

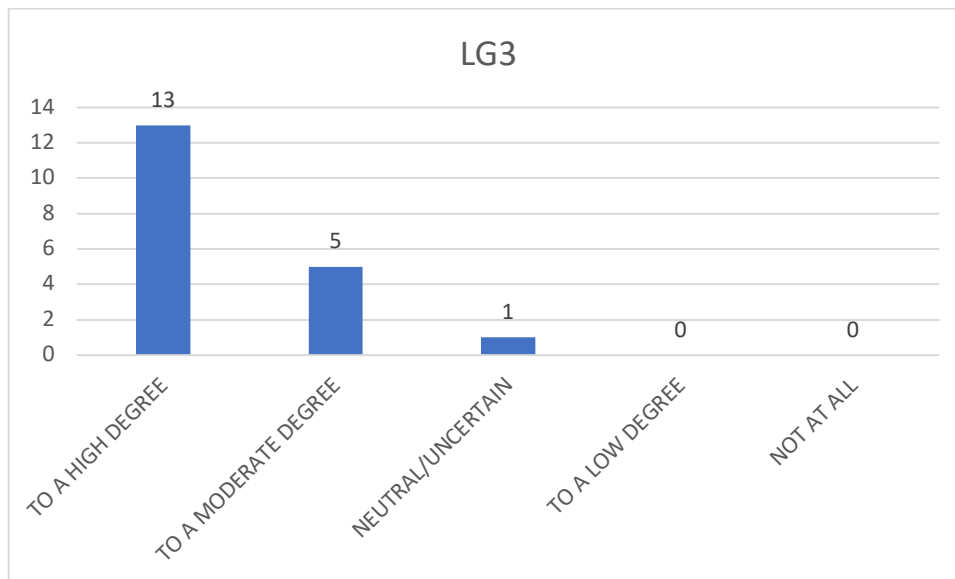
## Economics and Business Annual Assessment report 2019-2020

While the Economics and Business department gathered direct and indirect data on all learning goals and discussed this at our annual assessment meeting, in 2019-2020 the department is focusing on LG3:

**Students' ability to apply discipline specific tools of critical analysis and problem solving to contemporary social and political issues.** There were two issues we were focused on pursuant to this goal. One is our regular assessment of this as our students finish their degree. The second was a detailed analysis of both mathematical skills in our students (our main “discipline specific tool of analysis”) and the removal of the MATH 120 requirement in the major.

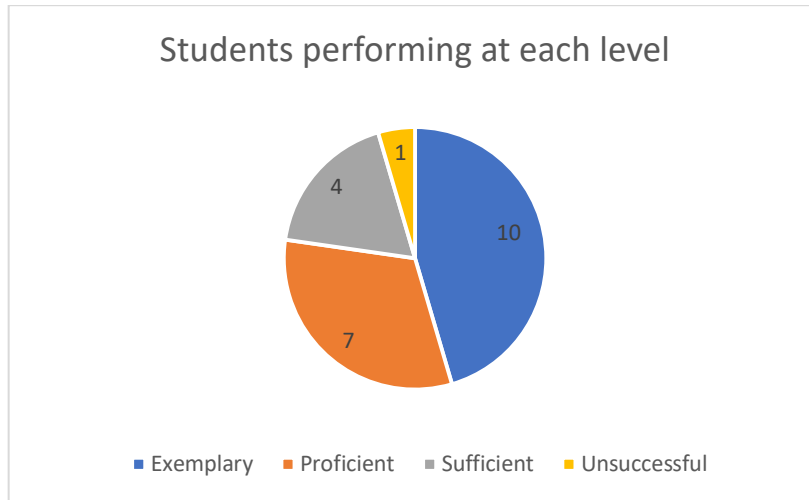
### Indirect assessment through the Senior Survey

In 2018-19, we had relatively low response rate for our senior survey (8). We had several ideas for increasing response rate, but due to campus closing for COVID19, several of these ideas were not able to be implemented. Our response rate in 2019-20 was 11. For the purpose of this report, we are aggregating the two years. It is perhaps not surprising, given the sudden shift to online courses, that all scores were slightly more negative in 2020.



On a scale of 1-5 with one being that completing the requirements for the major helped students achieve this goal to a high degree, the average score was 1.37. Students clearly feel that the department is contributing to their learning of these skills.

## Direct assessment occurs through the Capstone Rubrics for Corporate Strategy and Economic Research



77% of the students assessed performed this skill to an exemplary or proficient level. Only one student was unsuccessful and failed to graduate.

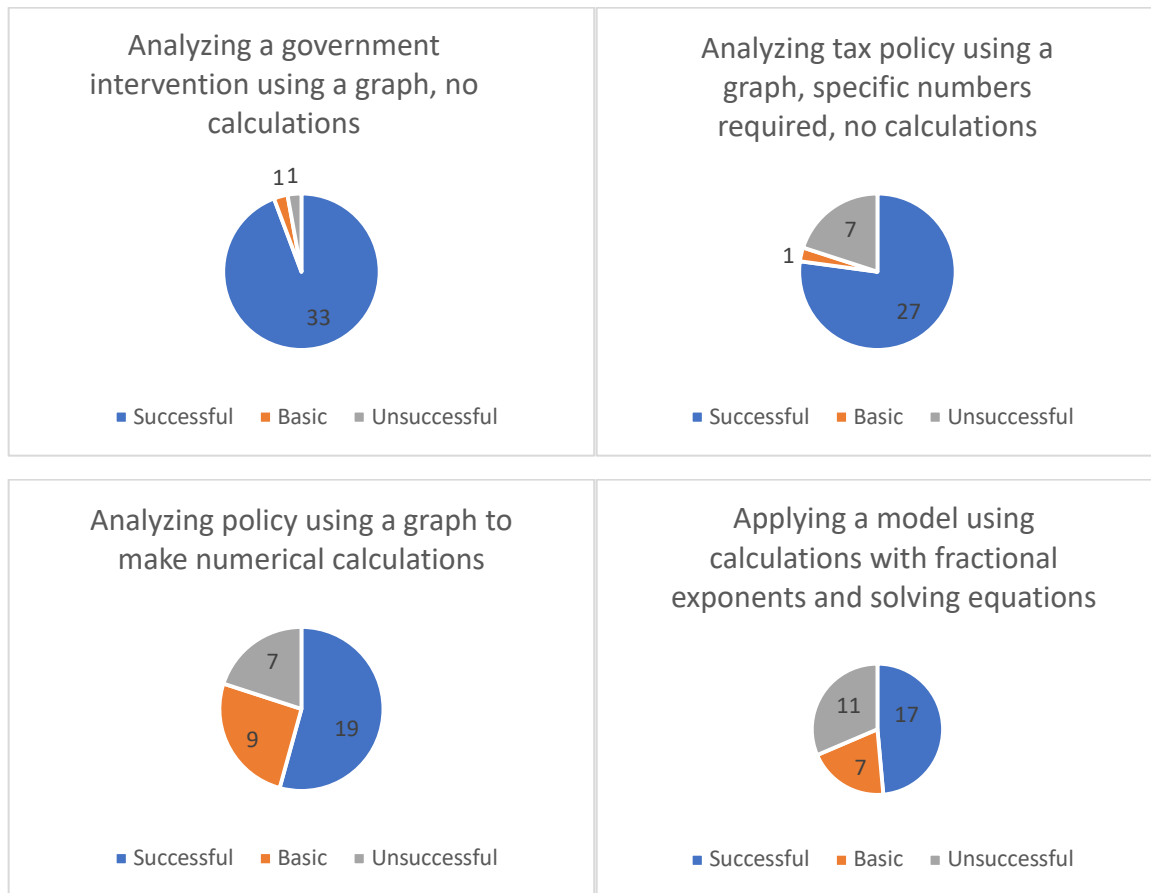
### In depth analysis of mathematical skills

We also conducted an extensive analysis of students' technical mathematical skills to both help improve their learning and determine whether removing the MATH 120 requirement from the major was in students' best interest.

Because a significant amount of math is involved in ECON 200, Microeconomic Theory, it carried a requirement to take MATH 120, Functions and Models as either a pre-requisite or a co-requisite. Previous assessments had indicated that this course was not beneficial to students in ECON 200 (and taking it as a co-req was actually detrimental), so the ECBU department dropped this requirement beginning in the 19-20 academic year.

Our indirect assessment is asking students how comfortable they feel solving two types of problems. We then have students in a different ECON 200 section solve those same problems as a form of direct assessment. This assessment indicates that students feel comfortable with basic math skills but prove to be largely unsuccessful on the direct assessment.

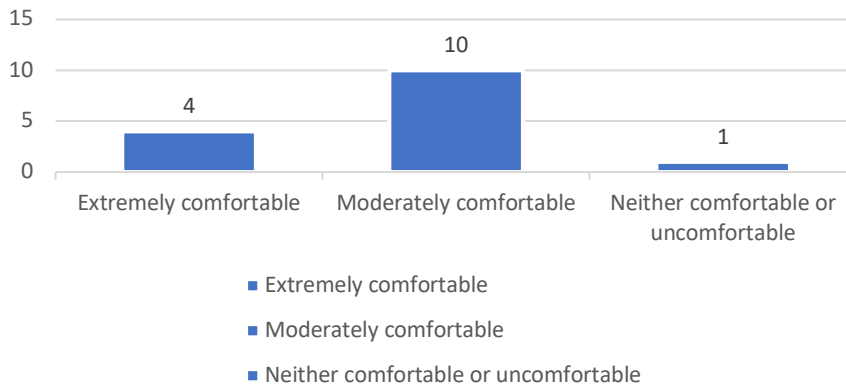
To get more information on what types of problems we might focus on, a second direct assessment was student's successful completion of 4 problems using varying methods. All 4 problems involved using various tools to analyze a social or political issue. Students were classified as successful if they correctly solved at least 80% of the problem. Students above 60% were deemed Basic, and students who could complete less than 60% of the problem correctly were classified as unsuccessful.



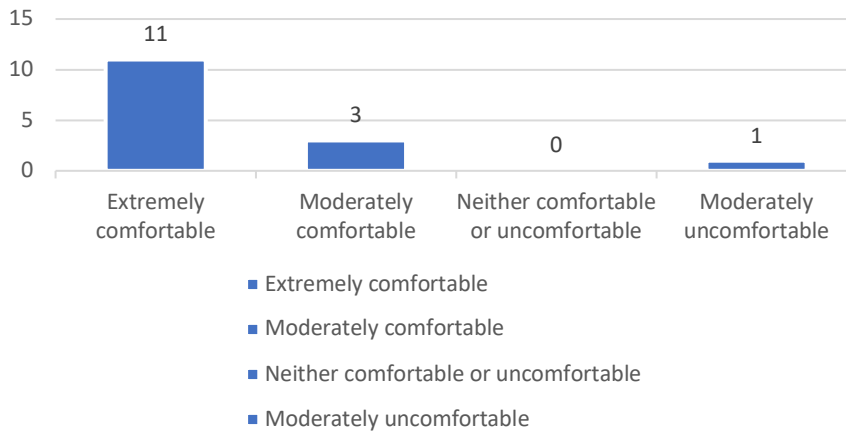
Direct assessment clearly indicates that as material requires more technical mathematical skills, students become less successful on average.

Econ 200 students were also surveyed about their math backgrounds, comfort with math, and math improvement. This survey was conducted at the end of the course. Unfortunately, the end of the course was after students had left campus due to COVID19, so the response rate was 43%. In the previous year, the same survey was given to students. The response rate was higher, but the results are very similar. Almost all students felt comfortable graphing an equation. More than half felt comfortable solving for X with fractional exponents.

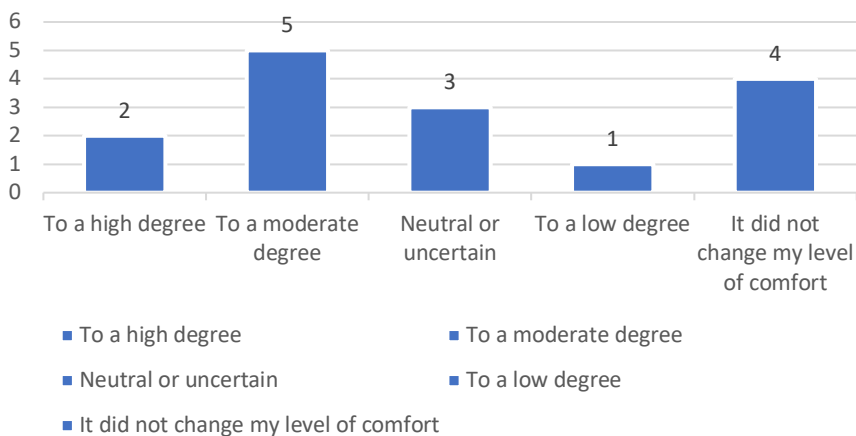
### How comfortable do you feel with math?



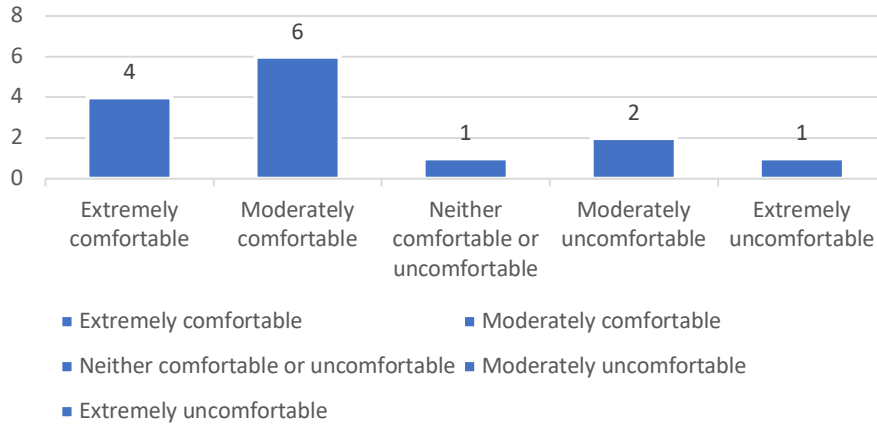
### How comfortable do you feel graphing an equation like $Q=2000-15P$ ?



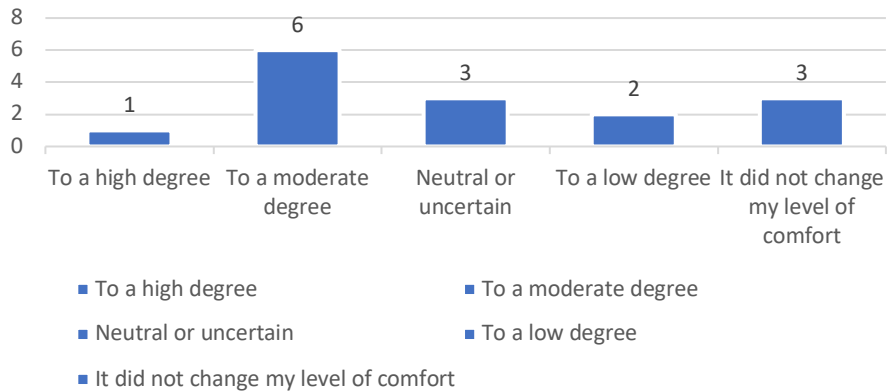
### To what degree did taking this class improve your comfort with graphing an equation like $Q=2000-15P$ ?

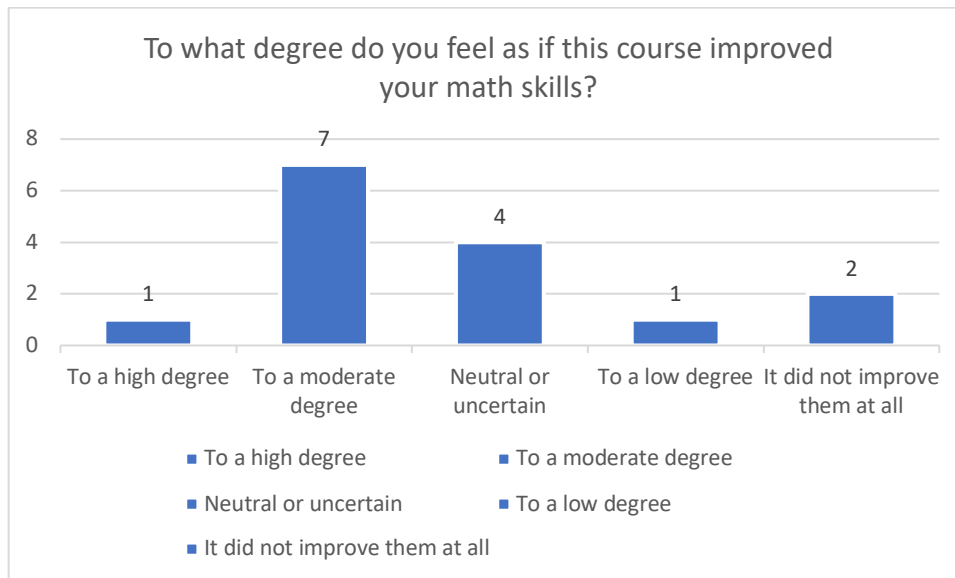


How comfortable do you feel solving for X in an equation like  $X^{1/4} = 9 \cdot X^{-1/4}$ ?



To what degree did taking this class improve your comfort with X in an equation like  $X^{1/4} = 9 \cdot X^{-1/4}$ ?





Two learning goals of ECON 200 are related to problem solving:

- Strengthened problem solving and graphing skills and developing an understanding of how mathematical models can apply to human behavior.
- The ability to identify and analyze concepts with economic tools to address real-world scenarios.

Only a little over half of the students felt that their math skills had been improved. To ensure that students are on track to meet our department goal of LG3, more analysis was done to see if this was a problem. If students reported that the course did not improve their math skills because their technical skills exceeded the level of math required for this course, this report is not worrisome. The correlation between “how comfortable do you feel with math” and “to what degree do you feel as if this course improved your math skills” is  $-.6355$ , meaning that students who feel more comfortable with math are less likely to feel as if the course improved their math skills. As the math skills required for this class are largely basic algebra, this is not surprising. In fact, a regression of “comfortable with math” and “course improved your math skills” indicates that a one point increase in self-reported math comfort leads to a 1.3 point reduction in self-reported math skills improvement ( $p=0.011$ ). Interestingly, a regression of “math background prepared me for this course” and “course improved your math” indicated no statistically significant relationship. This evidence in favor of the removal of the pre-requisite class.

The math survey also asked students what the highest math that they took in High School was and what the highest math they took at Hendrix was. Using this, I constructed two dummy variables to use in the analysis. The first was equal to 1 if the student took Calculus in High School. The second was equal to 1 if the student took Functions and Models or a higher math course Hendrix (the old major requirement). Unsurprisingly, students who took math at Hendrix found the Micro class to have improved their math skills by one point less than those who did not take math at Hendrix ( $p=.06$ ).

Students in this course also overwhelmingly indicated that the course helped develop their understanding of how mathematical models apply to human behavior: a question clearly linked to the department learning goal of applying “discipline specific tools of critical analysis and problem solving to contemporary social and political issues”

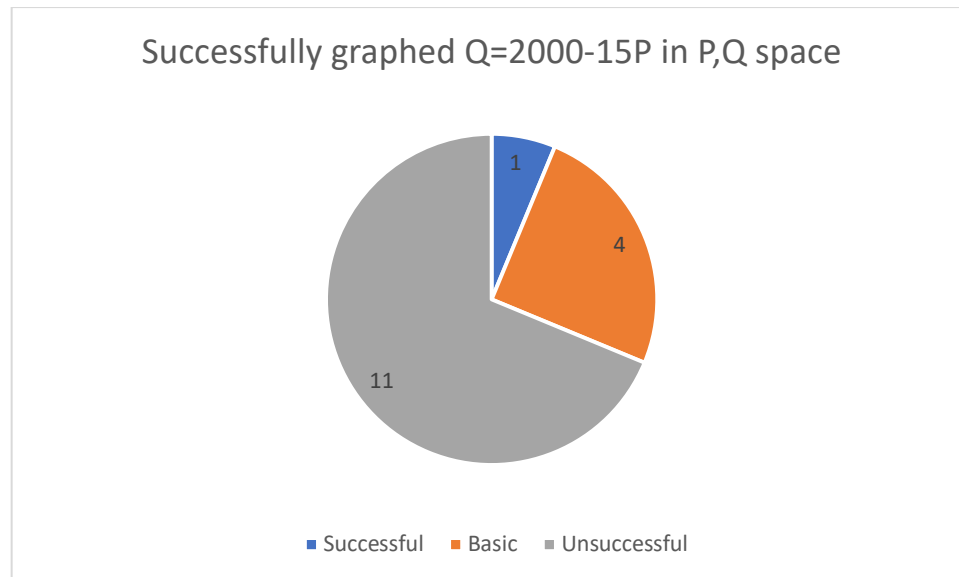
11 - This course helped develop my understanding of how mathematical models can apply to human behavior					
Response Option	Weight	Frequency	Percent	Percent Responses	Means
Strongly Disagree	(1)	0	0.00%		4.39
Disagree	(2)	1	5.56%		
Neither agree nor disagree	(3)	0	0.00%		
Agree	(4)	8	44.44%		
Strongly Agree	(5)	9	50.00%		
Response Rate				Mean	STD
18/35 (51.43%)				4.39	0.78
				Median	
				4.50	

• Every math related concept was more than just math and had a reason behind it

Given this evidence, we are not concerned with the lack of overall agreement that ECON 200 improved math skills. Additional direct assessment does indicate some cause for concern, however.

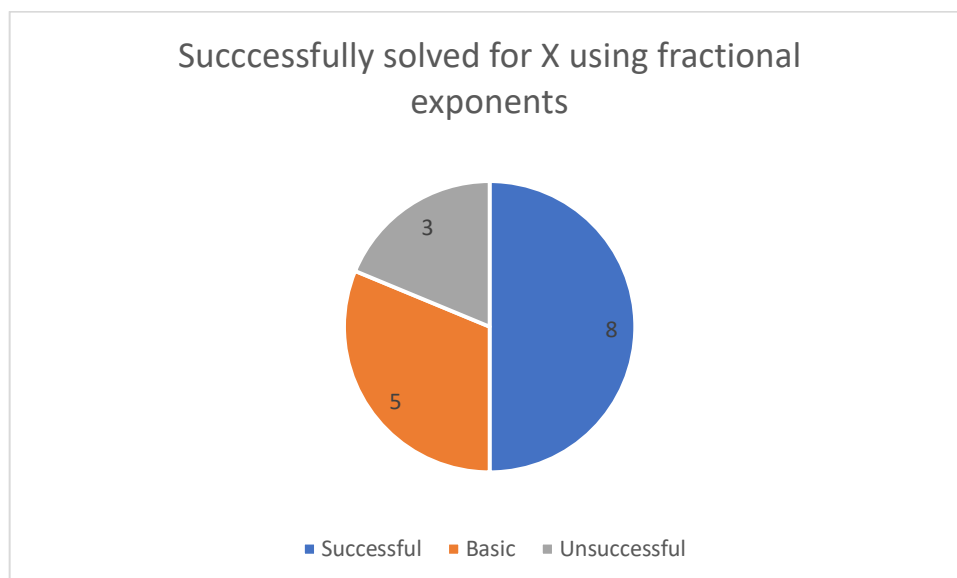
Additionally, in the Fall semester, Dr. Scott and Dr. Haden-Chomphosy had the students solve the problems from the indirect assessment. These are not the same students surveyed above, but they are students in ECON 200. Dr. Haden-Chomphosy's results are not available at this time (an oversight of leaving the state in response to the pandemic), but this report will be amended in August if his assessments indicate something different from the information presented here.

While two years of indirect assessment indicate that students feel comfortable graphing a demand equation, the direct assessment suggests a need for improvement.



Only one student was completely successful in graphing this equation (both intercepts correct). This highlights a problem we often experience in this course. Students believe that they know how to do these basic math steps, but they don't (and they discover this on an exam). We seem to have a Dunning Kruger effect in graphing equations.

While students felt less comfortable solving the equation, they were more successful.



The most common error here was getting that  $\sqrt{X} = 9$  and then finding the solution as 3. In response to this gap between the indirect and direct assessment results, the department will create problem sets with solutions that focus on these basic skills. We plan to begin using the peer learning system already in place to provide students with peers who can help them polish and practice these math skills.

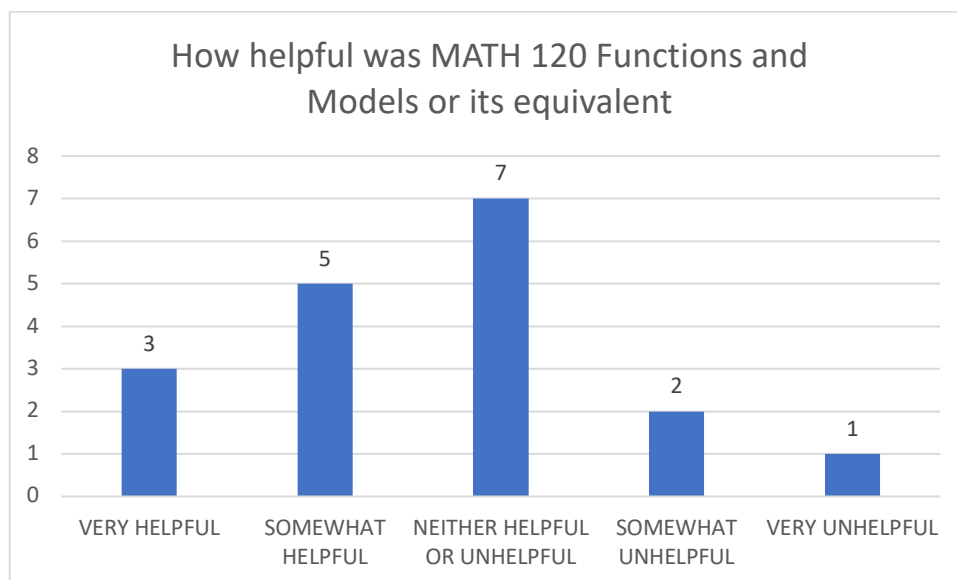
### Analyzing the 120 requirement

In terms of the MATH 120 requirement, we are interested in whether this course impacts student's ability to successfully solve problems. We are also interested in whether it impacts the students' final grades. A regression with grade (on a 4 point scale) as the dependent variable and Hendrix Math as the independent variable indicates no statistically significant relationship between the two. I also included as an independent variable the student's score on the most technical problem from the direct assessment. This regression also indicated no statistically significant relationship between the two. This is strong evidence that students did not benefit from the MATH 120 requirement.

Interestingly, in terms of final grade, the only significant variable was whether the student had taken High School calculus. Taking high school calculus does the equivalent of raising the student's grade from a C to an A. We can't claim this to be causal for many reasons, though. For one, the sample of respondents is small (15). I would also make the argument that taking calculus in High School provides us with different information than taking calculus in College. In High School, Calculus is generally the most advanced math class available, and reaching it requires students to both take math any time that they have the opportunity and begin an advanced track as early as 8<sup>th</sup> grade. In College, students can take math at any point in their career, so whether they have taken it at the time of taking ECON 200 is less strong of a signal. This strong relationship between HS Calculus and final grade is likely an indicator that of student type. If only smart and highly-motivated students take calculus in high school, we learn only that smart and motivated students perform well in ECON 200. Helping students practice regularly may be the best way to help them succeed.

In addition, Senior surveys indicate that students felt that MATH 120 was the least helpful of their graduation requirements.





#### Conclusions:

Direct assessment reveals that students struggle more with the technical aspects of mathematics. Indirect assessment suggests that they also overestimate their ability to successfully complete the more basic aspects. In response, Micro instructors will create video tutorials that walk through the technical aspects of graphing equations, solving equations, etc. Dr. Leonard is going to experiment with some aspects of a flipped classroom and give technique videos before class and spend class time working problems together.

All evidence suggests that the removal of Functions and Models has not negatively impacted students. Student grades as well as student scores on a technical problem were not statistically impacted by taking math at Hendrix. High School calculus was positively related to grades, but this is unlikely to be causal.