ACHIEVING EQUITY AND EXCELLENCE: A MULTILEVEL MODELING OF THE RELATIONSHIPS AMONG SCHOOL CLIMATE, STUDENTS' MOTIVATION, AND ACHIEVEMENT WITH TIMSS 2019

Yao Yang, Ph.D. candidate, Purdue University, yang1707@purdue.edu
Tugce Karatas, Ph.D. student, Purdue University, tkaratas@purdue.edu
Tybresha Ebony Glass, Ph.D. student, Purdue University, glass29@purdue.edu

Abstract

This study examined the effects of students' motivational factors and school climate factors on eighth-grade math and science achievement in the U.S. using data from the 2019 Trends in International Mathematics and Science Study (TIMSS). Two-level, cross-sectional hierarchical linear models were developed to analyze the data. The results showed that there was a significant variation in math and science achievement across schools. Only students' confidence in math and school SES had statistically significant effects on students' math achievement. School location and school SES had statistically significant effects on science achievement.

Analysis and Results

The purpose of this study was to understand how and to what extent school climate and motivational factors impacted U.S. 8th grade students' math and science achievement in TIMSS 2019. HLM 8.0 was used to create a sequence of two-level cross-sectional models.

The unconditional model ($Math\_achievement_{ij} = \gamma_{00} + u_{0j} + r_{ij}$) showed that the grand mean of the mathematics achievement scores in this model (γ_{00}) was 489.97 (SE=22.46, $p < .001$). The calculated ICC values was 0.642, which meant that about 64.2% of the total variance in the eighth-grade mathematics achievement in this model was accounted by between-school heterogeneity. A total of four two-level conditional hierarchical linear models (HLM) models were applied to explain the variation in the mathematics achievement outcome. We found no statistically significant effect of home resource, sense of school belonging, and student bullying. Math confidence (γ_{50}=16.09, SE=2.58, $p <.001$) had a statistically significant effect on students' math achievement. It indicated that a one-point increase in the score of math confidence resulted in a 15.72-point increase in math achievement. School SES (γ_{02}=-57.44, SE= 20.61, $p<.05$) and school emphasis on academic success (γ_{04}=9.85, SE= 4.39, $p<.05$) also had significant effects on students' math achievement.

The same two-level, cross-sectional HLMs were created for science achievement. The null model showed that the overall mean school science achievement was 503.94 points (SE=17.96, $p < .001$). It also revealed that 44.94% of the variance in science achievement was explained by between-schools heterogeneity. It showed that both school location (γ_{01}=13.65, SE= 5.26, $p< .01$) and school SES (γ_{02} = -59.76, SE= 19.25, $p < .01$) explained the variation in the intercepts across schools with statistically significance.

The results of this study showed that the variation in eighth-grade math and science achievement among U.S. schools was statistically significant. Findings from this study align with the literature on the effects of math confidence on math achievement (Ganley & Lubienski, 2016). Also, the substantial effect of school SES for both math and science achievement highlights the significant role schools have on promoting students' academic development.

References

Ganley, C. M., & Lubienski, S. T. (2016). Mathematics confidence, interest, and performance: Examining gender patterns and reciprocal relations. *Learning and Individual Differences*, *47*, 182-193. https://doi.org/10.1016/j.lindif.2016.01.002