

Method

Setting and Participants

The data for the following study was collected at a mid-Atlantic rural high school. The total student body is 500 high school students across freshmen, sophomores, juniors, and seniors. Out of the 500 students invited to participate in our study, 450 provided both parental consent and student assent. Demographics of the sample are described in Table 1 below.

Table 1
Demographic Characteristics of Sample

	N (%)
Gender	
Male	195 (43.33)
Female	245 (54.44)
N/A	10 (2.22)
Race	
White	329 (73.11)
African American	21 (4.67)
Asian	19 (4.22)
Hispanic	29 (6.44)
Native American	7 (1.56)
Other	32 (7.11)
N/A	13 (2.89)
Grade Level	
Freshman	162 (36)
Sophomore	151 (33.55)
Junior	84 (18.67)
Senior	39 (8.67)
N/A	14 (3.11)

Instruments

The following instruments were used during study data collection. All responses were on a 4 or 5-point Likert scale and reliability was adequate with Cronbach’s alpha > .70.

Self-Efficacy

Commented [AM1]: Not reported

Commented [AM2]: Not reported

Commented [AM3]: Not reported

Commented [AM4]: Construct were examined (since you don’t actually name any instruments here).

Student confidence in academic ability was measured using the Self-Efficacy scale. ~~This scale has 4 items, and a response scale of a 4-point Likert scale. Reliability is adequate (Cronbach's alpha > 0.7).~~

Commented [AM5]: Since the response scale and reliability info is the same for all—just one sentence before you go to individual constructs.

Value of Education

Student perceptions of the importance of education to themselves as a learner was measured using the Value of Education scale. ~~This scale has 5 items, and a response scale of a 5-point Likert scale. Reliability is adequate (Cronbach's alpha > 0.7).~~

Perceptions of Teacher Responsiveness

Student perceptions of how teachers attend to their needs in class were measured using the Perceptions of Teacher Responsiveness scale. This scale has 6 items, ~~and a response scale of a 5-point Likert scale. Reliability is adequate (Cronbach's alpha > 0.7).~~

Perceptions of Teacher Competence

Student perceptions of the quality of their teacher were measured using the Perceptions of Teacher Competence scale. This scale has 7 items, ~~and a response scale of a 5-point Likert scale. Reliability is adequate (Cronbach's alpha > 0.7).~~

Perceptions of Teacher Interest

Student perceptions of the interest their teacher has in their students' learning were measured using the Perceptions of Teacher Interest scale. This scale has 5 items, ~~and a response scale of a 5-point Likert scale. Reliability is adequate (Cronbach's alpha > 0.7).~~

Procedures

At the beginning of the first quarter of the academic year, parental consent forms were submitted to all guardians of students at the present high school via an emailed link to a Qualtrics

form. Once parental consent forms were returned, teachers distributed student assent forms—also a link to a Qualtrics form—to all students with parental consent via student email.

Approximately five weeks into the first quarter of the academic year, students who had submitted both parental consent and student assent were emailed a Qualtrics link to a survey that included the instruments above to measure self-efficacy, value of education, perceptions of teacher responsiveness, perceptions of teacher competence, and perceptions of teacher interest. The same survey instruments were then administered a second time five weeks into the third quarter of the academic year via the same means.

At the end of the academic year, student demographic data was collected from the school, including student grade level, age, ethnicity, and gender identity.

Data Analysis

Data Cleaning

Several steps were taken to clean the data used in the following analyses. First, we created a subset of our main dataset with the specific variables needed for our analysis. Within this, three dummy variables were then created for our “grade” variable to represent freshmen, sophomores, juniors, and seniors.

Once dummy coding was complete, missing data were removed. The total sample size is 450; however, 3.3% of cases were missing self-efficacy scores; 3.1% of cases were missing grade level; 2.2% were missing gender; 2.4% were missing value of education scores; 3.1% were missing teacher responsiveness ratings; 2.9% were missing ethnicity; 2.4% were missing age; 3.1% were missing teacher competence and teacher interest ratings. Six additional cases were missing all information, and all of these cases were deleted from the dataset.

T-tests were used with z-scores to check for univariate outliers. We established our cutoffs as $z > 3.29$ or $z < -3.29$ to explore our outliers as the top and bottom 0.5% of responses. Two cases close to the cutoff (for both, $z = -3.495$) were manually examined. Closer analysis revealed that neither of these cases had a self-efficacy score. Since self-efficacy was one of the independent variables in our research question, we could not use these two cases, and so they were removed.

Multivariate outliers were examined next. We created a data frame consisting of only the continuous variables in our model, enabling us to examine Mahalanobis distances. This tells us about the distance between vectors (results across variables within a single case), and flags if a distance is outside of the set bounds of a Chi-square test that points out multivariate outliers. We set our Chi-square significance level at 0.001 which made our chi-square cutoff value of 20.51501. Any figure more extreme than this figure was a multivariate outlier. After examining the data, we have one multivariate outlier with a Chi-square value of 20.6775909433. After examination of the specific case, we determined the case was not extreme enough to be deleted.

Assumptions

Following data cleaning, we examined our data to see if it met assumptions. We checked the following assumptions: normality, linearity, multicollinearity, and homoscedasticity. Normality was checked through the creation of boxplots (Figure 1) for visual examination. Our data were distributed normally, with the exception of ValEd_2s. To examine this further, we displayed a histogram for this specific variable (Figure 2), and the distribution appeared to be approximately normal.

Commented [AM6]: ?? T tests? This doesn't make sense.

Commented [AM7]: This isn't possible...you cannot calculate a Z score without a raw score.

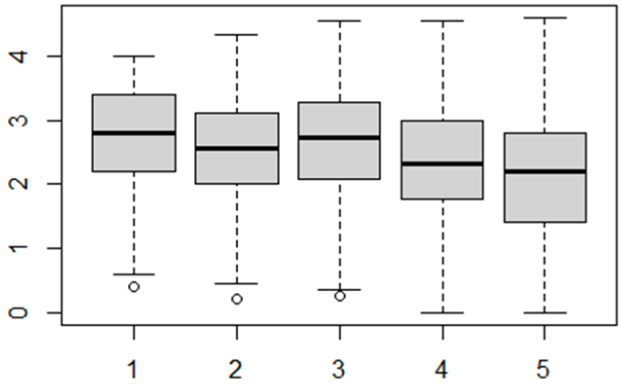
Commented [AM8]: Malahanobis value.

Commented [AM9]: APA –must round.

Commented [AM10]: Because?

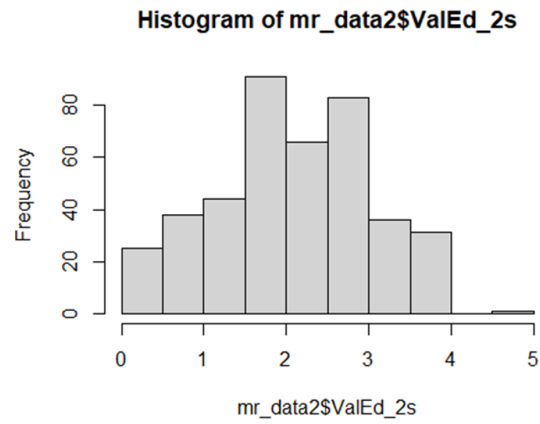
Commented [AM11]: Use construct names...not variable names.

Figure 1
Boxplots of Study Variables



Note: 1: SEff_1s; 2: TIntr_2s; 3: TComp_2s; 4: Rspnd_2s; 5: ValEd_2s

Figure 2
Histogram of Valuing of Education at Time 2



Linear relationships were then checked through the use of scatterplots. Figure 3 displays valuing of education at time 2 vs. self-efficacy; figure 4 displays Valuing of Education vs Student Perceptions of Teacher Responsiveness; and figure 5 displays Valuing of Education vs Student Perceptions of Teacher Competency. Looking at all three scatterplots, we can see linear relationships between our dependent variable and all of our continuous independent variables.

Figure 3
Scatterplot of Valuing of Education at Time 2 vs Self-Efficacy

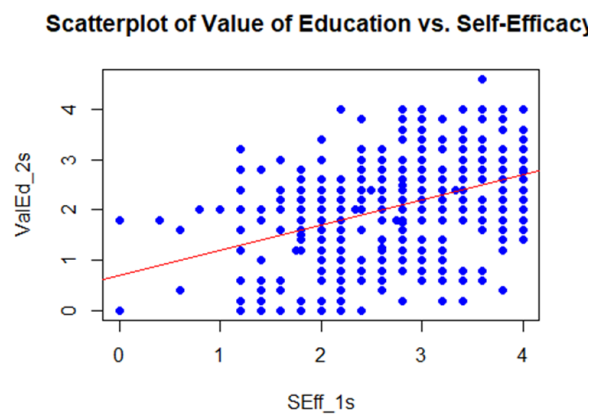


Figure 4
Scatterplot of Valuing of Education vs Student Perceptions of Teacher Responsiveness

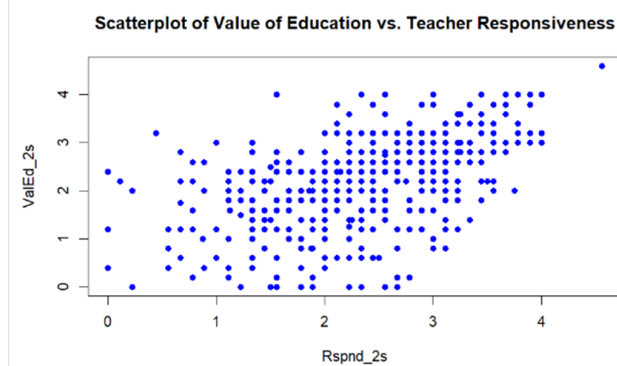
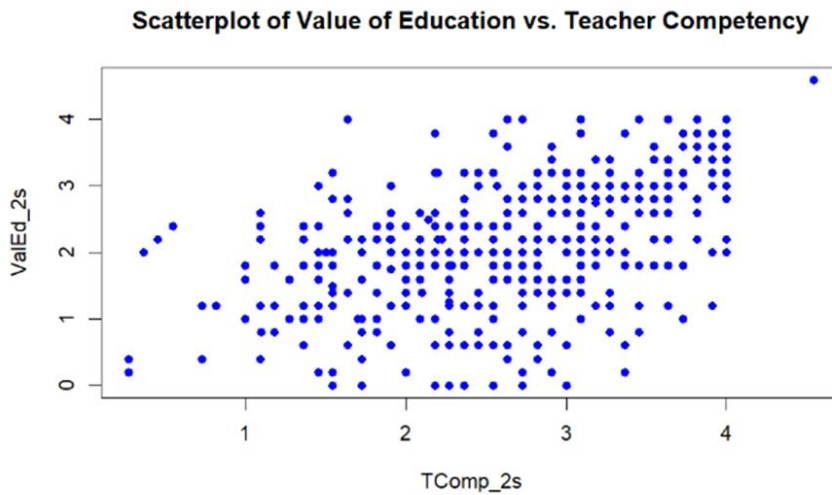


Figure 5
Scatterplot of Valuing of Education vs Student Perceptions of Teacher Competency

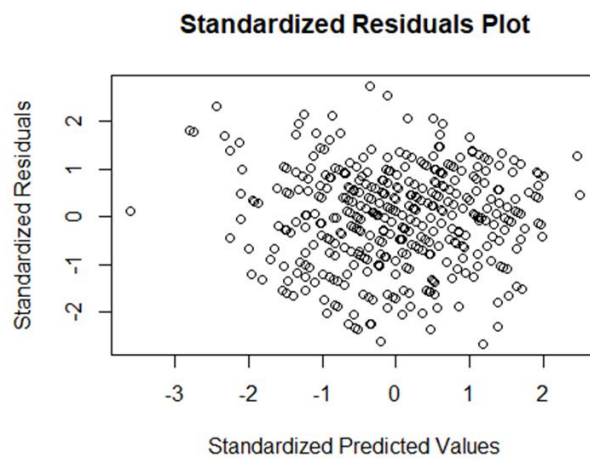


Multicollinearity was checked through the use of a correlation table of the relevant variables (see Table 2). The strongest correlations are among: 1) Teacher Interest and Teacher Competency, 2) Teacher Competency and Teacher Responsiveness, 3) Value of Education and Teacher Responsiveness, 4) Value of Education and Teacher Competency, and 5) Value of Education and Teacher Interest. We are concerned by the high (above .8) correlations between Teacher Responsiveness and Competency; Teacher Responsiveness and Interest; and Teacher Competency and Teacher Interests. These correlations are concerning because they suggest high interrelatedness among constructs as measured by these IVs, or multicollinearity, making it difficult to know if each variable is measuring each construct independently.

Homoscedasticity was then checked using a residuals plot (Figure 6). Because no funnel shape is present in the image, we can assume our data meet the assumption of homoscedasticity.

Commented [AM12]: There are many other shapes that could also signal heteroscedasticity...better to discuss what the desired shape is.

Figure 6
Standardized Residuals Plot



Descriptive Statistics

Table 2 below describes the means, standard deviations, and bivariate correlations for the study variables. It is worth noting the high (above .8) correlations between Teacher Responsiveness and Competency; Teacher Responsiveness and Interest; and Teacher Competency and Teacher Interests. Concerns regarding multicollinearity were addressed above.

Table 2.
Descriptive Statistics and Bivariate Correlations for Study Variables

Variable	M	SD	1	2	3	4
1.Self-efficacy 1	2.85	0.79	-			
2.Value of Education 2	2.12	0.97	.41**	-		
3.Teacher Responsiveness	2.33	0.85	.18**	.52**	-	
4.Teacher Competency	2.64	0.83	.20**	.50**	.89**	-
5.Teacher Interest	2.54	0.80	.13**	.45**	.92**	.84**

Hypothesis Testing

To answer our two research questions (listed below), we conducted regression analyses.

All analyses were run in R through the RStudio user interface.

Research Question 1: Do self-efficacy (measured at time1), grade level, and sex predict value of education (at time 2)?

To answer this research question, we conducted a multiple regression analysis. Our dependent variable was value of education (at time 2). Our independent variables were self-efficacy (at time 1), grade level, and gender identity.

Research Question 2: Do students' perceptions of teacher responsiveness, teacher competency and teacher interest (at time 2) predict any additional variance above and beyond the students' efficacy and demographics?

To answer this question, we conducted a hierarchical regression. Step 1 of this regression included.....~~was described under research question 1~~. For step 2 of this regression, the independent variables added included perceptions of teacher responsiveness, perceptions of teacher competence, and perceptions of teacher interest (all at time 2).

Results

Research Question 1: Do self-efficacy (measured at time 1), grade level, and sex predict value of education (at time 2)?

Our regression model is significant, $F(5, 409) = 18.05$, $p < 0.05$, $R^2 = 0.1708$; taken together, this indicates that grade level, self-efficacy at time 1, and gender identity significantly predict value of education at time 2. Within this model, grade level itself is not a statistically significant predictor. However, self-efficacy at time 1 is a statistically significant predictor of value of education at time 2 ($t = 9.186$, $P < 0.05$). Gender identity is also a significant predictor (t

Commented [AM13]: Sequential/ hierarchical.

Commented [AM14]: These rQ

Commented [AM15]: Both RQ are the sequential regression...just step 1 and step 2 in the analysis.

Commented [AM16]: Do not need to keep repeating time 1 and time 2 once you have cleared stated this about your data.

= -2.281, $p < 0.05$). The standardized results tell us that self-efficacy is the best predictor in this model.

We then examined the zero-order, part, and partial correlations for our model. We did not examine the values for grade level or gender identity as they are categorical variables. Since the figures are all relatively close to one another, self-efficacy at time 1 trends the way we expect across zero-order, partial, and part.

Research Question 2: Do students' perceptions of teacher responsiveness, teacher competency and teacher interest (at time 2) predict any additional variance above and beyond the students' efficacy and demographics?

To answer our second research question, we performed a second step in the hierarchical regression. Independent variables added to the model in this second step included student perceptions of teacher responsiveness, student perceptions of teacher competence, and student perceptions of teacher interest, all at time 2. Our regression model is significant, $F(8, 406) = 32.19$, $p < 0.05$, $R^2 = 0.3761$. In this model specifically, only self-efficacy at time 1 ($t = 7.842$, $p < 0.05$) and teacher responsiveness ($t = 3.933$, $p < 0.05$) were significant predictors within the model.

This second model functions significantly better than the model from step 1, $\Delta F(3, 406) = 45.869$, $p < 0.05$. This indicates that teacher responsiveness, teacher competence, and teacher interest do predict additional variance above and beyond student self-efficacy and demographic variables. However, it is notable that teacher competency and teacher interest (at time 2) are not significant in the model; instead, only teacher responsiveness at time 2 is a significant predictor in the model.

Table 3

Sequential Regression Results

	Step 1					Step 2				
	<i>R</i> ²	<i>B</i>	<i>SE</i>	β	<i>P</i>	<i>R</i> ²	<i>B</i>	<i>SE</i>	β	<i>P</i>
Dependent Variable										
Value of Education	.181	-	-	-	-	.388	-	-	-	-
Independent Variables										
Self-efficacy		0.512	0.055	0.416	.000***		0.390	0.049	0.314	.000***
Gender (male)		-0.201	0.088	-0.103	.0231*		-0.135	0.077	-0.055	.083
Freshman		-0.137	0.102	-0.068	.395		-0.194	0.140	-0.023	.168
Sophomore		-0.197	0.162	-0.096	.225		-.0.246	0.142	-0.028	.084
Junior		-0.126	0.174	0.051	.471		-0.254	0.153	0.053	.096
Teacher Responsiveness		-	-	-			0.543	0.138	0.504	.000***
Teacher Competency		-	-	-			0.157	0.101	0.119	.121
Teacher Interest		-	-	-			-0.176	0.125	-0.155	.159

Commented [AM17]: Nice table!