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# Homophily and heterogeneity of students' preferences increase persistence in STEM

*Keywords: Higher Education Persistence, Gender Inequality, Persistence in STEM, Network Science and Complex Systems*

## Extended Abstract

High dropout in STEM remains a significant challenge in Higher Education [1–3] with far-reaching implications like loss of talent and investment for society, as well as a significant personal setback for the individual. While several factors have been identified as contributing to student success in higher education [4, 5], the role of social support in helping students to overcome challenges and persist in STEM majors remains understudied. Research suggests that a sense of belonging and connection to peers can be crucial for encouraging students to pursue a STEM major [6] and persist in it [7], but most studies have focused on surveys of small communities. Here, we investigate social factors related to the persistence of students in STEM from administrative data from the entire Chilean higher education system between 2012 and 2022 [8] with a total of more than 850k individuals.

In Chile, students apply to higher education through a centralized admission system where students rank up to 10 programs (i.e, combined major and university choices). The system sorts applications based on a score calculated from standardized tests and high school grades, then the system allocates the programs for each student depending on the score and the program preferences. Thus, the students with higher score have higher probability of being selected to their first ranked program. A cohort then is created for a major in a university for a particular year. In order to analyze the social structure of the cohort and its heterogeneity we compute two metrics of similarity based on the comparison between their list of preferences in fields such as Informatics and Computer Science, etc. First, we compute the individual similarity as the distance between the individual preferences to their cohort. Next, we compute the group heterogeneity which is the average distance for all the individuals.

Our results indicate that students are highly dissimilar to their cohort, in a scale from 0 to 1, the students score from 0.84 to 0.87 in individual dissimilarity (Figure 1A). In particular, we found that women in STEM have the highest dissimilarity compared to men in STEM and to students not in STEM. This indicates that women that pursued a major in STEM tend to select other majors as preferences that are not necessarily chosen by their colleagues. Using a regression model, we found that a higher dissimilarity distance is robustly correlated with a lower persistence rate. Higher group heterogeneity improves the persistence rate for students in STEM and also for women not in STEM. These results hold even after controlling for other factors such as academic performance, socioeconomic background, university, year of enrollment, and cohort size.

Our findings suggest that having peers with similar preferences can be associated with higher persistence rates for both genders. However, we also found that having a diverse peer group in terms of preferences and in sex ratio positively correlates with persistence. One possible interpretation is that social support may be crucial for retaining students in STEM programs and a balance between similarity and diversity may foster an environment that promotes retention and success. These findings have important implications for creating efforts to increase diversity and inclusion not only for STEM fields but for any field.

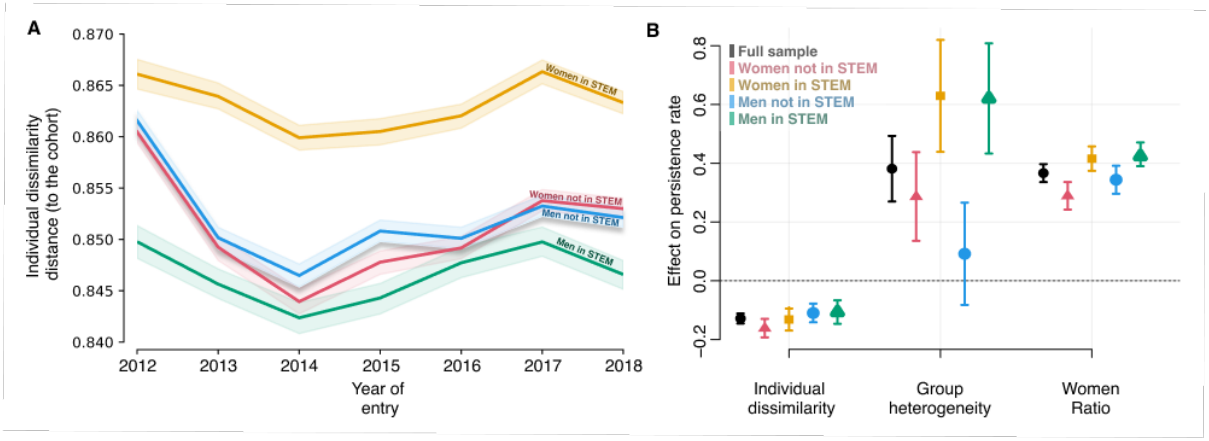


Figure 1: **(A)** Individual dissimilarity distance to the cohort disaggregated by gender groups and STEM programs **(B)** Regression Coefficients to explain persistence rate considering individual similarity and group heterogeneity (controlled by women ratio, academic performance, socioeconomic background, university, and year of enrollment).

# References

1. Sithole, A. *et al.* Student attraction, persistence and retention in STEM programs: Successes and continuing challenges. *Higher Education Studies* **7,** 46–59 (2017).
2. Slovacek, S., Miu, V., Soto, K. & Ye, H. Supporting STEM in Higher Education. *International Journal of Education and Practice* **7,** 438–449 (2019).
3. Kocsis, Z., Alter, E. & Pusztai, G. The Role of Student Employment in Persistence and Efficiency in STEM Higher Education. *International Journal of Education in Mathematics, Science and Technology* **10,** 831–848 (2022).
4. Contini, D., Cugnata, F. & Scagni, A. Social selection in higher education. Enrolment, dropout and timely degree attainment in Italy. *Higher Education* **75,** 785–808 (2018).
5. Mitchall, A. M. & Jeager, A. J. Parental Influences on Low-Income, First-Generation Students' Motivation on the Path to College. *J. Higher Educ.* **89,** 582–609 (2018).
6. Veldman, J., Van Laar, C., Thoman, D. B. & Van Soom, C. "Where will I belong more?": The role of belonging comparisons between STEM fields in high school girls' STEM interest. *Soc. Psychol. Educ.* **24,** 1363–1387 (Oct. 2021).
7. Pedler, M. L., Willis, R. & Nieuwoudt, J. E. A sense of belonging at university: student retention, motivation and enjoyment. *Journal of Further and Higher Education* **46,** 397–408 (Mar. 2022).
8. Candia, C., Encarnação, S. & Pinheiro, F. L. The higher education space: connecting degree programs from individuals' choices. *EPJ Data Science* **8,** 39 (2019).