The Effects of Adverse/Benevolent Childhood Experiences on Trauma-Informed-Care at UNC School of Medicine

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Abstract

This report aims to determine how the Adverse Childhood Experiences (**ACE**) and Benevolent Childhood Experiences (**BCE**) of students and preceptors at UNC affect their ability for Trauma-Informed-Care (**TIC**). In addition to this we see if there are any differences between the student and preceptor groups at UNC and attempt to fit a multiple regression model to predict TIC with the additional explanatory variable of demographic. Our analysis gave the following results:

- According to the Welch t-test and Wilcoxon rank-sum test, there are significant differences between the student and preceptor groups in terms of BCE. However, the t-test also shows significant difference in terms of Knowledge where the Wilcoxon does not.
- Pearson tests for correlation show a significant correlation between ACE and BCE but not between ACE/BCE and any TIC.
- Multiple Linear Regression models showed that :
  - Whether a person is a student or preceptor is significant in predicting both Knowledge and Attitude, but not Practice.
  - Whether someone has experienced sexual violence is significant in predicting Knowledge.
  - Whether someone identifies as LGBTQ is significant in predicting Attitude.

This study supports that there are differences in the student and preceptor populations in terms of BCE and Knowledge, and that there is correlation between ACE and BCE. It also supports that although ACE/BCE are not significant in predicting TIC, certain demographics are significant at predicting Knowledge and Attitude.

Introduction

Particular methods of learning in the medical field do not take into account the sentiment of the students (and preceptors). Traumatic events that occurred in childhood and early adolescence can affect a person throughout the rest of their life. Many sensitive situations may bring up this past trauma and make the moment hard or even unbearable. This is especially true in the medical school environment, where many times physical contact with a student's body is enacted to teach about human body structure. If students feel uncomfortable in their learning environment, then it is probable to think that their abilities in the field are also affected negatively. A connection between childhood experiences and the ability of medical students in their practice may suggest there are more beneficial methods that could be implemented into the medical school learning pipeline.

Data

The data consists of 133 Qualtrics surveys, 89 being from students, 44 from preceptors. Raw data included personal information (age, race, etc.) as well as ACE scores, Expanded ACE scores, BCE scores, and scores for the three measures of TIC (Knowledge, Attitude, and Practice). ACE scores and Expanded ACE scores were put together into a Total ACE score. All of the TIC has multiple measures for each category, these measures were averaged so that each person had one number for Knowledge, one for Attitude, and one for Practice.

Data Omission

For the non-modeling parts of the analysis, only one row of data was removed due to the data being faulty. This row had a BCE score of 0, but this was due to the person deciding not to answer any of the BCE questions, therefore we do not know what their BCE score would be had they decided to answer.

For the modeling part of the analysis, rows that had mixed race were removed from the data. This is because the number of samples that were mixed race were too low to be able to have meaningfulness in the analysis of the population. The columns Sexual Violence and Domestic Violence were turned into binary variables, which signified whether or not the person has ever experienced that violence or not. This was done due to the different levels of violence having too small of sample sizes when individual. Lastly the Veteran demographic variable was not included in the modeling analysis, due to the sample size of veterans being too small.

I Comparing Students and Preceptor Data

Visualization

Our first step was to visualize both Student and Preceptor data in histograms to see if there were any differences between the two. Figure 1 and 2 below show the ACE and BCE histograms of students and preceptors. We see similar distribution shapes in both types of person, but the range and and densities of them differ.

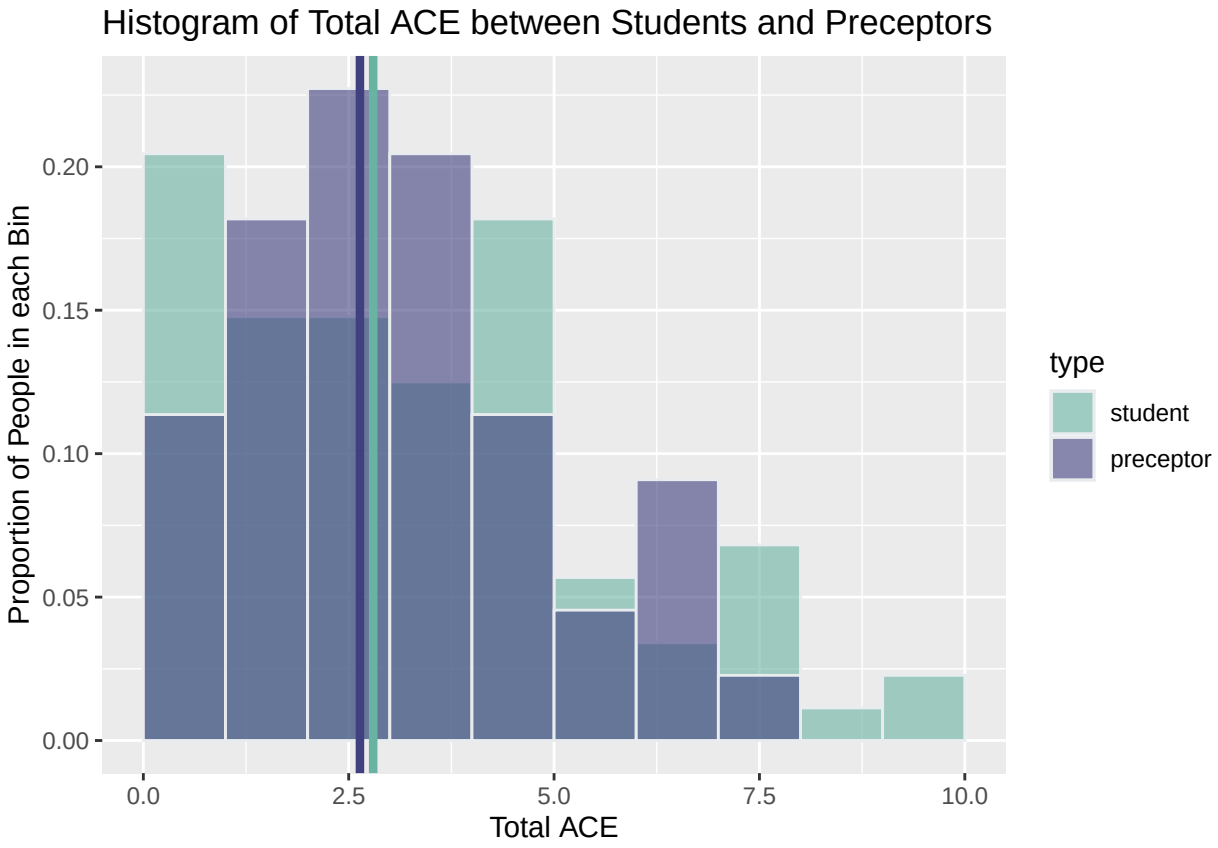


Figure 1. Histogram depicting Total ACE scores, split into two groups: student, preceptor. Vertical lines have been added to denote the means of each group, respective by color. Preceptors have higher density towards their mean, where students are more spread out and have a higher range of values.

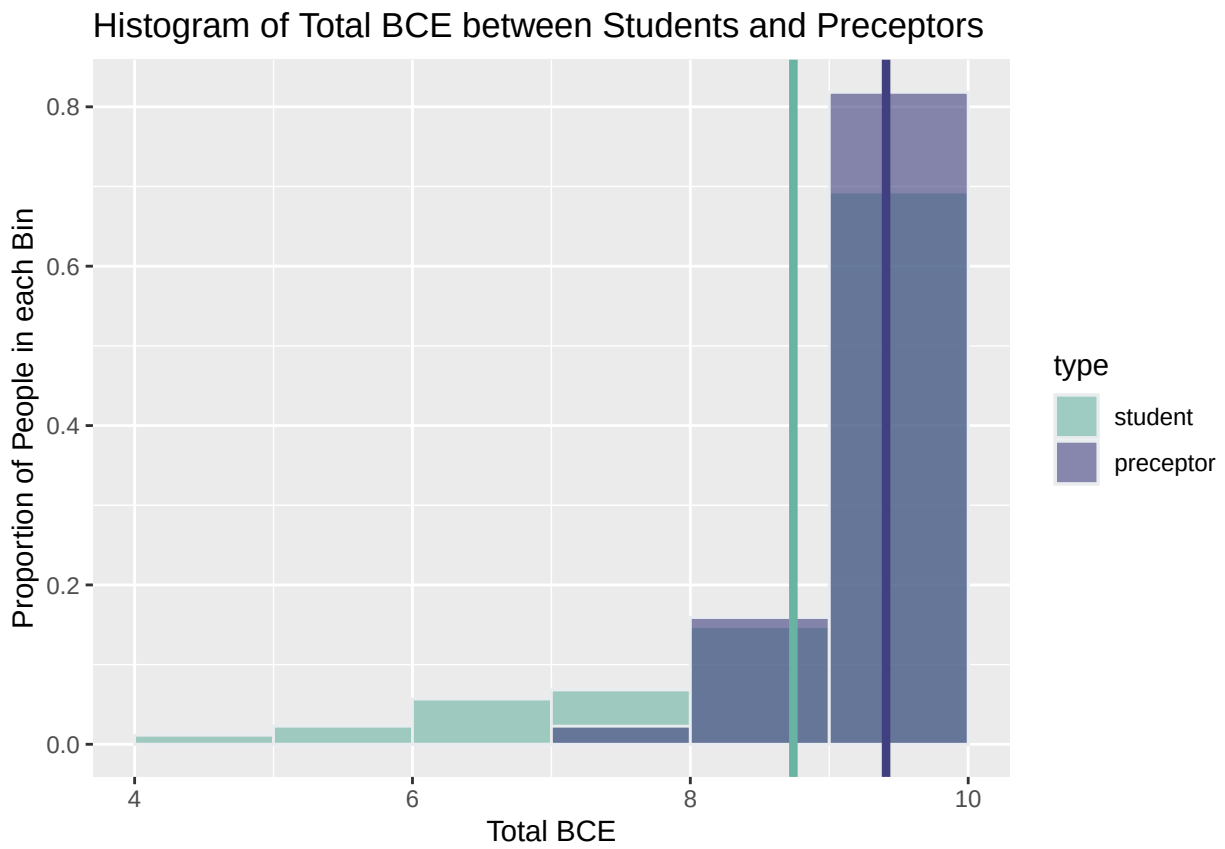


Figure 2. Histogram depicting Total BCE scores, split into two groups: student, preceptor. Vertical lines have been added to denote the means of each group, respective by color. Preceptors have higher density towards the higher scores, where students are more spread towards the lower values.

It is clear to see from the graphs that BCE values seem very different between the two groups. The minimum BCE for preceptors is 7, where the minimum for students is 4. Also, the density of BCE for preceptors is higher in the larger values compared to students. We also see differences in the ACE graph. In terms of ACE, We see that students have a denser right tail in ACE compared to preceptors and that their max value is 10, where the preceptors' is 8. The lower BCE scores and higher ACE scores could suggest an inverse relation between ACE and BCE. The different ranges and densities of the two groups also suggests that ACE and BCE scores may differ between the two. This will be tested in the next section.
It is also important to note that the BCE graph is very far from normally distributed. Due to this and the relatively low sample size of the groups, we will use both the non-parametric Wilcoxon rank-sum test, as well as the parametric t-test to test for differences between the groups.

Methodology

Wilcoxon rank-sum test

Tests for normality were done on the two sample groups (student and preceptor) for each variable (Appendix pg. 15). These showed that almost all sample distributions differed significantly from the normal distribution. Boxplots of the samples were also made for each group and variable. From these plots we see that the shapes of the distributions between groups are similar for all variables (Appendix pg.16).
Due to the non-normal distributions of the data we will use the Wilcoxon rank-sum test to see if the student group is different from the preceptor group. When the shapes of data are similar, the Wilcoxon test will test for a difference in mean. Table 1 below shows the p-values for the tests and shows that there is a significant difference between students and preceptors in their BCE score.

Wilcoxon rank-sum test p-values

Variable	p-value	Student mean	Preceptor mean
ACE	0.9222	2.829545	2.636364
BCE	0.03288 *	8.840909	9.409091
Knowledge	0.06168	4.543561	4.681818
Attitude	0.1652	4.087662	4.220779
Practice	0.3786	4.122159	4.207386

Table 1. p-values of the Wilcoxon test when comparing the means of students and preceptors. Each row is a test for the respective variable. BCE has a significant p-value and Knowledge is close to being significant.

From the table we see that BCE is the only variable with a p-value below the 0.05 significance level, showing that there is a significant difference in sample mean between student BCE and preceptor BCE. We also see that the preceptor mean is higher with a value of 9.4 compared to the student mean of 8.8. This suggests that preceptors generally may have a higher BCE score than students. Knowledge has a p-value of 0.06, which is very close to the significance level, but every other variable is much higher. These tests suggest that the BCE scores between students and preceptors are different, but the other scores are the same. However, Knowledge is very close to being significant and it is possible that a different sample group would have had a significant result for Knowledge.

t-test for means

Although the samples are significantly different from the normal distribution, the smallest group is of size n=44. Due to n being greater than 30, it is common to bypass the normality assumption of a t-test. Therefore t-tests were also conducted on the two groups to see if there is a significant difference in their means for each variable. Table 2 below shows the p-values for the tests and shows that there is a significant difference between students and preceptors in their BCE score and their Knowledge score.

t-test p-values

Variable	p-value	Student mean	Preceptor mean
ACE	0.611	2.829545	2.636364
BCE	0.004793 ***	8.840909	9.409091
Knowledge	0.04889 *	4.543561	4.681818
Attitude	0.1346	4.087662	4.220779
Practice	0.2449	4.122159	4.207386

Table 2. p-values of the Welch t-test when comparing the means of students and preceptors. Each row is a test for the respective variable. BCE has a very significant p-value and Knowledge has a significant p-value.

From the table we see that BCE has a very significant p-value that is much lower than .05. We also see that Knowledge also has a significant p-value. The preceptor mean for Knowledge (4.68) is higher than the student one (4.54). This suggests that preceptors may generally have a higher Knowledge score than students.

II Correlations Between Variables

Visualization

We wanted to find the relations between ACE and BCE with the TICs. To do this, scatterplots were created between ACE/BCE and the TIC variables to see if any visual trends could be seen. Figure 3 below shows these plots.

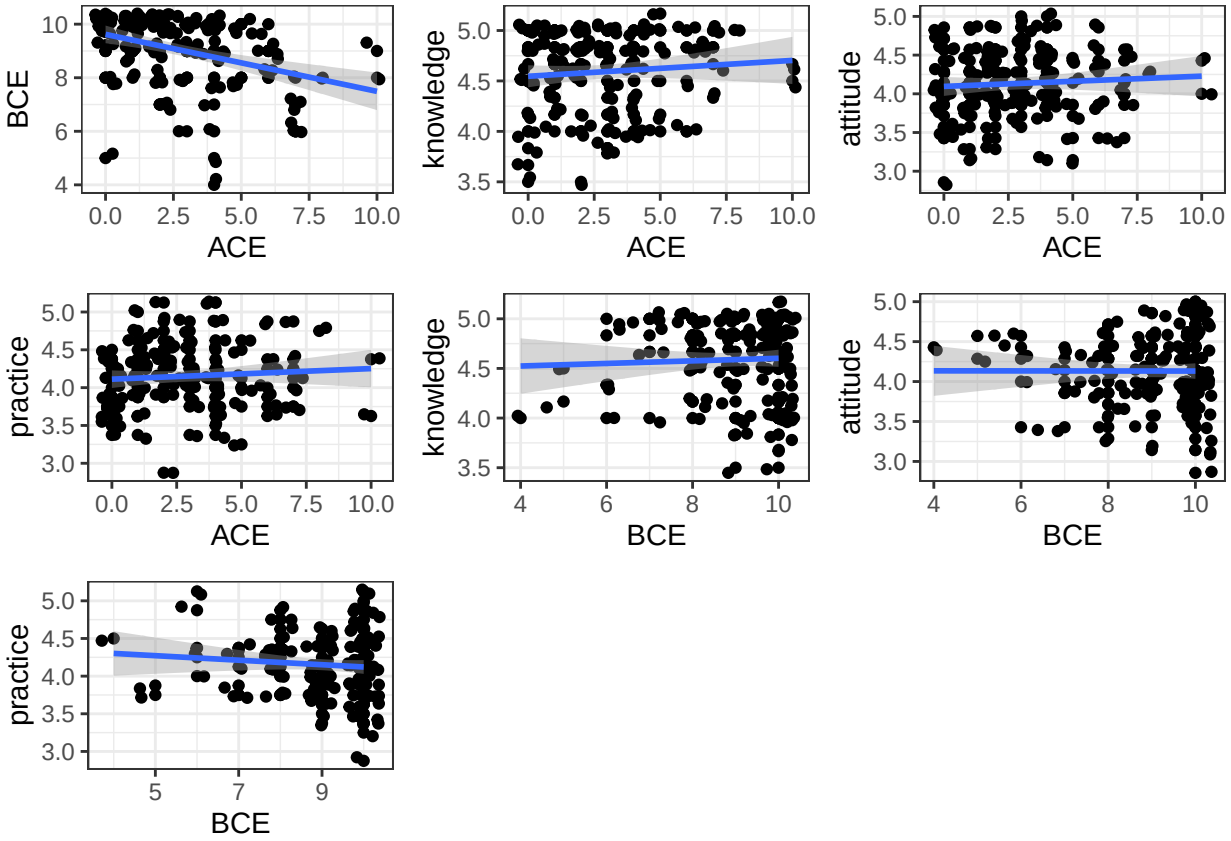


Figure 3. Scatterplots of variables. All scatterplots are using the full sample size (excluding outliers), x and y axes are changed based on which variables are being represented. The trendlines show that there is a somewhat strong inverse relation between ACE and BCE.

From the scatterplots we see a strong negative relation between ACE and BCE, but no other relations seem to be very non-zero. Although the trend between ACE and BCE is negative, it is worth noting that there are multiple people with an ACE score of 10, but also a BCE score above 8. The same is true the opposite way, where people have a very low ACE score, but have some of the lowest BCE scores. This suggests that while overall we would expect an inverse relation between the two variables, it may not always be the case. Figure three below gives more definitive numbers on the correlations between variables.

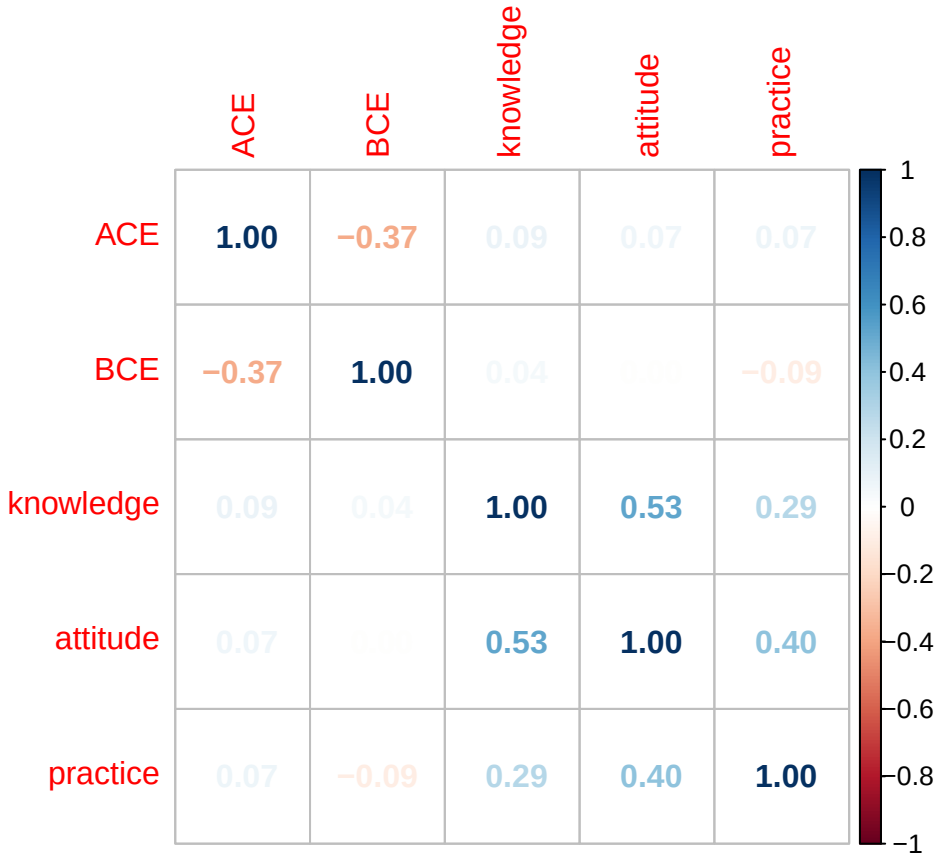


Figure 3. Shows correlations between each pair of variables. "BCE" refers to BCE score. Each number is the correlation between the two variables in its row and column. Darker blue colors denote stronger positive correlations where as darker red colors denote stronger negative correlations. Weak correlations are closer to white.

From the correlation plot we see very weak correlations between ACE/BCE and the three TICs, but there is a medium strength negative correlation between ACE and BCE.

Methodology

We then use Pearson correlation tests to see whether there is a true non-zero correlation between the variables. The p-values of these tests are shown in table 2.

Correlation Test p-values and correlation values

Variable Pair	p-value	correlation
ACE vs BCE	1.25e-05 ***	-.37
ACE vs Knowledge	0.3149	.09
ACE vs Attitude	0.4503	.07
ACE vs Practice	0.3989	.07
BCE vs Knowledge	0.6333	.04
BCE vs Attitude	0.988	0
BCE vs Practice	0.2993	-.09

Table 2. Shows p-values of Pearson tests for correlation between each variable pair. Each row is a different test for the respective pair. Only the ACE vs BCE correlation is significant.

Looking at the tests we see that the only significant test if the one between ACE and BCE, with a p-value of 1.25e-05. This suggests that there is a non-zero correlation between these two variables, but not between any of ACE/BCE and the TICs.

III Regression Models Predictng TICs

In addition to looking at correlations between variables, we also created predictive models to try and find significant relations between explanatory variables and TICs. In particular, we were interested to see if ACE,BCE, and demographics could predict Knowledge, Attitude, and Practice effectively. The demographics included were: type (student or preceptor), Race (asian, black, white), LGBTQ, exposed to sexual violence, and exposed to domestic violence. One model for each TIC was created, with the explanatory variables being the interactions between the demographics, ACE, and BCE. Residual plots and normal Q-Q plots were created and showed that the linear models were appropriate for the data. Figure 4 and 5 below show that a linear model is somewhat suitable for predicting Knowledge (plots for the Attitude and Practice models can be found in the Appendix pg. 19).

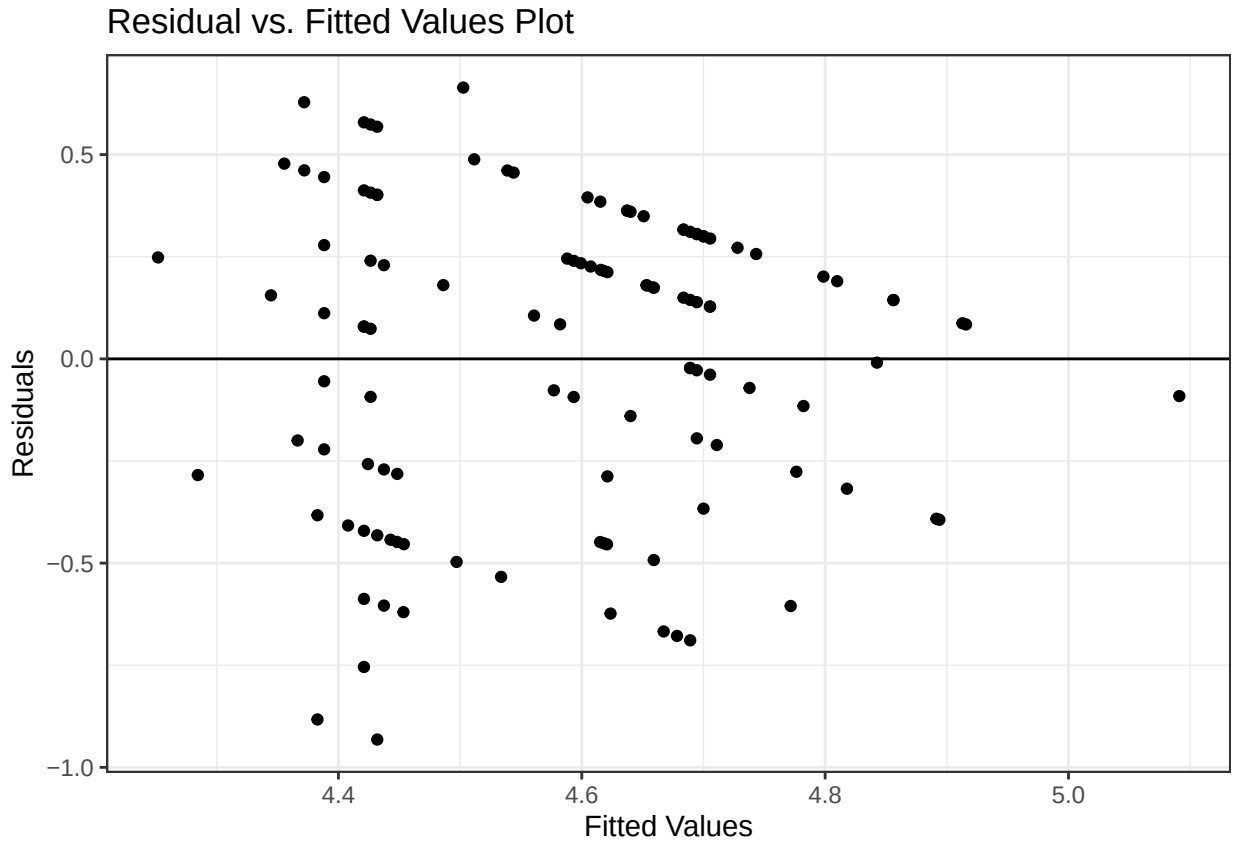


Figure 4. Residual vs fitted plot of Knowledge model. The residuals are evenly spread around the 0 line. There seems to be small linear patterns.

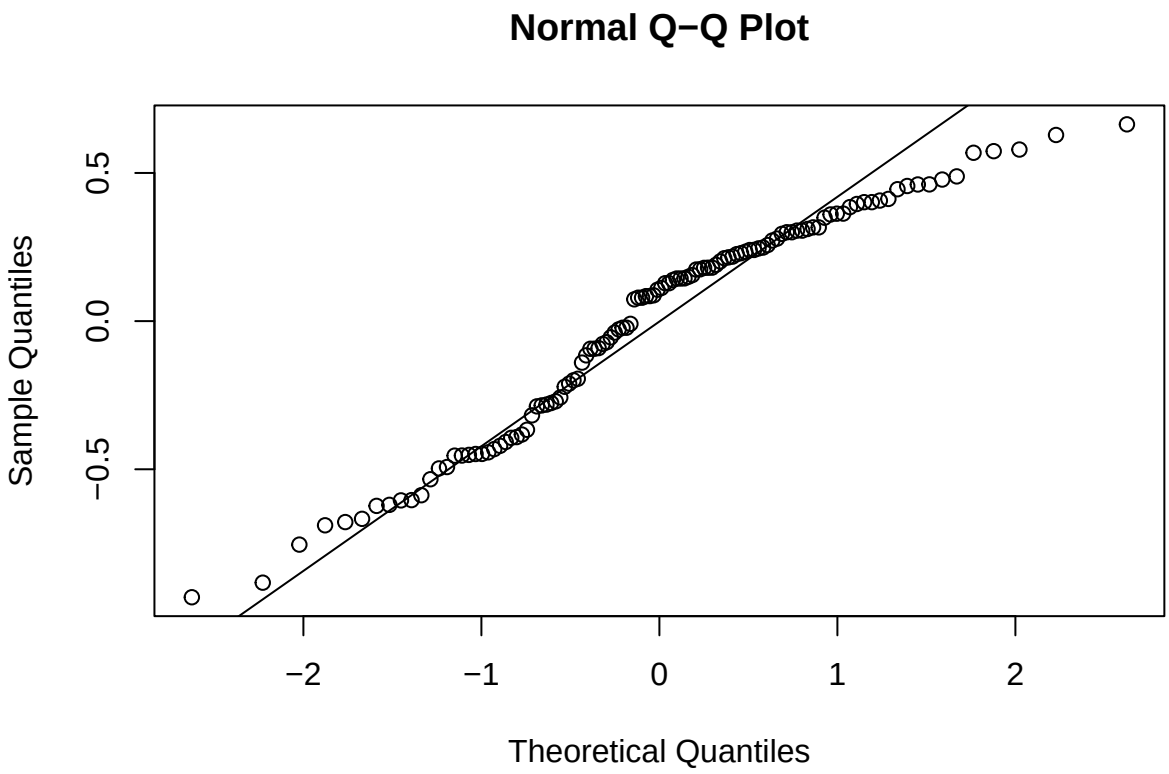


Figure 5. Normal Q-Q plot showing how suitable the data is for the model. The closer the dots are to the line, the more appropriate the model is. We see that most of the points are very close to the line, but the edges deviate.

The residual vs fitted plot shows that although the residuals are somewhat evenly spread, there are small patterns in them. Looking at the data values, this is likely due to there not being a large number of unique Knowledge values in the data. Many of the averaged Knowledge scores are the same between rows and so even though the data is numeric, there are not that many different values. Given that there is no large pattern in the residuals, we have decided the model is appropriate enough to continue. Table 3 below gives each variables coefficient in the model and their significance level to show which variables are significant in prediction and in what direction they push the Knowledge dependent variable.

Coefficients and p-values of demographics in Knowledge model

Demographic Variable	Coefficient	p-value	Adjusted R-squared
Type (Preceptor)	0.262657	0.00226 **	
ACE	0.005475	0.78645	
BCE	0.038206	0.24267	
Race (Black)	0.054364	0.76218	
Race (White)	0.000112	0.99920	
LGBTQ (Does not identify as)	-0.194299	0.05118	
Sexual Violence (Has Experienced)	0.216416	0.04930 *	
Domestic Violence (Has Experienced)	0.237528	0.06922	
			0.09276

Table 3. Coefficients and p-values of variables in the model. Type and Sexual Violence are significant in predicting the model and Domestic Violence is close to being significant.

From the table we see that person Type is very significant in predicting knowledge and the experience of sexual violence is also significant. Experience of domestic violence is almost significant as well. The coefficients for all of these variables are positive. Although the adjusted r-squared value is only 0.09, the significant p-values and coefficients suggest that one: preceptors may have higher Knowledge scores than students, and two: those who have experienced sexual violence have higher Knowledge scores than those who do not. We will now look at Table 4 which gives coefficients and p-values for the Attitude model.

Coefficients and p-values of demographics in Attitude model

Demographic Variable	Coefficient	p-value	Adjusted R-squared
Type (Preceptor)	0.2361891	0.0157 *	
ACE	-0.0007259	0.9750	
BCE	0.0153132	0.6820	
Race (Black)	-0.1199694	0.5604	
Race (White)	-0.2381117	0.0641	
LGBTQ (Does not identify as)	-0.2327940	0.0417 *	
Sexual Violence (Has Experienced)	0.0799414	0.5230	
Domestic Violence (Has Experienced)	0.2476802	0.0979	
			0.04696

Table 4. Coefficients and p-values of variables in the model. Type and LGBTQ are significant in predicting the model and Race (White) is close to being significant.

From the table we see that Type and not identifying as LGBTQ are significant in predicting Attitude. Being White instead of Asian is almost significant in predicting as well. The Type coefficient is positive, suggesting that being a preceptor may increase a person's Attitude score. The LBGTQ coefficient is negative, suggesting that a person who does not identifying at LGBTQ may have a lower Attitude score. (Practice table is located in the Appendix pg. 22)

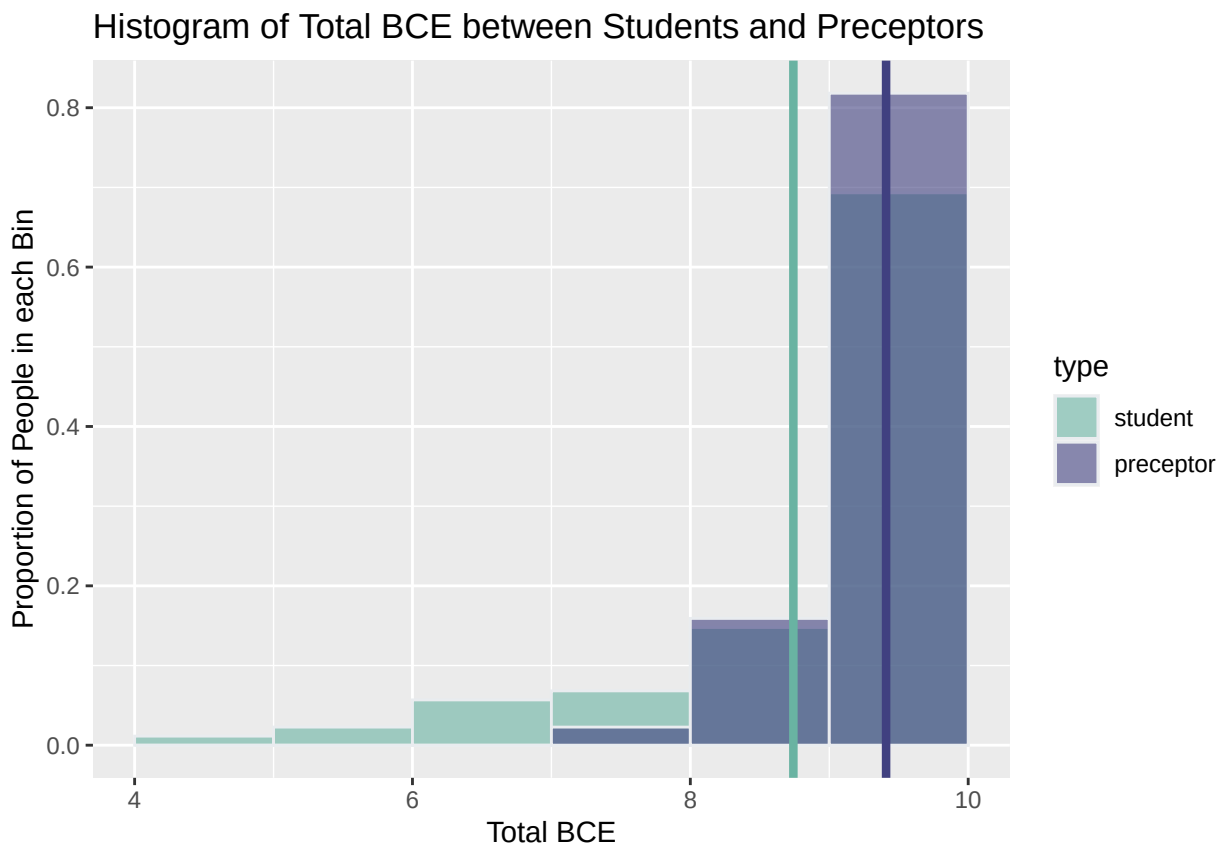
ChatGPT

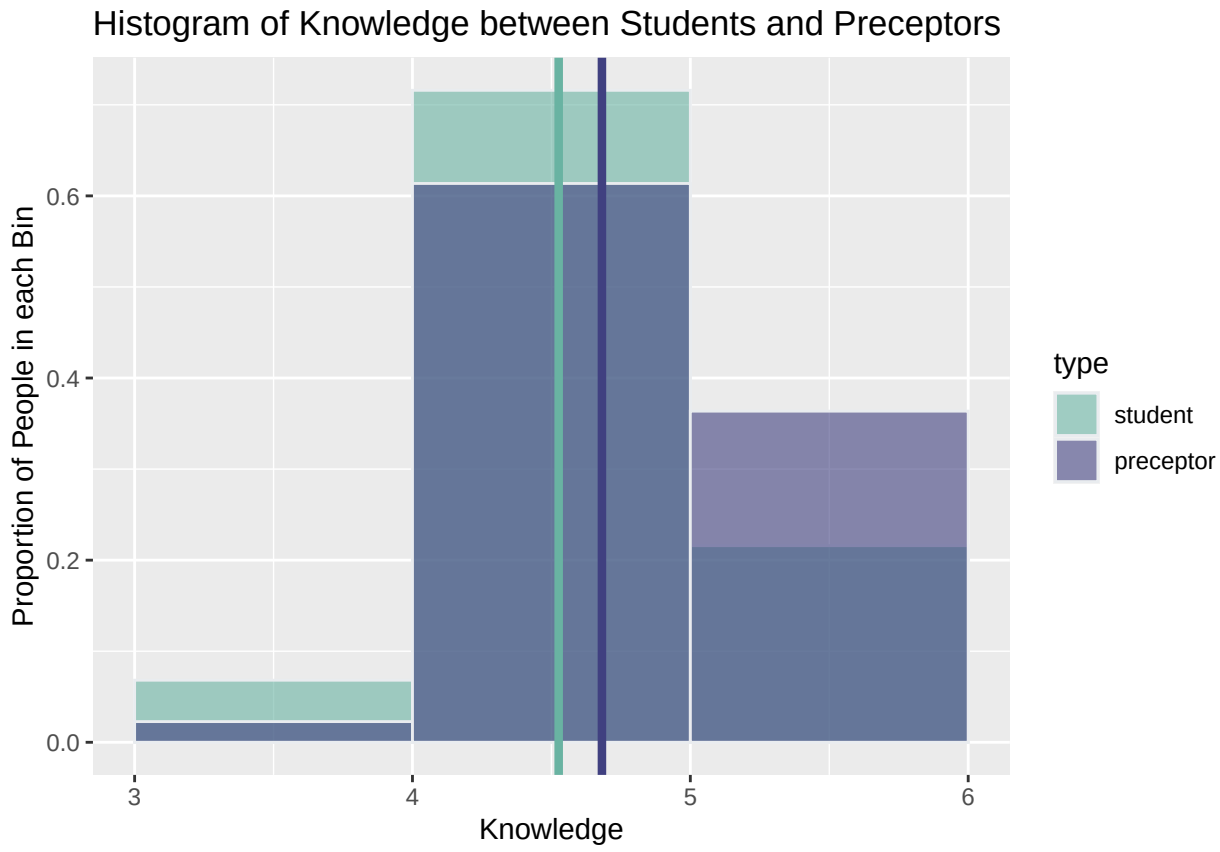
ChatGPT was not used for this report.

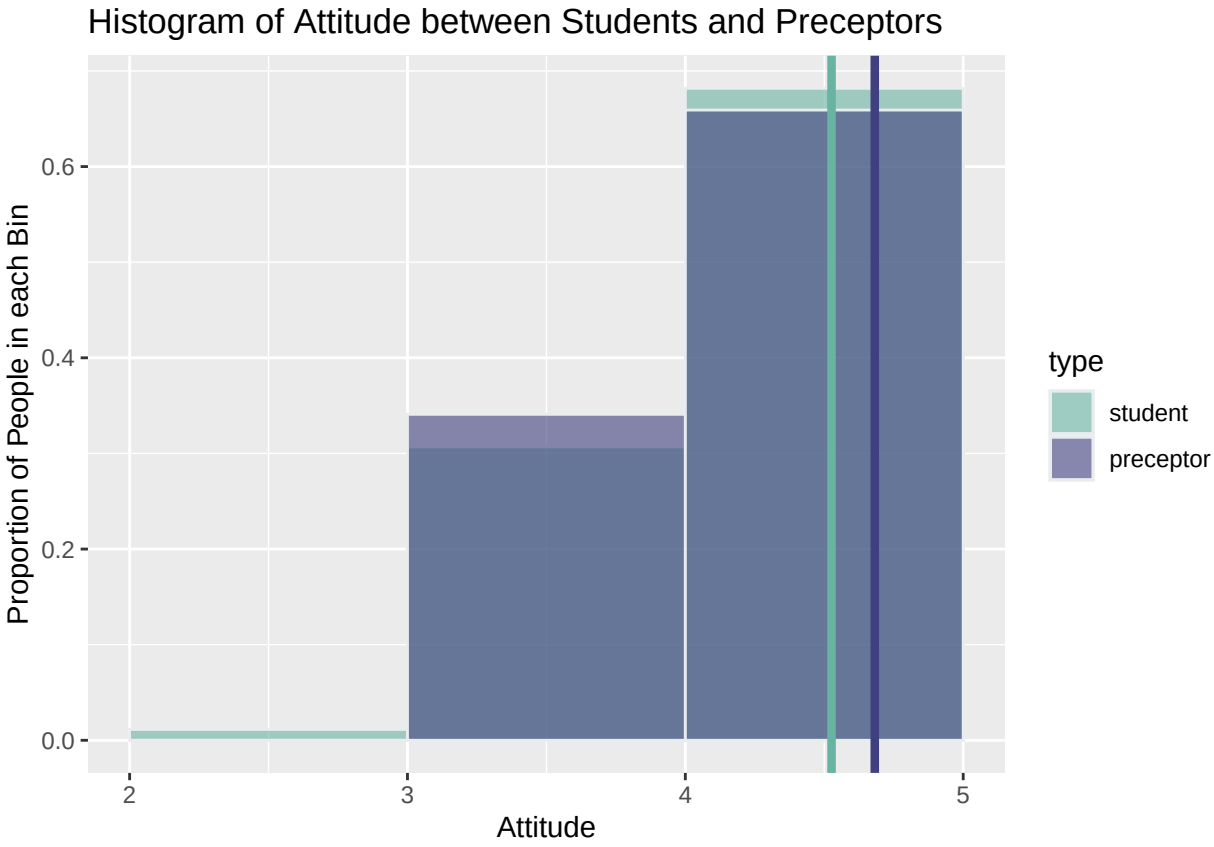
Appendix

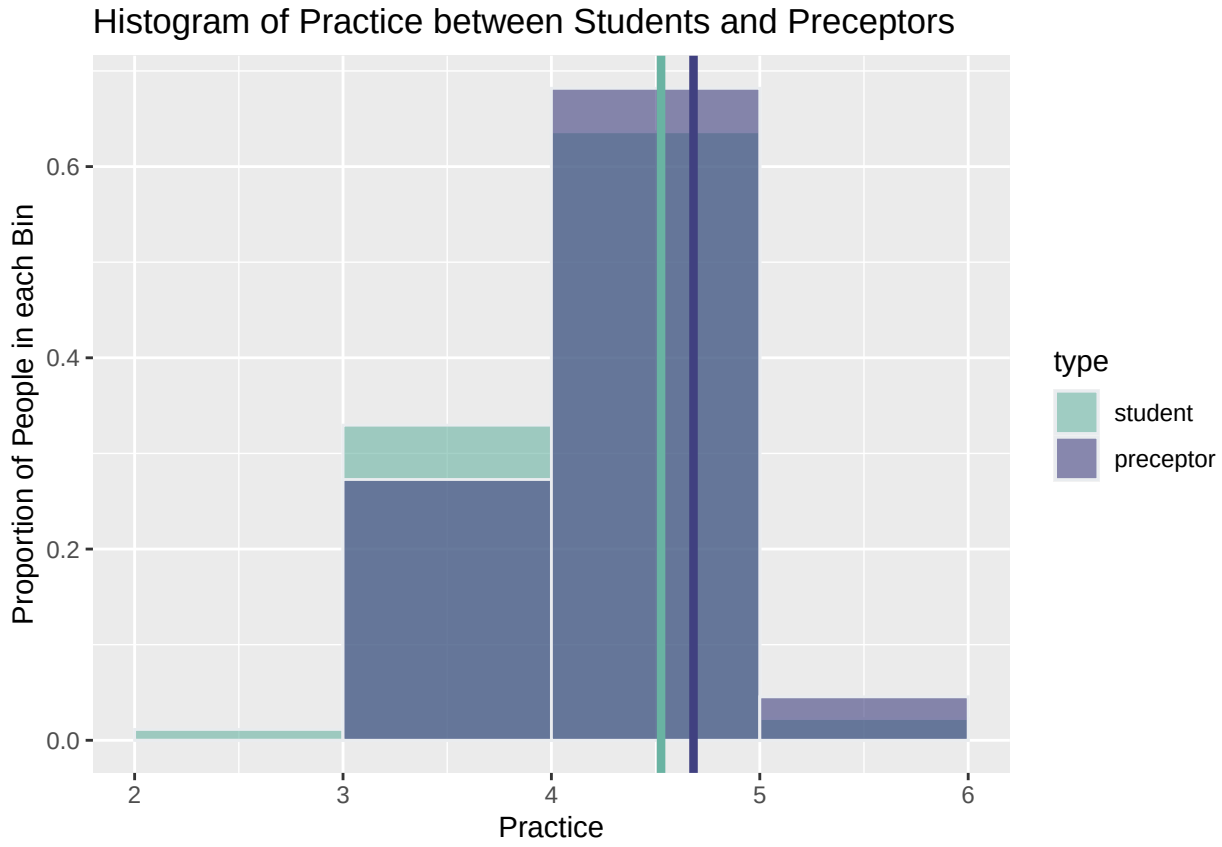
I Comparing Students and Preceptor Data

Histograms




Histogram of Knowledge between Students and Preceptors
Proportion of People in each Bin
0.0
0.2
0.4
0.6
3
4
5
6
Knowledge
type
student
preceptor


Histogram of Attitude between Students and Preceptors
Proportion of People in each Bin
0.6
0.4
0.2
0.0
2
3
4
5
Attitude
type
student
preceptor



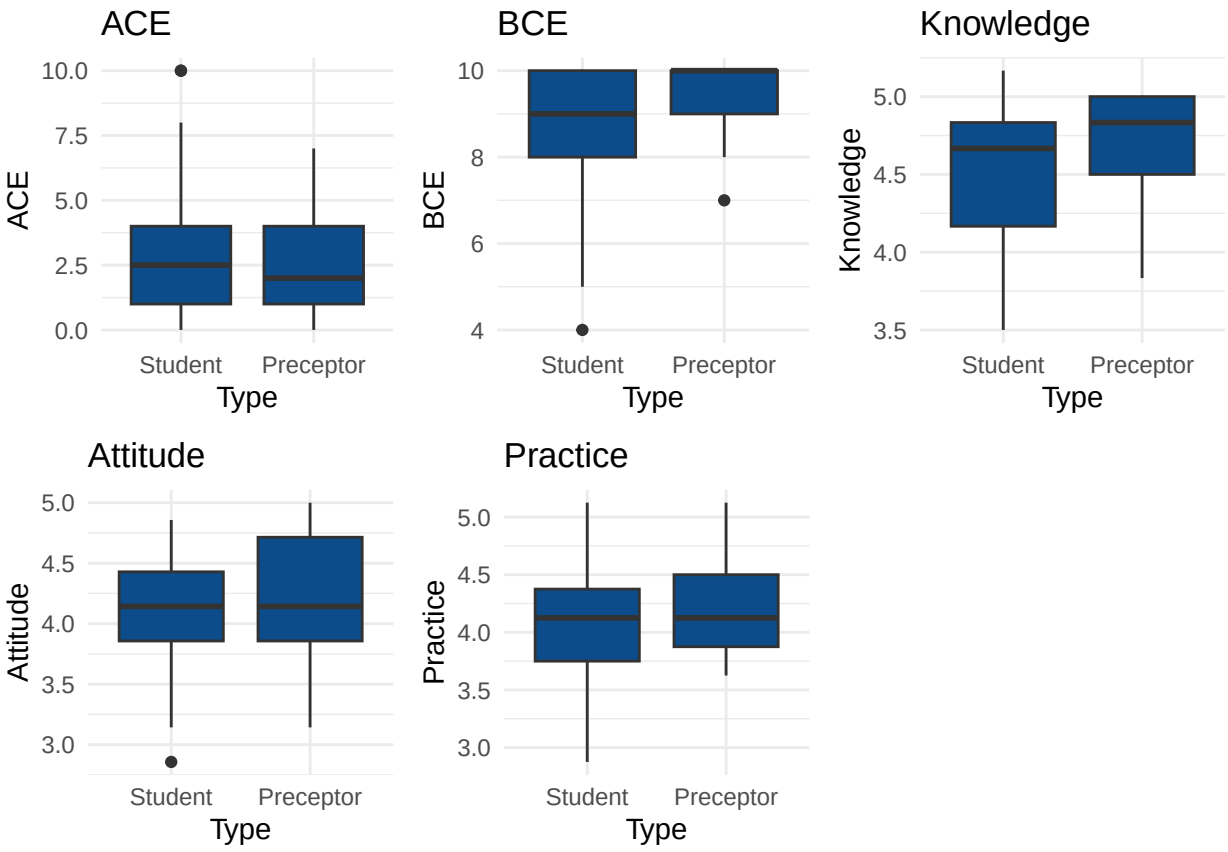
Tests for normality

Shapiro-Wilk normality test p-values

Variable	Student p-value	Preceptor p-value
ACE	1.563e-05 ***	0.0128 **
BCE	8.883e-10 ***	4.919e-08 ***
Knowledge	1.244e-05 ***	8.485e-06 ***
Attitude	0.01792 **	0.04648 *
Practice	0.3967	0.04854 *

Looking at Shapes of Samples

Boxplots of Variables of Interest separated by Sample Type



Wilcoxon Tests

Wilcoxon rank-sum test p-values

Variable	p-value
ACE	0.9222
BCE	0.03288 *
Knowledge	0.06168
Attitude	0.1652
Practice	0.3786

t-tests

t-test p-values

Variable	p-value
ACE	0.611
BCE	0.004793 ***
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Attitude	0.1346
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II Correlations Between Variables

Tests for correlation

Correlation Test p-values and correlation values

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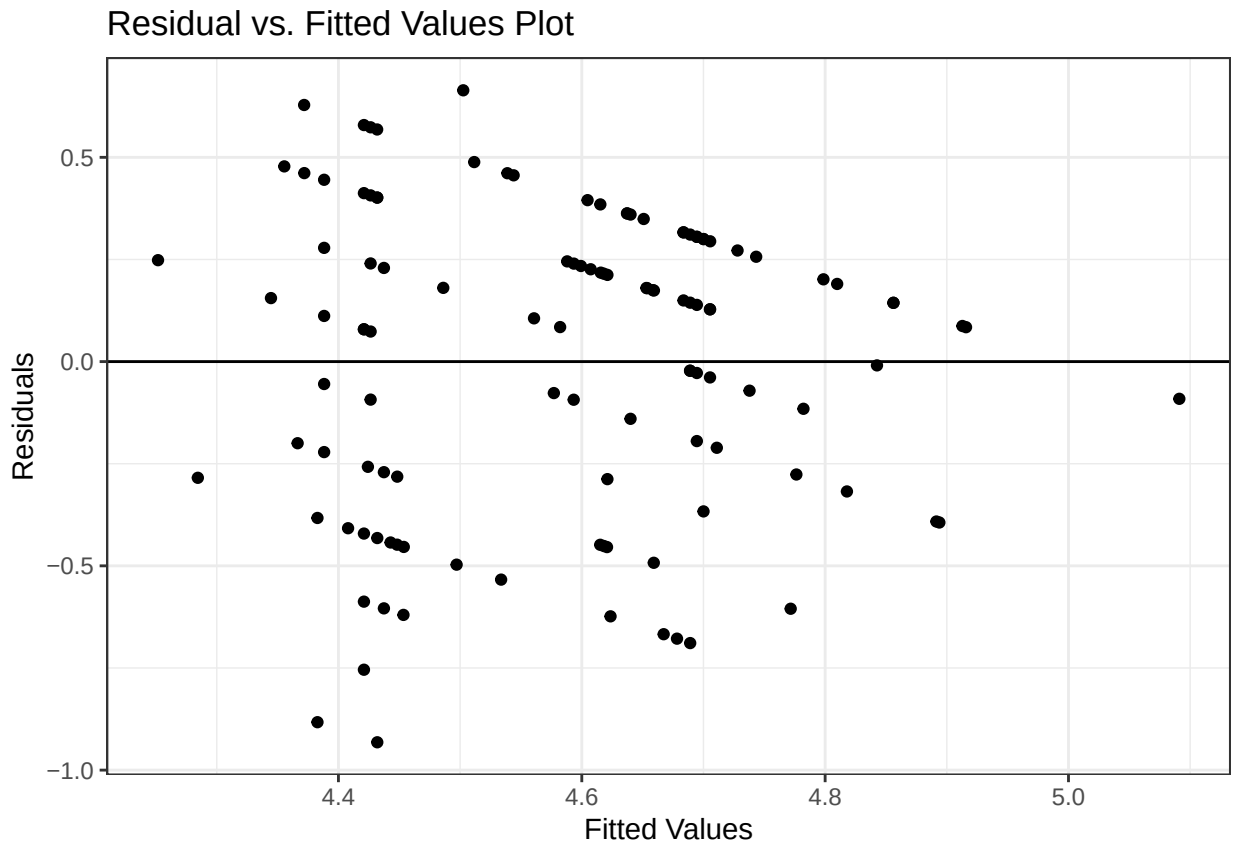
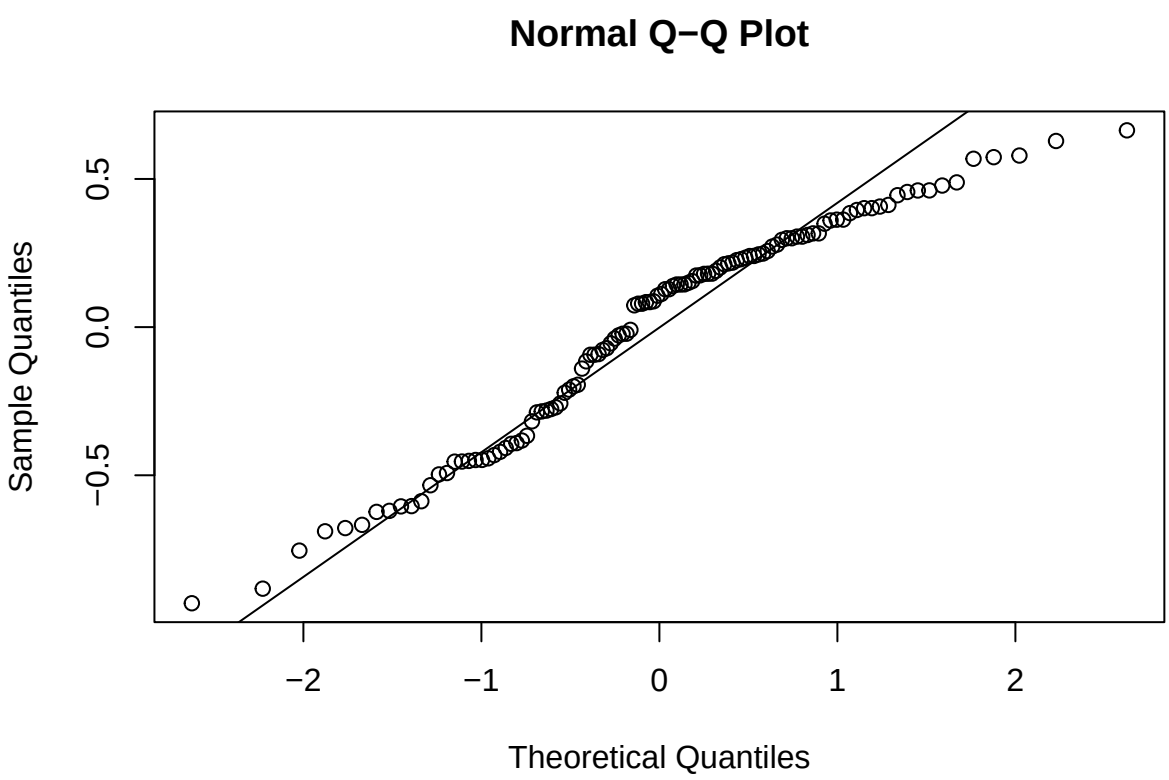
III Regression Models Predicting TICs

Knowledge Model





Coefficients and p-values of demographics in Knowledge model

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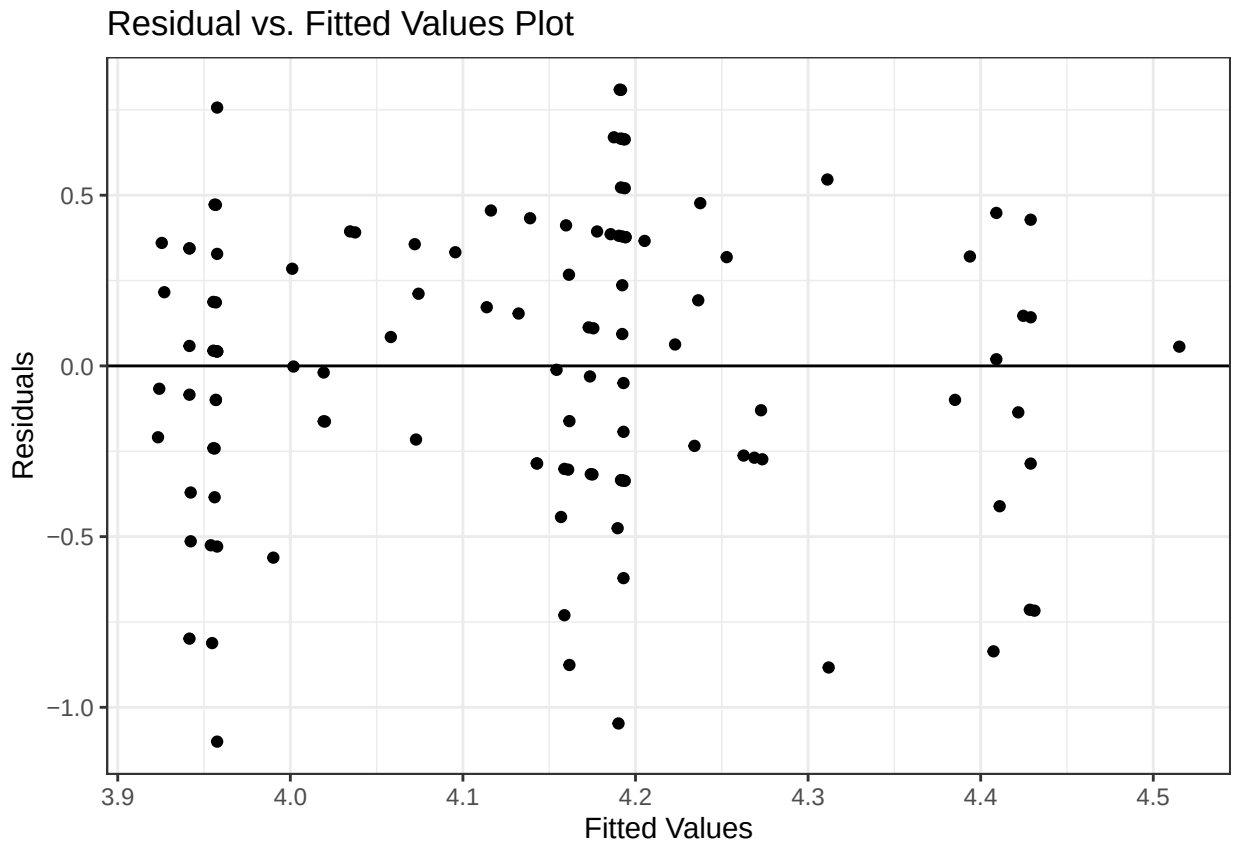
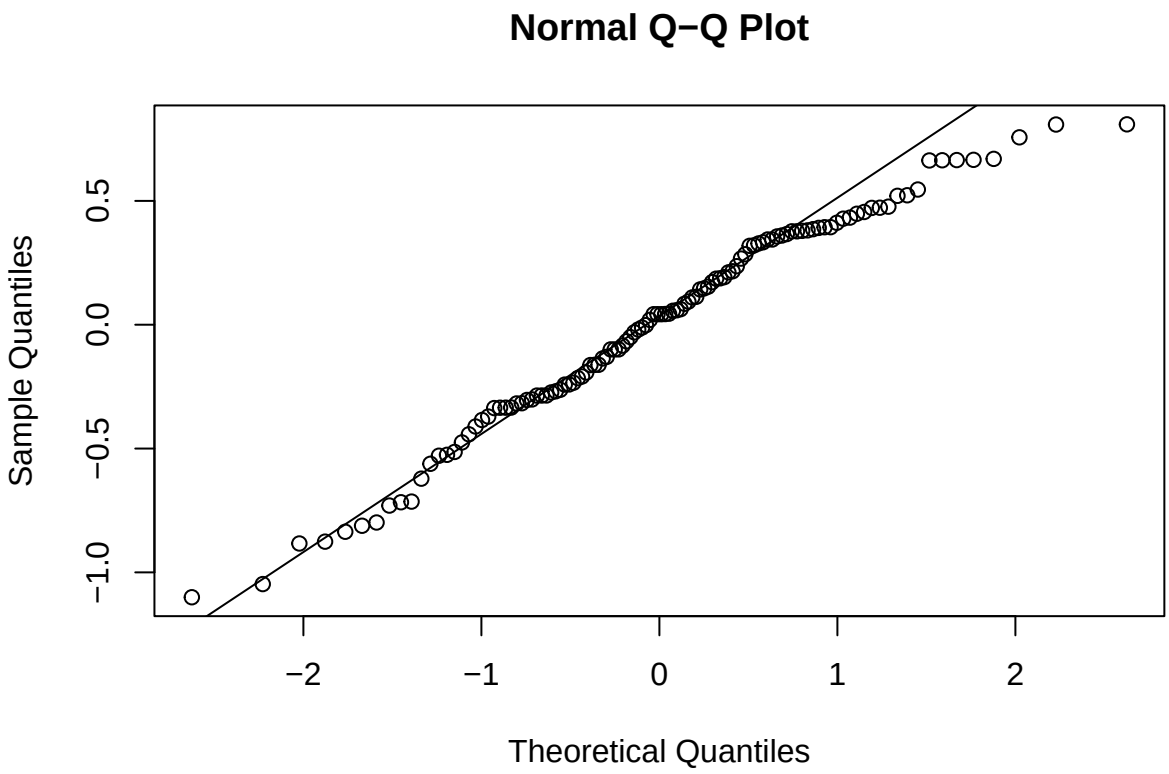
Sexual Violence (Has Experienced)	0.216416	0.04930 *	
Domestic Violence (Has Experienced)	0.237528	0.06922	
			0.09276

Attitude Model

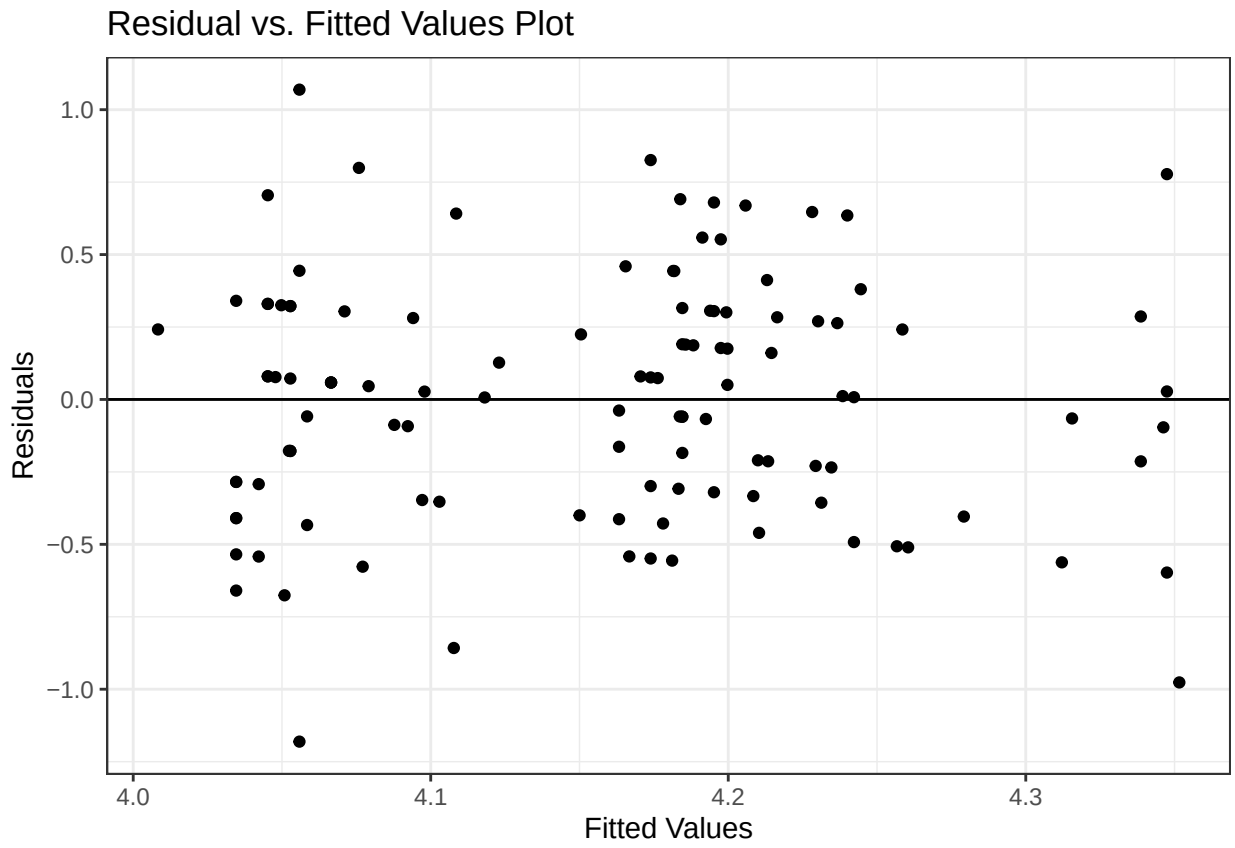


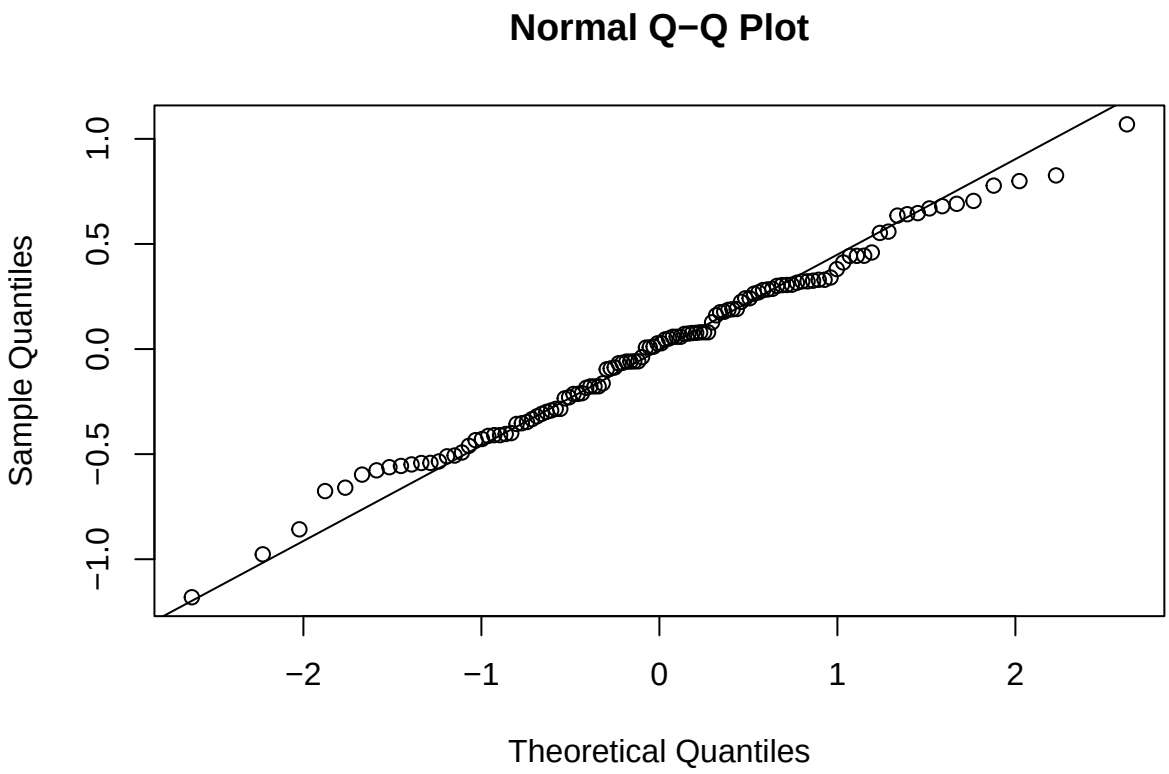


Coefficients and p-values of demographics in Attitude model

Demographic Variable	Coefficient	p-value	Adjusted R-squared
Type (Preceptor)	0.2361891	0.0157 *	
ACE	-0.0007259	0.9750	
BCE	0.0153132	0.6820	
Race (Black)	-0.1199694	0.5604	
Race (White)	-0.2381117	0.0641	
LGBTQ (Does not identify as)	-0.2327940	0.0417 *	
Sexual Violence (Has Experienced)	0.0799414	0.5230	
Domestic Violence (Has Experienced)	0.2476802	0.0979	
			0.04696

Practice Model





Coefficients and p-values of demographics in Practice model

Demographic Variable	Coefficient	p-value	Adjusted R-squared
Type (Preceptor)	0.128687	0.174	
ACE	0.010631	0.639	
BCE	0.038206	0.835	
Race (Black)	-0.121627	0.546	
Race (White)	-0.141623	0.257	
LGBTQ (Does not identify as)	-0.135899	0.221	
Sexual Violence (Has Experienced)	-0.026268	0.830	
Domestic Violence (Has Experienced)	0.044522	0.759	
			-0.02776