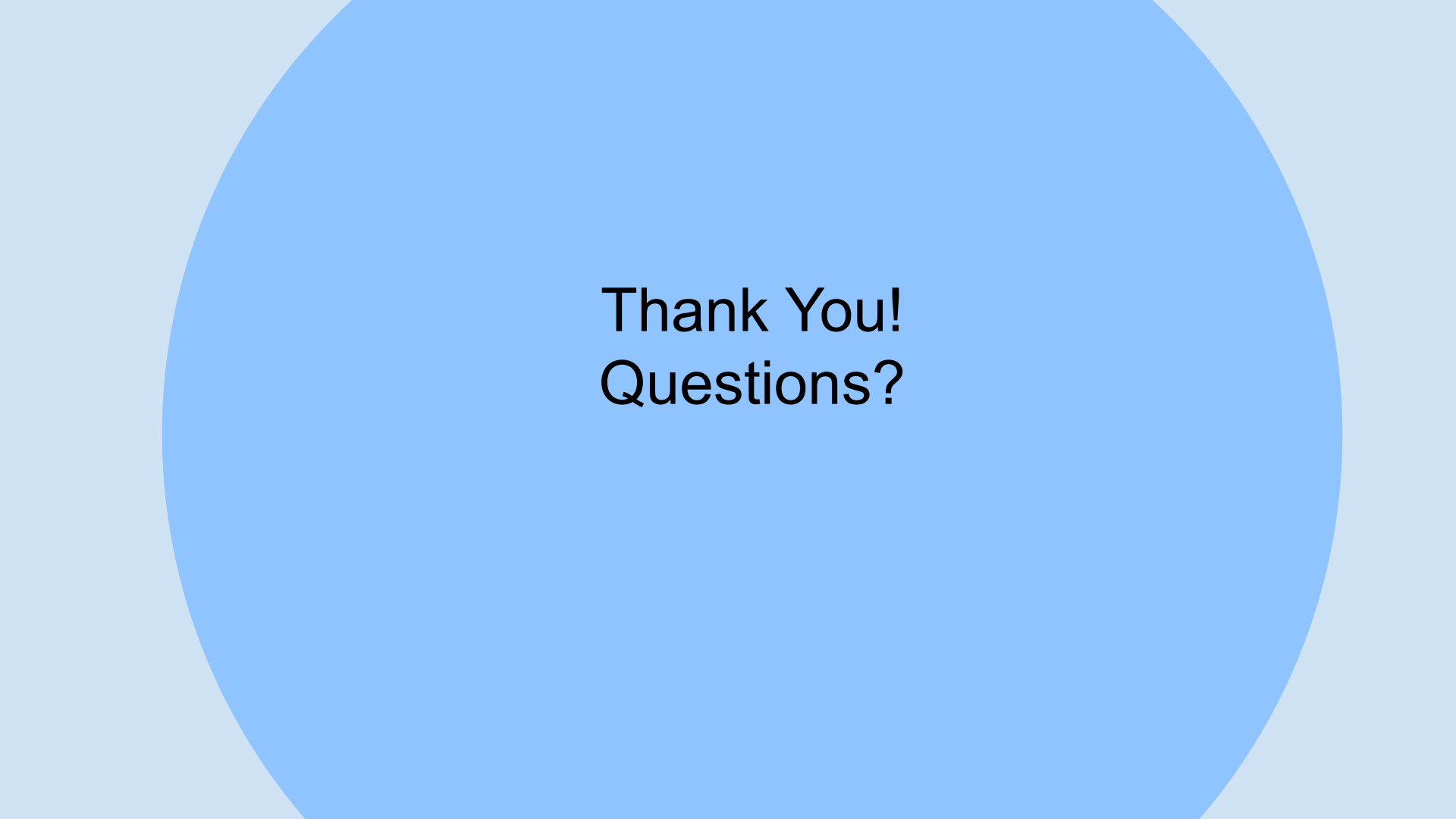
Join campus clubs and
organizations to meet peers
and build interpersonal skills

3- RESEARCH

Social responsibility research
projects promote campus
engagement and integration

4- DISCUSSION SECTIONS

Require discussion
sections for all physical
science courses at UCLA



Thank You!
Questions?