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Quantitative Reasoning in the Contemporary World

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Investigator(s):	Bernard Madison bmadison@uark.edu(Principal Investigator) Caren Diefenderfer (Co-Principal Investigator) Stuart Boersma (Co-Principal Investigator) Shannon Dingman (Co-Principal Investigator)
Sponsor:	University of Arkansas 120 Ozark Hall FAYETTEVILLE, AR 72701 479/575-3845
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ABSTRACT

Mathematical Sciences (21)

The ability to reason about issues that mix words and numbers is now an essential competency for residents of the United States. The proliferation of quantitative data and analyses has reached all aspects of life, including informed participation in democratic processes. Traditional education in mathematics and statistics is not sufficiently effective for the quantitative reasoning (QR) required. This project is continuing development of an

educational infrastructure of an innovative QR course and includes making the course transportable, adaptable, and more effective. The project is creating assessments and scoring rubrics to measure learning in the course and to compare that learning to the learning in two other courses, one somewhat similar and one traditional. The innovative course, called Quantitative Reasoning in the Contemporary World (QRCW), derives from a collection of newspaper and magazine articles and is organized by processes of QR and not by mathematical or statistical topics. The project is producing a volume of case studies of QR-based media articles, an accompanying volume documenting the learning results, pedagogical strategies, and a guide for using the volume of case studies in a QR course, including classroom videos of students reasoning about quantitative situations.

Intellectual merit: This work encompasses several fundamental and challenging educational problems: connecting and reconciling knowledge from school with contemporary real-world contexts, assessment of QR, effective QR courses that address issues in multiple contexts and multiple disciplines, and more general research questions on transfer and situated learning. During the initial development and teaching of QRCW, several pedagogical challenges were identified and partially addressed, but more effective strategies are needed. These pedagogical challenges include student attitudes toward mathematics, their beliefs as to its relevancy to their lives, and the habits they have developed from traditional courses in mathematics and statistics.

Broader impact: Innovative courses in QR are needed to reconnect students to the utility and importance of quantitative data and analyses in their everyday lives, thereby broadening the appeal of quantitative work by expanding the views of STEM education. Many students, including large fractions of minorities underrepresented in STEM disciplines, are increasingly alienated from quantitative studies and work because of their perceptions of the lack of relevance to their existence and welfare. QRCW has been successful in reversing this alienation and has the potential to have major impact in making all students more able to fully participate in public discourse, so critical to sustaining democratic processes.

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