Introduction:

Mapping, or the visualization of spatial information, is becoming an increasingly effective method for teaching college students to become adept, and critical, users of data (Kim and Bednarz, 2013). In particular, mapping/spatial visualization projects provide students in the social sciences and humanities with opportunities to develop empirical reasoning/quantitative literacy skills (Xie et al., 2018). However, few formal standardized assessment tools exist for the purposes of refining and evaluating various pedagogical approaches, especially with regard to mapping-related assignments and projects within the humanities and social sciences disciplines (Baker et al., 2015). This proposal describes a research project to develop, test, implement, and standardize an assessment tool for the purpose of evaluating the following spatial visualization-related learning goals in a liberal arts context:
- Apply principles of layout and visual design while avoiding misrepresentation
- Create accurate digital maps/spatial visualizations using GIS software
- Critically analyze visualizations and propose improvements
- Acquire critical skills of empirical reasoning/quantitative literacy

Background:

As Associate Director of the Barnard College Empirical Reasoning Center (ERC), I, along with a faculty director, professional staff, and a number of undergraduate and graduate fellows, develop and implement supplemental training sessions in a variety of data analysis and visualization tools across the curriculum. The ERC was originally developed through a Mellon Foundation grant as part of the Barnard Library in response to a recognition that data drives understanding, and that today's students need to learn – step-by-step – the skills to analyze and visualize information in a variety of forms.

Project Description and Plan:

In the Spring semester of 2019, ERC staff will develop and teach multiple training sessions in mapping/spatial visualization tools and techniques for 4 humanities courses. Pedagogically, we have developed and iterated on the curriculum of the training sessions over several years to focus on teaching students to think critically about data and map visualizations. However, we have not systematically conducted any rigorous empirical analysis as to whether our training sessions help meet learning goals related to students developing their mapping/spatial visualization skills and empirical reasoning. Thus, I am developing a pre- and post- assessment tool, and a rubric for evaluating

mapping assignments in the social sciences and humanities contexts, related to our learning goals, which we will pilot across these classes this current semester.

The pre- and post- assessment tool will consist of an exercise in which students will identify missing or problematic elements on two poorly designed maps visualizing demographic data of an urban area in the United States. Students will also be asked to analyze the argument of the maps and the accuracy of the map elements as they relate to the underlying data.

In addition to developing an assessment of specific mapping-related skills, I will also ask students to complete the 8-item subjective numeracy scale (SNS) in order to benchmark our pre- and post- test assessments and to measure impact on a relevant, existing, validated scale. The SNS is a self-report measure of confidence in performing tasks involving numerical information (Fagerlin et al., 2007). Although social sciences and humanities students may not fundamentally view mapping/spatial visualizations as quantitative, we have specifically designed our training sessions to rely on visualizing quantitative information in order to infuse empirical reasoning throughout these courses. I will use the SNS instead of an objective measure of numeracy (e.g. a math test), because such objective measures often cause anxiety, especially for populations who may already have low confidence in their numeracy abilities. The SNS also correlates with objective numeracy measures, meaning it can be used to approximate and/or predict numeracy ability. Following the pilot semester, I plan to analyze the results and improve the tools as necessary before implementing a full study during the 2019-2020 academic year.

Anticipated Impact:

The ERC plans to support the broader implementation of this assessment model to a range of social science and humanities courses incorporating mapping/spatial visualization assignments and projects. ERC staff will train relevant Barnard faculty, and other teaching support staff including librarians, and provide dedicated research assistants to code and analyze mapping assignments according to the rubric. This will allow for specific instructional interventions or curricular changes to be evaluated in discipline-specific contexts. In addition, I will make the assessment tool and this study data publicly available, and support the use of the tool in other contexts or at other institutions to contribute to the development of an assessment community of professionals and instructors involved in providing GIS/mapping/spatial visualization training.

References:

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