Class Size, Room Setup, and Use of Group Work: Undergraduate STEM 2019-2025

Michel Manrique
San Diego State University

Naneh Apkarian
San Diego State University

Keywords: instructional practice; class size; STEM; teaching change

Despite recommendations to engage in interactive pedagogy, didactic lecture remains the primary experience of most undergraduate students in introductory STEM courses (e.g., Apkarian et al., 2021; Stains et al., 2018). Often-cited barriers to adoption of alternatives, such as group work, include large class size and auditorium-style setup, though the empirical evidence is somewhat inconclusive across instructors' experience and contexts (e.g., Ake-Little et al., 2020, Apkarian et al., 2021; Yik et al., 2022ab). We endeavor to shed further light on how these factors impact instructors' pedagogical decisions, leveraging survey data from the same individuals at two points in time: Spring 2019 and Spring 2025. Specifically, we explore the research question: *to what extent do changes in course enrollment and classroom setup relate to changes in the percentage of class time instructors report spending in group work?* For brevity, this proposal discusses only the former.

Data come from two NSF-funded projects which surveyed postsecondary instructors of general chemistry, single-variable calculus, and introductory physics across the USA. The surveys deployed in each project used web-based surveys with many identical questions; the latter additionally included items related to instructors' experience during the pandemic response teaching period, although that is not the focus of this analysis. The same roster was contacted for both projects, with a smaller response to the follow-up: $N_{19} = 3769$; $N_{25} = 933$.

Our outcome variable is the reported percentage of in-class time, during a normal week, that students are expected to work on mathematics problems in small groups. We also considered their course enrollment (binned as: 0-19; 20-29; 30-39; 40-59; 60-99; 100+) and classroom setup (easily accommodates group work; does not). Instructors' responses to these items were paired across their 2019 and 2025 responses. In total, 551 instructors' responses were available for pairwise pre-/post-analysis of these items; we admit appropriate caution about generalization in light of response bias and the complexity of the intervening years. Instructors were assigned to one of three groups based on a comparison of their class size in 2019 and 2025: increase, decrease, or no change. Three paired *t*-tests, with Bonferroni-corrected *p*-values to account for repeated testing, were conducted for class time spent in group work between 2019 and 2025. The results are in Table 1. In short, we find no differences in the amount of time spent using groupwork, regardless of whether, and how, their class size changed. Our poster will include additional details of this analysis and a similar analysis related to changes in classroom setup.

Table 1. Results of paired t-tests on instructors' reports of percentage of class time spent in group work, 2019 compared to 2025, disaggregated by changes in their course enrollment.

	Percentage of class time spent in group work: M (SD)					
Enrollment Change	2019	2025	Δ	*df*	*t*	Adjusted *p*
Increase (N = 89)	20.51 (19.96)	17.98 (18.80)	-2.53	88	-1.736	0.258
No change (N = 324)	22.24 (20.82)	24.58 (21.51)	2.34	323	2.372	0.055
Decrease (N = 138)	20.83 (18.74)	21.48 (20.43)	0.65	137	0.479	1.000

Acknowledgments

This material is based upon work supported by the National Science Foundation under Grant Nos. 2416741, 2534608 (2025-27) and 1726126, 2028134, 1726328, 1726042, and 1726281 (2017-2022). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.

References

Ake-Little, E., von der Embse, N., & Dawson, D. (2020). Does class size matter in the university setting? *Educational Researcher, 49*(8), 595–605. https://doi.org/10.3102/0013189X20933836

Apkarian, N., Henderson, C., Stains, M., Raker, J., Johnson, E., & Dancy, M. (2021). What really impacts the use of active learning in undergraduate STEM education? Results from a national survey of chemistry, mathematics, and physics instructors. *PLOS ONE, 16*(2), e0247544. https://doi.org/10.1371/journal.pone.0247544

Stains, M., Harshman, J., Barker, M.K., Chasteen, S.V., Cole, R., DeChenne-Peters, S.E., Eagan Jr, M.K., Esson, J.M., Knight, J.K., Laski, F.A., & Levis-Fitzgerald, M. (2018). Anatomy of STEM teaching in North American universities. *Science, 359*(6383), 1468-1470.

Yik, B. J., Raker, J. R., Apkarian, N., Stains, M., Henderson, C., Dancy, M. H., & Johnson, E. (2022a). Association of malleable factors with adoption of research-based instructional strategies in introductory chemistry, mathematics, and physics. *Frontiers in Education, 7*, 1016415.

Yik, B. J., Raker, J. R., Apkarian, N., Stains, M., Henderson, C., Dancy, M. H., & Johnson, E. (2022b). Evaluating the impact of malleable factors on percent time lecturing in gateway chemistry, mathematics, and physics courses. *International Journal of STEM Education, 9*(1), 1-23.