Practicing and Teaching Reproducibility and Replicability in the Human-Environment and Geographical Sciences

Reproductions and replications (R&R) are needed in the human-environment and geographical sciences (HEGS) to evaluate the validity of findings and generalizability of theories across geographic contexts. Failures to independently reproduce the results of published studies undermine validity and ability to inform public policy. Meanwhile, the development of generalizable theory requires verification of theorized relationships across multiple independent studies. The goal of reproducing a study is to verify its findings and assess its validity by repeating the study with identical data and methods. The goal of replicating a study is to test its reliability and generalizability by collecting new data while repeating the same methods. Despite a flurry of recent publications on the topic of reproducibility in HEGS, most research publications are not reproducible and HEGS lacks a precedent for publishing reproduction or replication studies.

We will integrate discussions about integrating R&R in HEGS research and teaching with introductory technical training in tools for reproducible research and teaching. Discussions and techniques will use the case of a reproduction of a geographic COVID-19 study that was collaboratively developed with students using a new GitHub template repository for reproducible HEGS research, Open Science Framework (OSF) registration, and open source R Markdown computational notebooks.
This workshop is based on an ongoing research project to advance the production of theory in the geographical sciences by (1) identifying barriers to R&R in HEGS, (2) assessing the credibility of recent impactful studies, and (3) establishing a project-based educational model for R&R in HEGS. To date, we have (1) developed a framework for reproducible research practices in HEGS, (2) trained undergraduate and graduate students enrolled in GIScience courses in reproducible research practices, and (3) reproduced or replicated seven published studies with teams of undergraduate and graduate students.