

Math Anxiety and its Effects on Academic Performance: A Look at Community College Students and their Decision-making

By: Matthew Sandell, Jimena Ramos, and Teresita Aragon

As mathematics and related fields see increased importance and integration across fields, many students still struggle with anxiety relating to math. Despite its prominence, the subject stands as an obstacle to many college students. Personal reasons vary, but math anxiety is prevalent in preventing students from pursuing certain degrees and career paths. To understand the formation of math anxiety and how students navigate this experience in their academic career, we conducted research focusing on students at Spokane Community College (SCC). Our conclusions are derived from a combination of quantitative and qualitative research methods. We reviewed existing literature, conducted data analysis of student behavior, and hosted a focus group to interview students at SCC. By discovering and highlighting the reasons behind math anxiety, the results of this study may be useful for administrators at SCC. Enrollment, testing, and course environments are all examples of processes that could be improved to lower the barrier of entry that math poses to students. These insights may not be unique to SCC; universities and other community colleges could use these results as a basis for their own independent research.

To start, we reviewed two articles to learn about the topic of math anxiety and how research has shown that the topic impacts students. Throughout these readings, a common theme was that math anxiety created a barrier to learning by hindering students from advancing their math skills due to avoidance and fear of failure, and it may also lead students to avoid math-intensive career fields. In the article, “From Janet T. Spence’s Manifest Anxiety Scale to the Present Day: Exploring Math Anxiety and its Relation to Math Achievement,” by Herts, J. B., & Beilock, S. L., the authors discussed the antecedents and development of math anxiety, as well as the ways in which other individual differences, such as working memory, affect the relation between anxiety and performance. In addition, they discussed Janet Taylor Spence’s work in operationalized trait anxiety by creating the Manifest Anxiety Scale, and numerous studies linking scores on this scale to performance across a variety of cognitive tasks. Next, the article “Math Anxiety: A Factor in Math Achievement Not to Be Ignored,” by Beilock, Sian L., and Erin A. Maloney, the authors discuss the phenomenon of math anxiety, and the implications math anxiety carries for math success and STEM engagement. This article gives us insights on how the U.S. is experiencing a shortage of graduates from STEM fields and how an improvement of math engagement and reduction of math anxiety could help improve this shortage issue. The knowledge gathered from these articles helped us identify questions that we would like to ask when we conduct the interview process of our research and gave us an idea of what relationships to look for when conducting dataset insights.

After covering an initial literature review, we then moved to analyzing the dataset of student behaviors and information. The goal was to identify any trends/insights before the

formulation and execution of the focus group. The dataset used contained anonymized data of 1,698 students of SCC, both past and present, with variables relating to various metrics of student behavior. Of the students in the dataset, 201 of them (11.84%) never placed in math. Furthermore, a third of students in the dataset never enrolled in math. This means there was a significant portion of students that did place but chose not to enroll in math. Naturally, we wondered why this occurs. Additionally, it took the average student approximately 8 months between their earliest placement and first math enrollment. This could imply that students face barriers to timely enrollment or maybe waiting for the right course availability. Alternatively, this may be because of the different methods of attaining placements. Regardless, it is worth noting that a large portion of students waited many months before enrolling in a math class. While inconclusive on its own, this further supports the notion that students are waiting longer than necessary to begin math at SCC and could be a topic we discuss in the focus group.

We also tested how good placements were at fitting students into classes. Running a Pearson's correlation test between first math placement and first math grade indicated an extremely weak negative correlation of -0.022 between the two variables. This means that other factors are impacting math grades, something we can investigate in the focus group. Also of note is that 6% of students in the dataset withdrew from their first math class. This could indicate being placed in a math level above their current competency level, but because the percentage is so small it is not strong enough on its own to indicate this. Additionally, when calculating the time between the first math placement and the first math class and performing a Pearson's correlation between that time and the first math grade, a weak positive correlation of 0.166 was found. This is unintuitive, as we would expect an inverse relationship – the sooner you take math, the better you perform. As with the correlation test between math placement and math grade, this data gave us something to consider asking during the focus group, but due to the weakness of the correlation coefficient, we cannot draw insights from this alone.

Drawing from these data insights, we began to prepare questions for the focus group, our next stage of analysis. The dataset led us to create questions for the focus group concerning three categories: Decision-making and academic pathways, impact of past experiences and challenges, and self-perception and external barriers.

The goal of our focus group was to conduct qualitative research by receiving real world answers from a focus group of four students attending SCC. We noticed two themes. Some students were comfortable with math and appeared to experience low math anxiety while others were not comfortable with math and experienced higher levels of math anxiety. Students that experienced low levels of math anxiety reported to have had parental help growing up and mentioned that this was beneficial in developing their relationship with math. These students began their college math journey as soon as they enrolled due to the engineering path they chose. Even though these students were comfortable with math they still experienced levels of math anxiety due to the consequences of them failing a math class. Overall, though, these students maintained a positive attitude towards math and felt comfortable in their abilities. Other students

who experienced high levels of math anxiety expressed that they had no parental help growing up and developed a negative relationship with math. This led to feeling uncomfortable in their math abilities and avoiding math while in college and steering clear of careers with higher math loads. Unlike the other group, this group did experience personal circumstances that held them back from fully engaging in math coursework to be successful. When it came to life experiences and the influences it has on math anxiety, it was apparent in our focus group that environmental factors do have some impact. Environmental factors to consider are parental influence, personal events, and academic support.

In addition to using questions to learn about the students, we also took note of their behavioral actions during the interview process. Throughout the interview it was noticed that all students were respectful and mindful of each other's experiences. Students were open and willing to share their personal math anxiety experiences which allowed us to get a clearer understanding of their journeys. Additionally, students were willing to get personal with us through the process and gave clear answers about how environmental factors influence math anxiety. This openness may have been helped by the anonymity granted to them. Each student was allowed to choose a fake name to go by during focus group, ensuring everything they shared was anonymized. The overall atmosphere of the room was welcoming; we believe that is what allowed the students to be so willing to share their stories. Due to the students being so willing to converse, this opened the room for the interviewers to share their own experiences with math and create a dialogue between both parties.

Furthermore, we compared the findings from our quantitative analysis with insights gained through our focus group. By integrating both sets of data, we created a more comprehensive understanding of the factors influencing students' decisions regarding math placement, enrollment, and success at SCC. The comparison between the dataset and focus group insights revealed both alignment and divergence in understanding students' experiences with math at SCC. The dataset showed trends such as an 8-month delay between placement and enrollment, a lack of strong correlation between placement level and grades, and a weak positive correlation between time to enrollment and grades. The focus group provided context, explaining that delays in enrollment were often due to personal factors, as seen with Stephanie, while others, like Michael and Eli, enrolled promptly due to academic requirements. Both the dataset and focus group highlighted that math performance correlates with graduation rates, with all focus group participants on track to graduate and achieve good grades. However, the focus group revealed nuances such as how personal attitudes and early experiences with math heavily influence students' enrollment choices and success, providing insights that the dataset alone could not capture. Together, they suggest that both academic factors and personal histories play significant roles in math enrollment and performance.

To conclude, our findings highlight the relationship between math anxiety and academic performance at SCC. Through a combination of quantitative analysis and qualitative research, we identified key factors that influenced students' math experiences. This included the delay in math

enrollment, the weak correlation between placement and performance, and the significant role that personal experiences play in shaping attitudes toward the subject. Our quantitative analysis helped us uncover what is happening within the student population, revealing trends such as the 8-month delay between math placement and enrollment. On the other hand, our qualitative research provided the reason behind these trends. Through the focus group interviews, we learned about personal and emotional factors that contribute to math anxiety, such as negative past experiences, lack of parental support, and lack of confidence in math abilities. Students shared how these factors influenced their decision to delay enrollment or avoid math-intensive courses. Our findings reflect that students who experience math anxiety are more likely to avoid math courses and math-intensive careers, while those with positive early experiences tend to feel more confident and engage more readily in their math education.

While these insights can help inform administrators and faculty on potential improvements, the scale of this project is too small to support the conclusions empirically. While everything was done to ensure high-quality data, the given students that were interviewed may be outliers or not accurately represent overall student sentiment. Therefore, we would recommend in the future conducting numerous focus groups of 4 to 8 people each. The more separate focus groups conducted, the better idea administrators can get about the overall feeling of students. Additionally, if resources permit, it would be advisable for SCC to reach out to other community colleges and universities in the area, such as Spokane Falls Community College, Eastern Washington University, Whitworth University, and Gonzaga University. This could give a broader indication of students' attitudes towards math. The increased sample size and diversity of student population across colleges would increase the probability of high-quality, representative data.

References

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