

Socioeconomic Status and Perceived Course Effectiveness
Final Executive Summary
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Sociology 91: The Sociological Imagination
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March 17th, 2021

Introduction / Significance

In analyzing the quantitative study done by DCAL provided to us, we decided to examine what makes a course effective for students. With the new online learning experience due to COVID-19, certain students have an inherent advantage over others based on their situations at home. DCAL's mission statement involves the improvement of teaching and learning through access to resources and the removal of barriers (DCAL Mission, 2021). The DCAL survey focuses on accessibility and methods of remote learning, but we wanted to dive deeper and analyze the ways in which course effectiveness differed for students of different socioeconomic backgrounds, particularly given that the COVID-19 pandemic necessitated a quick shift to remote learning. Understanding how socioeconomic status relates to course effectiveness will provide feedback on what changes need to be made so that everyone is accommodated.

Our curiosity about socioeconomic status and course effectiveness led us to our two research questions.

- Research Question 1: How does socioeconomic status affect reported course effectiveness?
- Research Question 2: How does the relationship between socioeconomic status and reported course effectiveness change over time?

Understanding how socioeconomic status affects course effectiveness is critical in online learning because resources are not spread equally outside of campus. Access to technology, income-based disparities, and external obligations play a substantial role amid the remote learning environment. Examining the change in the relationship over time will give clear indications if the time and efforts committed by Dartmouth improved remote learning and led to better outcomes.

Background

Based on our research questions, we read relevant literature that guided us to our study hypotheses. We began by examining the differences in educational outcomes between first-generation and non-first-generation students, finding that first-generation students have disproportionately encountered learning barriers such as increased anxiety and motivation (Gillis and Krull 2020). First-generation students also display lack of self-regulation in the online learning environment, which negatively impacts achievement of goals (Williams and Hellman 2004). These findings led us to our first hypothesis, outlining the main relationship in our study -- that first-generation students would report lower course effectiveness than non-first-generation students. We also found that higher-income individuals used the Internet with greater frequency, and the COVID-19 pandemic has exacerbated disparities related to technological access (Bacher-Hicks, Goodman, Mulhern 2021, Lai and Widmar 2020). These findings led us to our second hypothesis that access to technology would mediate the relationship between students' generational status and course effectiveness. As we continued our research, we discovered the idea of disparities between middle and lower-class individuals in terms of navigating bureaucracies (Lareau, 2020). When combined with evidence of the lack of digital capital in low-income communities, we hypothesized that technological cultural capital could also mediate our focal relationship proposed in the conceptual model in our methodological appendix. (Bach, Shaffer, Wolfson 2013). Finally, we also found evidence of the importance of studying change over time with regard to educational attainments, as disparities between higher-income and lower-income groups shrank over time (Papay, Murnane, Willett 2015). When considering the quick shift to remote learning and the findings of this Massachusetts study, we developed our fourth and final hypothesis, which was that disparities between first-generation students and non-first-generation students would decrease over time between the Spring 2020 and Fall 2020 terms. Our hypotheses are also listed in our appendix.

Data / Methods

This study was conducted using the DCAL dataset generated from responses to their remote learning survey. Using the questions presented in this survey, we were able to generate the variables needed to conduct our study, starting with our independent variable. To measure socioeconomic status, we used the "First Generation Indicator" in the DCAL survey, a question that was presented in the survey in a Yes / No format. Using this question, we were able to create a variable that indicated the generational status of the student. With our dependent variable of course effectiveness, the process was more complex. We used student responses to a series of six statements, which are listed as the first item in our methodological appendix, to create our effectiveness variable.

These statements were posed to students with possible responses ranging from Strongly Agree (1) to Strongly Disagree (4), and the answers for each question were summed and subsequently averaged to create an aggregate measure of these responses for course effectiveness. We also adjusted the scale through our coding to make higher numerical values of course effectiveness correspond with higher levels of reported course effectiveness, contrary to the way the Agree - Disagree scale in the survey is constructed. This same response structure of Strongly Agree (1) to Strongly Disagree (4) existed for our mediators of access to technology and technological cultural capital, and the same procedure as that of the dependent variable was used in terms of totaling responses and creating an aggregate average measure. The questions for each variable are provided at the beginning of our methodological appendix.

Finally, our initial sample from the DCAL data was restricted in two ways to meet the needs of our study (N = 10,181). First, we eliminated responses from students in non-traditional class years, leaving us only with responses from the members of the Classes of 2021-2024 (N = 8,538); these responses were removed because the circumstances of students in non-traditional class years are likely vastly different from those in traditional class years. The second step of this process was creating a listwise deleted sample by removing students' responses with missing data for each of our variables (N = 7,705). Removing this missing data helped facilitate a cleaner analysis and left us with the final sample for our study.

Results

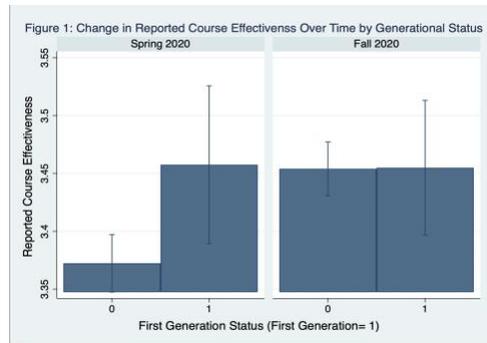
Before addressing how our key findings supported our hypotheses, it's important to understand some key points about our data. Looking to Table 1, both groups, first-generation and non-first-generation students reported high course effectiveness overall with a mean of 3.42. In addition, with a low standard deviation of 0.542, others reported a score close to the mean of 3.42. With the average high reported course effectiveness paired with low amounts of variation in our data, it may suggest that DCAL has done a fairly good job at creating effective virtual courses across different groups of students. However, when we closer at our results, we do find some interesting differences between the two groups of students that spur further questions.

	Mean	Median	SD	Range
Generational Status of Students (0=non-firstgen, 1= firstgen)	0.12			
Reported Course Effectiveness (1=strongly disagree, 4=strongly agree)	3.42	3.5	0.542	
Access to Technology (1=strongly disagree, 4=strongly agree)	3.37	3.33	0.58	
Technological Cultural Capital (1=strongly disagree, 4= strongly agree)	2.70	2.67	0.770	
Time (0=spring, 1=fall)	0.48			
Notes: N=7705				
Source: DCAL Remote Learning Survey 2020				

Referring back to our first hypothesis, where we predicted that first-generation students would report lower course effectiveness compared to non-first-generation students, we actually found that opposite of what we hypothesized. While we only found a small difference of 0.04, first-generation students reported on average a higher course effectiveness compared to non-first-generation students. So, we discovered a paradoxical result that rejected our first hypothesis.

Moving to our mediators, technological cultural capital and access to technology, we hypothesized that first-generation students would report a lower technological cultural capital and access to technology. However, because we rejected our first hypothesis about our main focal relationship, we can automatically reject our hypothesis relating to our mediators, technological cultural capital and access to technology. Our results suggest that technological cultural capital and access to technology actually influenced first generation students' higher average reported course effectiveness. While we reject these hypotheses, this doesn't mean our mediators are insignificant to DCAL.

Finally, we hypothesized that the disparities between reported course effectiveness among first-generation and non-first-generation students would decrease from Spring 2020 to Fall 2020. Looking at Figure 1, we did find that these disparities did decrease between first-generation and non-first-generation students. However, this occurred in the opposite direction than we hypothesized. Instead of first-generation students closing the gap by Fall 2020, it was non-first-generation students who did, which rejects our last hypothesis.



Conclusions, Implications, and Limitations

Our research study yielded four critical findings that are worth highlighting:

- On the whole, reported course effectiveness levels reported by students were quite high, as shown in Table 1, which displays both a high mean and low standard deviation when considering the 1-4 scale used to measure course effectiveness
- While our first hypothesis proposed the idea that first-generation students would report lower course effectiveness than non-first-generation students, we found the opposite to be true -- a crucial paradoxical finding that underlies our entire study
- While introducing our mediators of access to technology and technological cultural capital into the study had the opposite effect than we hypothesized (that is, they increased the disparity between reported course effectiveness levels for first-generation and non-first-generation students), these mediators are still powerful. Even though there clearly was not the mediation that we hypothesized, these mediators do matter, and it is clear that students need access to technology and technological cultural capital to succeed
- Changed in the level of reported course effectiveness, particularly for non-first-generation students, indicate that increased fall term provided a better remote learning experience than the spring term, likely due to increased efforts by the college to provide greater structure for the term -- these results are shown in Figure 1

In considering the limitations of our research study, the use of generational status as a proxy for socioeconomic status is important to note. These two indicators are not interchangeable, which may explain why our results did not reveal what we expected. Not all first-generation students are created equal, and this includes their socioeconomic status. In addition, the 1-4 Likert Scale used by DCAL to measure the student responses to many of the questions we used to create our variables was a limiting factor. When considering the breadth of experiences of remote learning, these few answer choices provide limited opportunities to fully express their sentiments. For example, in responding to a statement like “I know where to get help if I’m experiencing equipment or internet connectivity issues,” it can be difficult for a student to quantify if they know where to get help, showing that the Likert scale can be restrictive. Ultimately, DCAL may opt to use a larger scale or ask students more about how they feel about reaching out for help, which leads us to the implications of our study.

Our study uncovered a high reported course effectiveness on average across groups, but the findings of our qualitative counterparts indicated lower course effectiveness than we found, especially for first-generation students. While they may have spoken to students who did not respond to our survey, it is quite possible that DCAL is not adequately measuring the effectiveness of courses as efficiently as qualitative research conducted by our peers. The integration of an open-ended question to the DCAL survey might help measure course effectiveness more accurately. Another important implication is the creation of a more apt indicator of the socioeconomic status of the student. Whether it was due to a lack of low-income first-generation respondents, or other factors, our independent variable of generational status did not reveal the disparity that we hypothesized, so a different indicator, such as the type of school a student attended for high school, could serve as a more useful measurement of socioeconomic status (Jack, 2016). Finally, while the observation of change over time in reported course effectiveness did not yield the results we expected, the disparity between first-generation and non-first-generation students did shrink significantly, ultimately proving the importance of measuring change over time. Especially given that the mission of DCAL includes “improv[ing] teaching and learning by providing resources [and] removing barriers,” measuring change over time serves as a method of evaluating their progress, and our study proved the value of that by identifying change, if not in the way we expected (DCAL Mission, 2021).

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Methodological Appendix

DCAL Survey Statements / Questions Used to Create Study Variables

- Course Effectiveness Variable Criteria
 - The requirements for earning credit in this course are clear
 - I am able to access the course materials (lectures, readings, assignments, etc.)
 - There are opportunities to engage with other students
 - There are opportunities to engage with my instructor(s)
 - I know where to get help if I need assistance with my coursework
 - I am confident I can reach my instructor(s) if I have questions
- Access to Technology Mediator Criteria
 - My Internet connection is sufficient to enable full participation in my courses
 - I have access to the technology necessary to succeed in my courses
 - My computer is capable of running all the software needed in my courses
- Technological Cultural Capital Mediator Criteria
 - I know where to get help if I'm experiencing equipment or Internet connectivity issues
 - I know what software and technology tools are available to me as a student
 - I know where to get help if I need assistance with technology

Study Hypotheses

H1: Compared to non-first-generation students, first-generation students are more likely to report a lower perceived course effectiveness.

H2: The disparity in reporting of perceived course effectiveness between first-generation and non-first-generation students will be explained or mediated by access to technology.

H3: The disparity in reporting of perceived course effectiveness between first-generation and non-first-generation students will be explained or mediated by technological cultural capital.

H4: The disparities between the reporting of perceived course effectiveness among first-generation and non-first generation will be smaller in Fall 2020 when compared with Spring 2020.

Results from Regression Analysis

Table 2a: Two Sample Test Estimating the Association Between the SES and Course Effectiveness			
	First Generation Status		Significance Test
	Yes	No	
Mean Response	3.456 (.018)	3.411 (.007)	t = -2.376*
<i>Notes: N=1868; ***p<.001; **p<.01; *p<.05; two-tailed significance test; Standard Errors in Parentheses</i>			
Table 2b: Two Sample Test Estimating the Association Between SES and Technological Cultural Capital			
	First Generation Status		Significance Test
	Yes	No	
Mean Response	2.687 (.027)	2.706 (.009)	t = 0.713
<i>Notes: N=1868; ***p<.001; **p<.01; *p<.05; two-tailed significance test; Standard Errors in Parentheses</i>			
Table 2c: Two Sample Test Estimating the Association Between SES and Access to Technology			
	First Generation Status		Significance Test
	Yes	No	
Mean Response	3.181 (.022)	3.396 (.007)	t = 10.615***
<i>Notes: N=1868; ***p<.001; **p<.01; *p<.05; two-tailed significance test; Standard Errors in Parentheses</i>			
<i>Source: DCAL Remote Learning Survey 2020</i>			

Note: Tables 2a, 2b, and 2c display results from various t-tests. A few important things to note:

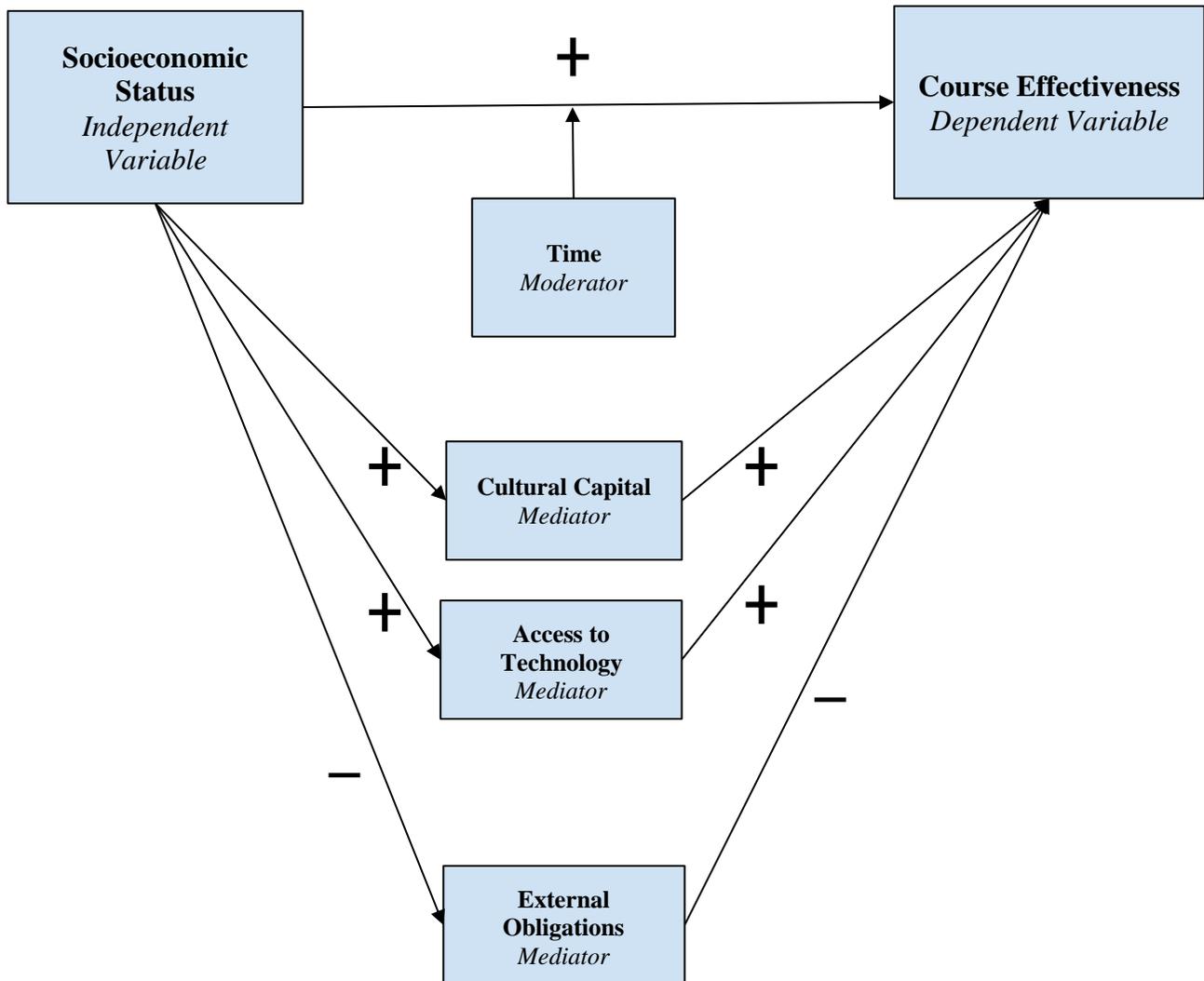
- In Table 2a, first-generation students reported, on average, a higher (by 0.04) course effectiveness compared to non-first-generation students. This created a paradoxical finding that led us to reject hypothesis one
- In Tables 2b and 2c, first-generation students reported lower technological cultural capital and access to technology. While these results support our second and third hypotheses, because we rejected our focal hypothesis, we automatically reject hypothesis two and three.

Table 3: Results from OLS Regression Models					
	Model 1	Model 2	Model 3	Model 4	Model 5
First Generation Status (1=yes)	0.045 (.024)	0.048 * (.024)	0.098 *** (.023)	0.087 *** (.023)	0.085 * (.037)
Tech Cultural Capital		0.154 *** (.011)		0.079 *** (.012)	
Tech Access			0.245 *** (.016)	0.188 *** (.018)	
Change Over Time					.0817 *** (.017361)
Firstgen*Change Over Time					-.084 (.049)
Constant	3.412 *** (0.009)	2.993 *** (0.034)	2.580 *** (0.058)	2.558 *** (0.058)	3.372 *** (0.013)
R-Squared	0.001	0.049	0.069	0.077	0.006
<i>Notes: ***p<.001; **p<.01; *p<.05; two-tailed significance test; N=1868</i>					
<i>Standard Errors reported in parentheses</i>					
<i>Source: DCAL Remote Learning Survey 2020</i>					

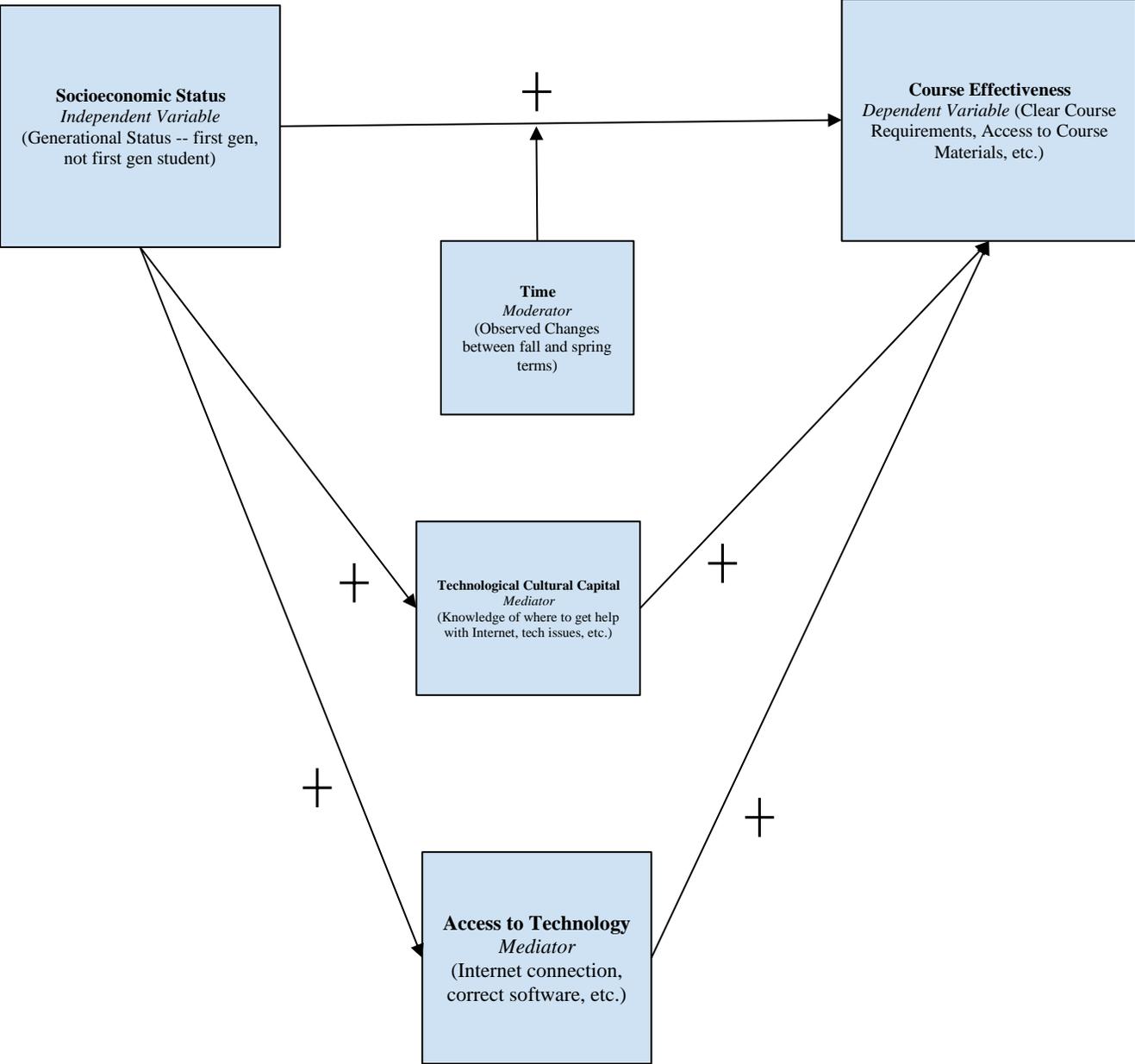
Note: Table 3 displays the results from our regression analysis. A few important things to note:

- The value in Model 1 of 0.045 represents the difference in average reported course effectiveness between first-generation and non-first-generation students (that is, 0.045 indicates the amount by which first-generation students reported higher course effectiveness, on average)
- The value of 0.154 in Model 2 and 0.245 in Model 3 indicate that, when controlling for our mediators, the initial disparity in average reported course effectiveness between first-generation and non-first generation actually increases. This proves our second and third hypotheses wrong, but the amount by which the disparity increases does prove that these mediators are indeed important in the focal relationship

Conceptual Model

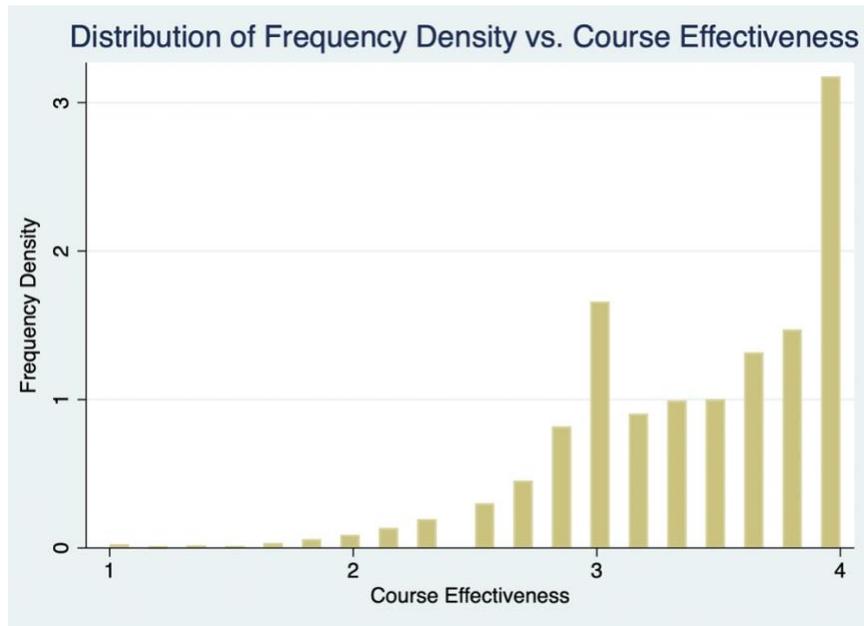


Operational Model



Note: The conceptual model presents our proposed relationships based on our research while our operational model presents these proposed relationships in the context of the data provided in the DCAL study. It is important to note the ways in which the variables are defined in the operational model (Ex: socioeconomic status as generational status of the student). Also, external obligations were not able to be adequately measured given the data.

Histogram of Course Effectiveness



Note: This histogram displays the reported course effectiveness levels for all student responses. This provides a clearer picture of the high mean reported course effectiveness overall and the low standard deviation.

Stata Coding Do and Log Files

Do File: https://drive.google.com/file/d/1GNiUsLYMDa7W0eDFYSKKf5_ay2uYvBk/view?usp=sharing

Log File: https://drive.google.com/file/d/1thuQ4YyaPMFNdDTUgAuxfELXZ5gcD2v_/view?usp=sharing

Note: These files detail the coding that went into the creation of our variables and restrictions applied to our sample discussed in the Data / Methods section, as well as the statistical tests carried out that led to our discussion in the Results section.