Exploring Mathematic Struggles Among STEM Students at Fairmont State University

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Introduction

Mathematics serves as the cornerstone of every STEM major, and proficiency in this subject is paramount for achieving academic success, societal integration, and meaningful participation in the workplace. However, numerous students encounter challenges in mastering math concepts. In West Virginia (WV), students face an additional hurdle, poverty, with households in the state ranking among the lowest in the nation. This has significant implications for funding and resource availability in the WV School System (Fig. 5). Since The Coleman Report (1966) numerous studies have emphasized the significant impact of socioeconomic status (SES) on academic success. Students from lower SES backgrounds often encounter barriers such as limited resources and opportunities, which can affect their overall academic performance, particularly in math. Recognizing this correlation guides the creation of targeted interventions, such as tutoring and support programs, designed to ensure equitable access to math education for all students.

Purpose

The purpose of this research is twofold: 1) investigate the impact of students' SES and views of math; 2) explore the intricate relationship between sociocultural variables and academic performance. This exploration is essential for identifying and addressing disparities in education and for implementing vital support mechanisms.

Methods and Materials

- Administered a cultural survey (Laubach and Stamper, 2015) in 50 STEM courses at Fairmont State University (n = 447).
- Collected data on tutoring from the Fairmont State University Learning Enrichment and Academic Development (LEAD) Center
- Data were analyzed in PAST (Paleontological Statistics - Hammer et al., 2001).

Results

447 participated, 375 completed over 60% of the survey. STEM and Health Sciences made up 87% of the population. Demographic data is available in Figure 1. 87.3% identified as white, 3.8% black, 2.5% Latino, 1% American Indian, 1% Asian, 1% Middle Eastern, 3.4% mixed races. 82% are middle class, 13% working class, and 4% are on assistance. 61% are from nuclear families, 13% single families, and 25% live with non-relatives. 29.5% are first generation; 62% are within their first two years of study. The most common math completed in high school was algebra (24.8%), trigonometry (34%), and calculus (24.4%). Math made up 50% and chemistry 37% of requested tutoring subjects in STEM and 69.7% receiving tutoring were in their first two years (Fig. 2). PCA results 36.3% of variability is PCA 1 (29.4%) and PCA 2 (6.9%) (Fig. 3) Results varied when comparing SES, family dynamic, and views on math/science (Fig. 4). On average 46%. Results were compared via chi-square to determine intersectionality of variables, but results were not significant. Family dynamic and enjoyment of math (p=0.5) and science (p=0.7), SES and enjoyment of math (p=0.3) and science (p=0.8). We also examined first-generation status and math (p=0.6). 54% of students did not feel prepared for college. SES and preparation (p=0.1), family dynamic (p=0.2), first-gen (p=0.1). SES and GPA were not significant (p=0.3) but family dynamic and GPA were (p=0.05).

Spearman RS correlation results showed a very strong correlation between age and science (0.99; p=0.0003) and a strong correlation with math (0.6; p=-0.03). A very strong correlation between age and having a good science teacher in school (0.8; p=-0.03)and a good math teacher (0.7; p=-0.02). A strong correlation between SES and having a good science teacher (0.8; p=0.01) and enjoying math (0.5; p=-0.03).

Conclusion

Many variables seem to influence a student's likelihood of success in math. SES and family dynamic, though not always statistically significant seem to be the biggest drivers in GPA, teacher support, and college preparedness. The data suggests a systemic issue influenced by the economic status of the state and familial dynamic. Most students seeking tutoring displayed deficiencies in fundamental algebraic skills, writing proficiency, or both.

Acknowledgements

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Socioeconomic status and family dynamic are the largest drivers of academic and mathematic success

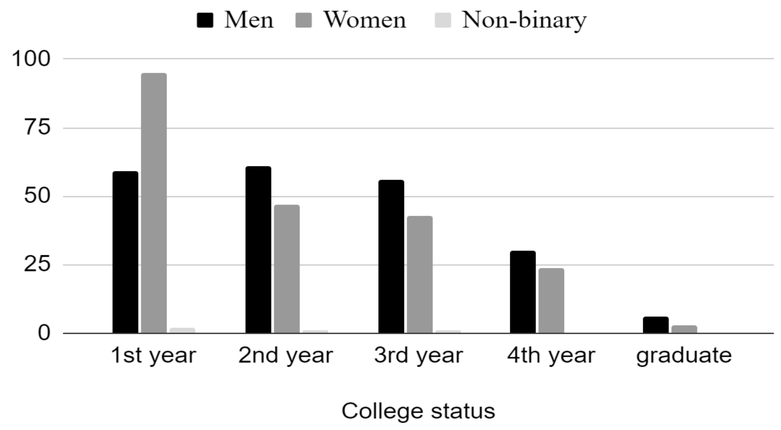


Figure 1. Sex and college status of sample

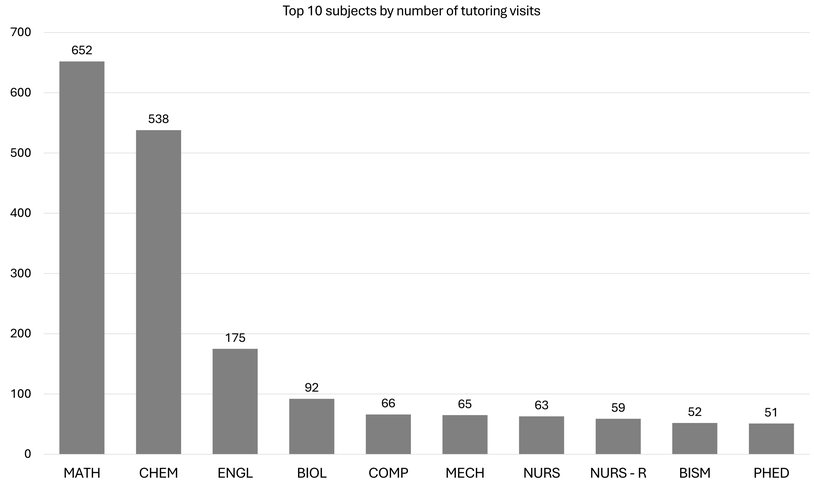


Figure 2. Number of tutoring visits by subject for 2022 – 2023 academic year.

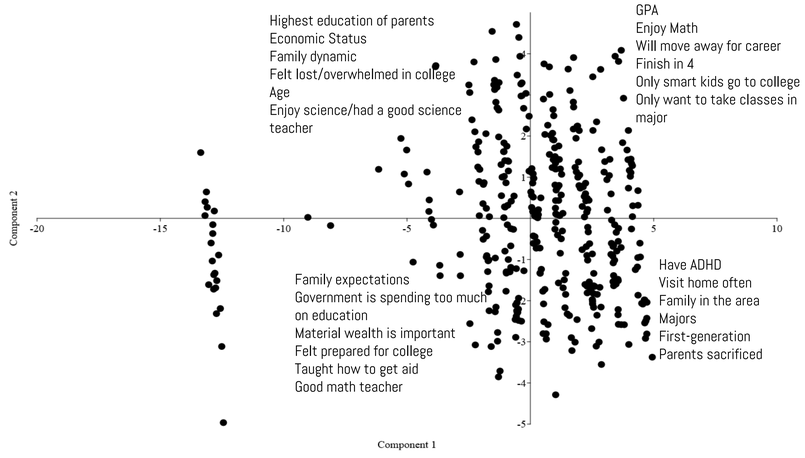


Figure 3. PCA showing 36.3% of variability. Outliers did not answer all questions.

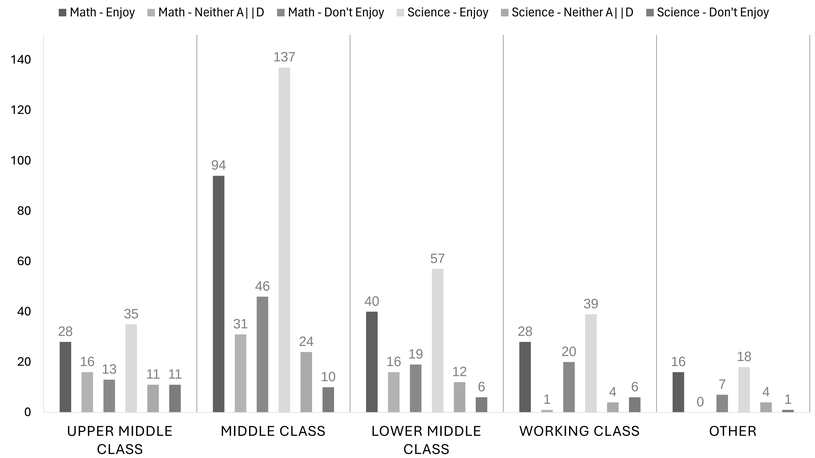
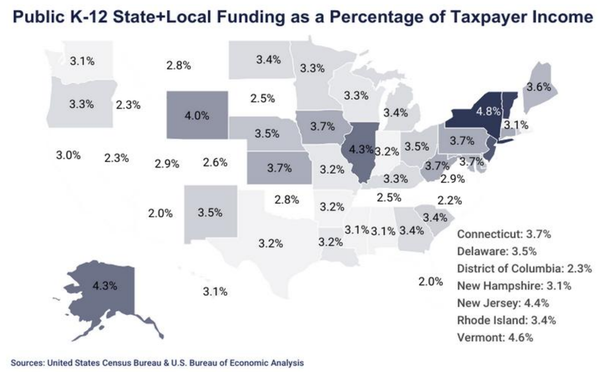


Figure 4. Student views on math and science separated by SES and family dynamic.



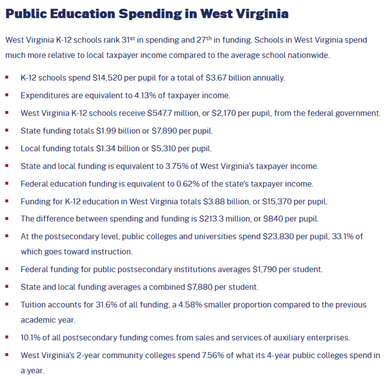


Figure 5. K-12 spending rates country and state compared (US Census, 2022).

References