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Learning Statistics Through Collaboration and Music: The Case of Albums and Algorithms

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Problem and Research Question

Albums and Algorithms is a large general education introductory statistics course at a research university. To foster a supportive classroom environment, learning, engagement, and statistics self-efficacy, concepts are illustrated through a music theme and students collaborate on a semester-long project (Bromage et al., 2022; Meng, 2009). Through a mixed-methods case study, we explored student perceptions of this approach.

Research Question: What aspects of a project-based, music-themed introductory statistics course support statistics self-efficacy and student engagement?

Method

Participants

Data were collected from 74 students across the Spring '23 semester: 41% non-White, 23% first-generation, 58% female.

Measures

Measures consisted of statistics self-efficacy, expectancy value-theory, sense of belonging, demographics, and open-ended responses. Likert measures showed good reliability across time (>.70).

Procedure

Students took the survey at three points during the semester: (a) week 3, (b) week 9, and (c) week 15.

Data Analysis Plan

Data were analyzed through a multilevel model using student ID number (level 2) as the cluster variable and fixed effects as the level 1 variable. Qualitative data from each time point were open-coded then grouped using axial coding. Authors 1 and 2 conferred to agree on code applications.

Quantitatively, statistics self-efficacy was positively predicted by time, faculty belonging, and perceptions of motivation in the class. Identifying as someone who is non-White demonstrated significantly lower statistics self-efficacy. Qualitatively, students perceived the music theme, instructors, and collaborative work as supporting student engagement.

Sig. Parameter	*B*	*SE*	*p*
Time	.36	.06	<.001
Non-White	-.46	.17	.010
BelongF	.18	.07	.011
EVT	.31	.08	<.001

**Equation:* $sse_{ij} = \beta_0 + \beta_1 wave_{ij} + \beta_2 female_{ij} + \beta_3 nonwhite_{ij} + \beta_4 fg_{ij} + \beta_5 belongingc_{ij} + \beta_6 belongf_{ij} + \beta_7 belongs_{ij} + \beta_8 evt_{ij} + u_{oj} + e_{ij}$

***Final model statistics: Conditional* $R^2 = .75$*; Marginal* $R^2 = .36$*; ICC = .61*

Supplemental Information

Quantitative Results

The model showed that variation among students impacted statistics self-efficacy. Statistics self-efficacy increased over time; being non-White negatively impacted students' statistics self-efficacy; a greater sense of faculty belonging positively impacted statistics self-efficacy, and students' value and confidence to succeed in the class positively predicted statistics self-efficacy.

Qualitative Results

Perceived **supports** included course content, especially music; instructors; collaborative pedagogy; faculty support; and recitation sections.

Perceived **challenges** included course content, especially math/statistics; course structure; and course work.

Implications

*A music theme may help students engage with statistics, which may be particularly useful for students with math/statistics anxiety.
*Students may feel engaged and supported by instructors who are transparent and success-oriented.
*Collaborative projects may foster a supportive environment and may work best in small classrooms.
*Racial inequities in SSE may reflect systemic differences that require further research.

References

Bromage, A., Pierce, S., Reader, T., & Compton, L. (2022). Teaching statistics to non-specialists: Challenges and strategies for success. *Journal of Further and Higher Education*, *46*(1), 46–61. https://doi.org/10.1080/0309877X.2021.1879744

Meng, X-L. (2009). Desired and feared—What do we do now and over the next 50 years? *The American Statistician*, *63*(3), 202–210. https://doi.org/10.1198/tast.2009.09045