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Teaching with STEM Project-Based Learning in a Virtual Summer Camp

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Dr. Mary Margaret Capraro is a Professor of Mathematics Education in the Department of Teaching, Learning and Culture and Co-Director of Aggie STEM. She received her Ph.D. from the University of Southern Mississippi and joined Texas A & M University in 2000 as a clinical professor in Mathematics Education. She earned a position as an Assistant Professor in 2007 and was promoted to Full Professor in 2016. Her research interests include student understanding of mathematical concepts especially in the area of problem solving and problem posing. She was previously employed with the Miami Dade County Schools as both a teacher and an assistant principal. She has over 100 peer-reviewed articles, and 175 national and international presentations.

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Robert M. Capraro, is Co-Director of Aggie STEM, Director of STEM Collaborative for Teacher Professional Learning, and Professor Mathematics Education in the Department of Teaching Learning and Culture at Texas A&M University. Dr. Capraro's expertise is applied research in school settings, program evaluation, the teacher as change agent for STEM school improvement, and STEM student achievement. He recently received the best paper award from the International Conference on Engineering Education where he and two colleagues presented their work related to the Aggie STEM project. He is currently involved in research in four school districts and more than 20,000 students and 80 teachers. His editorial work includes Associate Editor of the American Educational Research Journal, School Science and Mathematics, and Middle Grades Research Journal and the Research Advisory Committee for the Association of Middle Level Education. He was selected as a minority scholar for 2007 by the Educational Testing Service and served as president of the Southwest Educational Research Association. He is the author or co-author of three books, several book chapters and more than 100 articles on mathematics education, quantitative research methods, and teacher education published in such venues as Journal of Mathematics Education, International Journal for Studies in Mathematics Education, Journal of STEM Education: Innovations and Research, International Journal of University Teaching and Faculty Development, LEARNing Landscapes, Special Issue: Mind, Brain and Education, Journal of Mathematical Behavior, European Journal of Psychology of Education, The Journal of Mathematical Sciences and Mathematics Education, Urban Review, Journal of Urban Mathematics Education, Educational Researcher, Cognition and Instruction, Educational and Psychological Measurement. He recently was awarded a $400,000 dollar grant - - continued support by the Texas Higher Education Coordinating Board to continue his work with developmental education bringing his total external funding to ˜ 7 million.

ABSTRACT

During this faculty presentation, we will present the lessons learned from hosting and teaching in a virtual summer camp that used science, technology, engineering, and mathematics (STEM) project-based learning (PBL) as the primary instructional strategy.
From its roots in constructivism and the project method of teaching by Kilpatrick (1918) and Dewey (1938), PBL has become an important pedagogy in today's active student-centered classrooms. Situated within the unique interdisciplinary perspective of STEM learning, STEM PBL engages students in collaborative problem solving and real-world learning experiences (Capraro & Slough, 2013; Clark & Ernst, 2007). In STEM PBL, students are given a problem scenario with criteria and constraints and explore creative solutions, eventually creating final products, or artifacts, that represent their chosen, researched, and tested solution to the problem.

We have been hosting summer camps with STEM PBL activities as the primary method for instruction for nearly a decade. However, in summer 2020, during the COVID-19 pandemic, our STEM education group offered a virtual STEM summer camp for middle and high school students. During this camp, 54 students across the country connected via the widely-used teleconferencing platform, Zoom. They attended multiple classes covering topics such as computer programming, physics, engineering design, and advanced mathematics.

For this presentation, we will examine the unique challenges faced by teachers and students in this online summer camp. The first challenge was ensuring that every student and teacher had sufficient technology and internet access to connect. We also had to ensure that the students were sent critical construction and laboratory materials and were given lists of suggested project materials that they could pick up at local stores. The students were engaged in the summer camp classes, presentations, and tours from morning until night; this presented its own challenges that required balancing engaging classes, well-earned breaks, and social activities. We will give examples of the classes and how we integrated educational technologies and provided materials to support STEM PBL in a unique setting.

Finally, we will conclude with tips for teachers who are looking to use STEM PBL in an online environment. It is our hope that this presentation will provide valuable information for teachers, researchers, and administrators considering the unique challenges involved in engaging students in active learning in online settings.

References

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