Empowering Citizens: The Importance of Quantitative Reasoning in Higher Education

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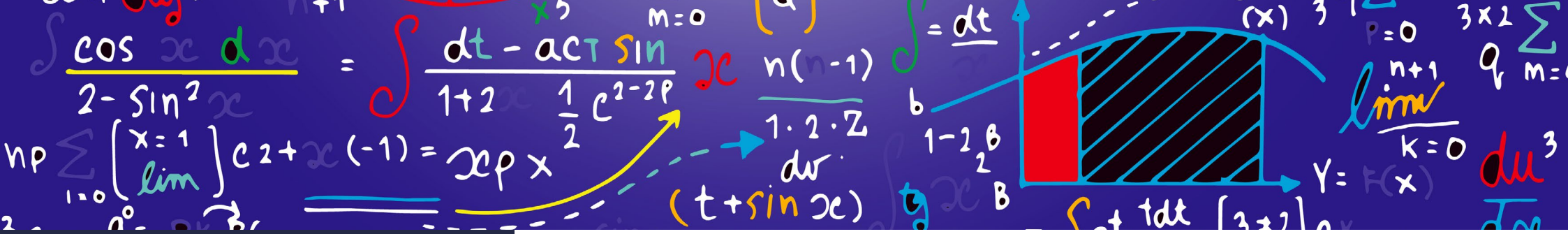

Empowering Citizens: The Importance of Quantitative Reasoning in Higher Education

Despite a growing emphasis on Quantitative Reasoning in education, particularly as universities develop courses that move beyond traditional math, its role in fostering critical citizenship remains underexplored. Professor Gregory D Foley's research studies the perspectives of instructors on teaching Quantitative Reasoning at university and examines how these courses can promote critical citizenship. By evaluating practical teaching approaches, the study highlights the evolving role of quantitative reasoning in preparing students for thoughtful civic participation.

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Quantitative Reasoning

Understanding and applying quantitative concepts in real-world contexts is a learned competency influenced by language and culture rather than an innate ability. In today's data-driven society, innumeracy can leave individuals vulnerable, underscoring the need for robust quantitative skills. In response, many American postsecondary institutions have established entry-level courses in Quantitative Reasoning (QR) to address this educational gap.

These courses, designed as alternatives to traditional math for non-math degrees, aim to develop skills like critical thinking, problem solving, quantitative literacy, and communication – skills that are essential for informed civic engagement. Specifically, QR courses use real-world applications of math to foster skills that support active citizenship.

The research conducted by Professor Gregory D Foley and his colleagues investigates how instructors assist students in developing the quantitative skills necessary for critical citizenship, including critical thinking, problem solving, and effective oral and written communication.

Challenges in QR Instruction

Instructors encounter various obstacles when teaching QR courses. Many students have negative perceptions of mathematics, leading to reluctance to engage with QR content. Additionally, academic advisors may hesitate to recommend QR courses to non-math majors. Instructors who are accustomed to teaching more technical math often struggle to adjust their approaches to focus more on reasoning and communication rather than mere mathematical concepts.

The Five C Model of Quantitative Reasoning

For the study, Professor Foley and his colleagues developed the '5 C Model', which consists of five key elements: Critical Thinking, Context, Concepts, Competencies, and Collaboration. Critical thinking is central to the QR curriculum, helping students to apply mathematical models to real-world problems. Competencies like representation, interpretation, calculation, analysis, assumptions and communication, are critical elements of QR instruction.

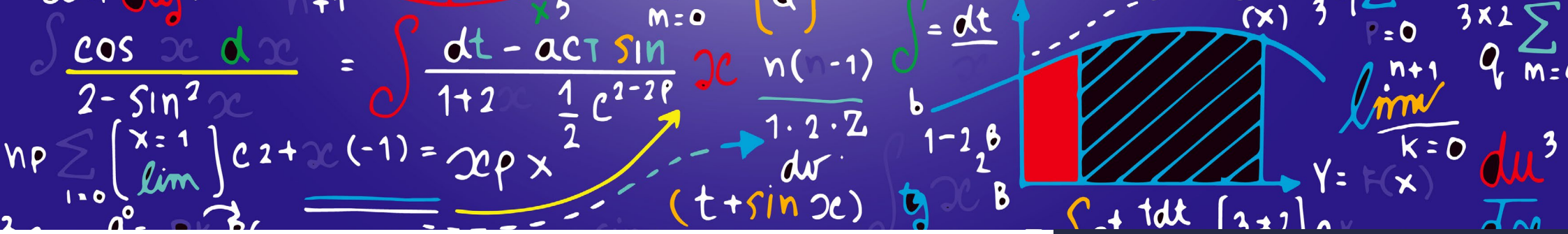
Exploring Instructor Experiences in QR Instruction

The study explores the experiences of four QR instructors teaching a newly developed QR course at a public university in Ohio. The course, designed for undergraduate students not majoring in math, aimed to enhance students' quantitative skills using an inquiry-based approach. The QR curriculum covers topics like proportional reasoning, probability, statistical reasoning, and mathematical modelling, with a strong emphasis on real-world applications.

Instructor Perspectives

The purpose of Professor Foley's study was to explore how instructors implemented the QR course, particularly in fostering critical citizenship skills. Data were collected through semi-structured interviews with QR instructors.

One instructor emphasised the role of critical thinking as a means to empower students and encourage civic awareness by prompting them to question quantitative data. Another instructor, initially unprepared for the course's demands, adapted by focusing on group projects that fostered collaboration and critical analysis of misleading statistics. A third instructor engaged students with real-world projects but expressed hesitance in addressing politically sensitive topics. Finally, another instructor prioritised



fostering self-awareness and learning from mistakes, viewing critical thinking as essential for civic engagement. Together, these perspectives illustrate the diverse approaches adopted by instructors.

However, overall, instructors expressed general satisfaction with the QR course, focusing more on self-improvement for future semesters rather than proposing department-wide changes. This suggests that their autonomy in teaching and assessment played a role in shaping their approach to the course..

Effective Factors for QR Instruction

The study revealed several critical factors that contribute to effective QR instruction. Regular instructor meetings fostered collaboration and shared learning, allowing instructors to exchange ideas and refine their teaching practices. The autonomy granted to instructors in their teaching methods empowered them to tailor their approaches, ensuring they could meet the diverse needs of their students. Additionally, the incorporation of group projects was vital in promoting active learning, encouraging students to engage with quantitative reasoning in real-world contexts.

Critical thinking and QR competencies, in particular communication skills, emerged as the most influential aspect. Instructors recognised that these skills are essential for fostering informed civic engagement among students, allowing them to navigate complex quantitative information effectively. Contexts and collaboration were also important, while content was considered the least important aspect. The fact that traditional mathematical skills were considered less central to the QR curriculum highlights a shift away from procedural mathematics towards a more holistic approach that prepares students for a more active role as citizens.

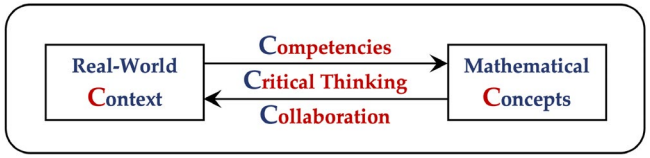
Support and Resources for Instructors

Quantitative Reasoning courses have the potential to prepare students for critical citizenship by emphasising real-world applications and collaborative learning. However, instructors require adequate support and resources to navigate the challenges of teaching QR. The study recommends creating professional networks to foster collaboration among QR instructors and exploring ways to boost students' confidence in mathematics, ensuring that QR courses continue to develop essential civic skills.

While instructors need a general framework for the course, the structure should not be too rigid. Instructional autonomy and flexibility facilitate the development of skills for citizenship. Wherever such courses are taught at postsecondary institutions, the ideal would be to create state- or provincial-level QR professional development networks that encourage these innovative practices.

Conclusion

A well-designed Quantitative Reasoning course can effectively enhance students' quantitative skills for active citizenship, provided that there are sufficient resources and support systems for instructors. Therefore, the study underscores the necessity of supportive teaching environments and innovative pedagogical practices to cultivate critical reasoning skills in QR education. With sufficient resources and support systems in place, QR courses can empower students to engage in today's complex world, fostering a generation of informed and active citizens.



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MEET THE RESEARCHER

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Gregory Foley is Morton Professor of Mathematics Education at Ohio University. He received BA and MA degrees in mathematics and a PhD in mathematics education from the University of Texas at Austin. Since 1975, Professor Foley has taught a wide variety of mathematics and education classes in Ohio, North Carolina, and Texas. He has taught mathematics from Grade 7 through the master's level and mathematics education from the undergraduate through the PhD level. Professor Foley is the principal investigator of the US National Science Foundation-sponsored project Developing a Statewide Professional Development Network for Effective Teaching of Undergraduate Quantitative Reasoning Courses. In recognition of his work, Professor Foley has received the American Mathematical Association of Two-Year Colleges Award for Mathematics Excellence in 1998, the Teachers Teaching with Technology Leadership Award in 2005, and the Ohio Council of Teachers of Mathematics Kenneth Cummins Award for exemplary mathematics teaching at the university level in 2015 and the Christofferson-Fawcett Award for lifetime contributions to mathematics education in 2022.

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FURTHER READING

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