



SAN DIEGO STATE UNIVERSITY

College of Education

# Math Anxiety and Academic Success for Future Educators

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## BACKGROUND

This project is third in a series of related College of Education Data Champions projects. Year 1 identified groups of liberal studies transfer students delayed in their major and not graduating on time. Year 2 identified significant relationships between transfer student delays and low math course grades/assessment scores, with evidence of disproportionate impact for Pell Grant recipient and first generation students. Now, Year 3 will explore the relationship of math anxiety to academic success for currently enrolled liberal studies students.

### California has a predicted deficit of 2 million degrees by 2025.

Millions of Californian lack the required credential or degree to benefit from California's projected economic growth. The California State University (CSU) publicly committed to improved graduation rates and zero achievement gaps by 2025. To reach these goals, we must identify students needs at the program level, and disaggregate by student groups.

### Liberal Studies advisors recommended exploring the connection between mathematics and student success.

This is an issue of equity. We want to encourage students to see themselves as confident problem solvers who can make valuable mathematical contribution, and to be confident and enthusiastic when teaching math to young minds (Aguirre, Mayfield Ingram, & Martin, 2013; Ching, 2018)

### Math anxiety is prevalent in pre-service teachers.

For decades, research in education has addressed the impact of math anxiety on course outcomes for pre-service teachers (Bursal, Murat & Paznokas, 2006; Johnson & VanderSandt, 2011), as well as the potential for negative impact on future students (Uusimaki & Nason, 2004) and especially female students (Beilock, Gunderson, Ramirez & Levine, 2010).

### Low grades impede progress, damage confidence and add to student debt.

Low grades are known to negatively impact student retention and graduation rates by impeding student progression (Bahr, 2009; Yue & Fu, 2017), to damage academic confidence (Fowler & Boylan, 2010), increase the cost of college, and add to student debt (Britt, Ammerman, Barrett & Jones, 2017).

## RESEARCH QUESTIONS

For Liberal Studies students:

- Is there a relationship between math anxiety and math course outcomes?
- Is there a relationship between math anxiety and total grade point average?
- Is there a relationship between math anxiety and math placement assessment scores?
- Do math anxiety scores differ between transfer students and first-time students?
- Do math anxiety scores differ for traditionally underserved students?
- Do math anxiety scores differ by transferring institution?

## METHODS

### Preparation: Update of Previous Results

The team updated key data views from 17-18 and 18-19 Data Champion projects with current data and confirmed that trends exhibited in previous studies were continuing.

### Data Collection: Math Anxiety Survey

Liberal Studies students enrolled Spring 2020 at San Diego State University (N=105) completed an online survey based on the 14-question Math Anxiety Scale - Revised (MAS-R) (Bey, Wang, Pan & Frey, 2009). College of education academic advisors visited course sections of TE 170, ED 200, LIBS 300 and LIBS 498, and administered the survey which could be completed on students' computer, tablet or phone. Participation was optional.

### Data Exploration

Using Tableau Software, the team explored potential relationships between math anxiety survey scores, academic outcomes and student groups.

### Data Analysis

In SPSS, the team employed independent t-tests and analyses of variance to determine if total math anxiety scores differed by student group, and correlation analyses to identify significant relationships (if any) between math anxiety and academic outcomes.

### Data Sources:

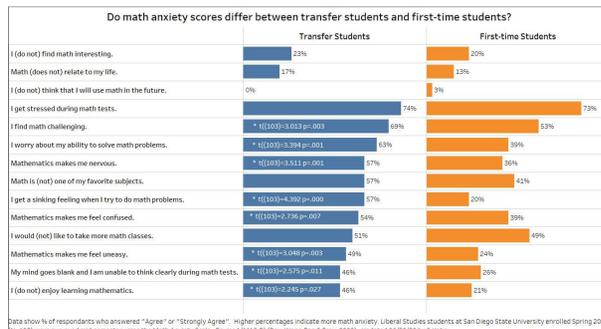
SDSU SIMS/R, queried by Sandra Kahn using PLSQL in Oracle Application Express

SDSU Data Champions Longitudinal Data Set

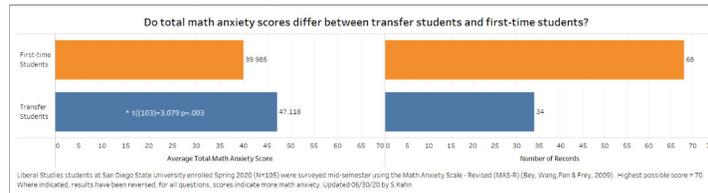
Survey of Liberal Studies Students Learning and Using Math, deployed Spring 2020 using Qualtrics

## FINDINGS

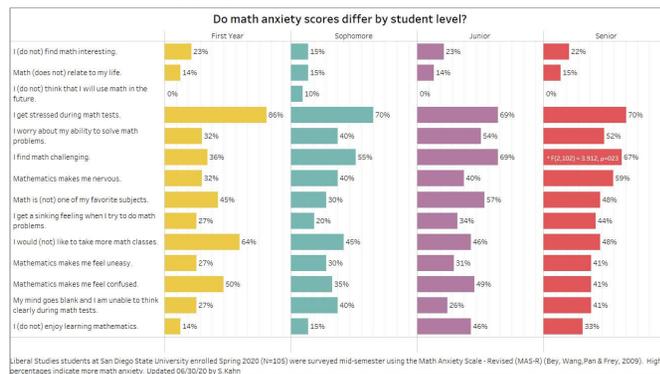
Transfer student math anxiety scores are higher, for 8 of 14 questions.



Transfer student total math anxiety scores are higher.



Seniors find math more challenging, compared to first year students.



There are significant and negative relationships between Math Anxiety and Academic Measures.

	Correlation Coefficient
Total GPA	<b>-0.301**</b>
GPA Average in Lower Division Math Courses	<b>-0.388**</b>
GPA Average in Upper Division Math Courses	<b>-0.058</b>
SAT_Math	<b>-0.509**</b>

\* p < .05

## DISCUSSION

### Observations

- Higher levels of math anxiety in Liberal Studies transfer students, versus first time students.
- Evidence of more math anxiety amongst seniors, as compared to first year students.
- Negative relationship between math anxiety and academic outcomes such as GPA.
- No significant differences for other student groups.

These observations are consistent with academic advisors' experiences with students. They note that upper division courses become "make or break" points, with high stakes requirements that include passing math assessment(s).

### Recommendations

#### Liberal Studies Summer Bridge

For first time and transfer students. Provides opportunity to build community, pass required math assessments in a supportive and low stress environment, and engage in academic scheduling.

#### College of Education University Seminars

For first time and transfer students. Builds navigational, study and neurocognitive (sense of belonging, self-compassion, etc.) skills. Specifically addresses math anxiety and test-taking.

#### Liberal Studies Workshop Series

Pending available funding for summer programming or university seminars, online/recorded workshops with guest speakers on topics such as math anxiety, test taking skills and mindfulness.

#### Math Courses Designed for Future Educators

Use of pedagogy that focuses on teaching applications (Van der Sandt & O'Brien, 2017), de-emphasizes exams (Beilock, 2008), and uses manipulables (Tooke & Lindstrom, 1998).

### Future Research

- Student interviews to gain insight into math anxiety, as well as out of school factors that influence progress to degree completion
- Pre- and post- MAS-R survey to assess Liberal Studies student math anxiety, for students who attend workshops, summer bridge or university seminar.

## REFERENCES

Bai, Haiyan, Wang, LiShing, Pan, Wei, & Frey, Mary. (2009). Measuring mathematics anxiety: Psychometric analysis of a bidimensional affective scale. *Journal of Instructional Psychology*, 36(3), 185-199.

Beilock, S. L., Gunderson, E. A., Ramirez, G, & Levine, S. C. (2010). Female teachers' math anxiety affects girls' math achievement. *Proceedings of the National Academy of Sciences - PNAS*, 107(5), 1860-1863.

Beilock, S. L. (2008). Math Performance in Stressful Situations. *Current Directions in Psychological Science*, 17(5), 339-343.

Bursal, Murat, & Paznokas, Lynda. (2006). Mathematics Anxiety and Preservice Elementary Teachers' Confidence to Teach Mathematics and Science. *School Science and Mathematics*, 106(4), 173-180.

Britt, S. L., Ammerman, D. A., Barrett, S. F., & Jones, S. (2017). Student loans, financial stress, and college student retention. *Journal of Student Financial Aid*, 47(1), 1-14.

Ching, Cheryl D."Confronting the Equity "Learning Problem" through Practitioner Inquiry." *The Review of Higher Education*, vol. 41 no. 3, 2018, pp. 387-421.

Fowler, P. R., & Boylan, H. R. (2010). Increasing student success and retention: A multidimensional approach. *Journal of Developmental Education*, 34(2), 2-4.

Johnson, B. & VanderSandt, S. (2011). "Math makes me sweat." The impact of pre-service courses on mathematics anxiety. *Issues in the Undergraduate Preparation of School Teachers: The Journal*, 5, Karunakaran, M. S. (2020). Opportunities to Decrease Elementary Prospective Teachers' Mathematics Anxiety. *The Mathematics Enthusiast*, 17(2/3), 469-492.

Uusimaki, L. & Nason, R. (2004). Causes underlying pre-service teachers' negative beliefs and anxieties about mathematics. *Proceedings of the 28th Conference of the International Group for the Psychology of Mathematics Education*, 4, 369-376.

Van der Sandt, Suziza, & O'Brien, Steve. (2017). Impact of instructor teaching style and content course on mathematics anxiety of preservice teachers. *Journal of Technology Education*, 29(1), 95-111.

Yue, H., & Fu, X. (2017). Rethinking graduation and time to degree: A fresh perspective. *Research in Higher Education*, 58, 184-213.

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