East Carolina University: Efficacy Study with Plasma Games

Leonard Annetta, Ph.D.
Taft Distinguished Professor of Science Education
East Carolina University

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Why is a High-Quality STEM Curriculum so Critical for our Students?

The need for a competitive, specialized workforce has driven national priorities in the 21st century. In response, Congress enacted the American Competitiveness in the Twenty-First Century Act of 2000, which tasked the National Science Foundation (NSF) with creating grants to improve STEM education, particularly for underrepresented communities. To address challenges like inequitable access, evolving career pathways, and ethical issues in technology, the NSF encourages STEM educators to engage underrepresented learners, teach foundational STEM and computational skills, and foster adaptability, creativity, teamwork, and awareness of technology's societal impacts. STEM education must develop a workforce that understands both modern technologies and the societal effects of technology (NSF, 2020).

What Plasma Games is Doing to Fix this Challenge:

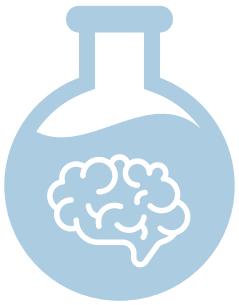
Plasma Games is an education technology company based in Raleigh, North Carolina. They equip teachers with rigorous, entertainment-quality resources that allow them to engage students, improve learning, and inspire the next generation of STEM leaders. In 2019, Plasma Games created a chemistry-based game, Sci-Ops: Global Defense. This educational video game empowers learners to become scientific operatives who save the planet from invaders trying to strip energy resources while polluting the planet. The game's goal is for students to use their knowledge of chemistry and science to thwart the invaders, thus also learning about STEM careers.

This educational video game learning platform was released in spring 2023 to high school chemistry, physical science, and career and technical education (CTE) students in 22 North Carolina counties. A pretest-posttest study was used to ascertain learner knowledge of chemistry concepts and chemistry-related careers on 1,872 students. Knowledge questions were taken from the North Carolina Department of Public Instruction chemistry end-of-course released items. The O*Net Career Exploration tool determined chemistry-related career interests with a threshold score of 70. Students were assigned to a control group if their maximum level was less than five or if their account was created on the same day the post-survey was taken. This indicates they did not play the game before the post-survey was completed. Students were assigned to the treatment group if they had completed at least level 5 of the game before they took the post-survey. The chemistry careers and college major analysis did not have a control group because everyone was exposed to at least one STEM career-related resource.

Post-intervention gameplay results suggest gains in chemistry knowledge and awareness of chemistry-related careers. Students engaging with Sci-Ops: Global Defense saw an overall increase of **19%** in chemistry knowledge, a **49%** increase in physical science career awareness, a **6.5%** increase in chemistry major understanding, and a **32.5%** increase in physical science major understanding.

Previous study results align with the other recent findings: Plasma Games positively impacts chemistry and STEM knowledge and interest in STEM career pathways.

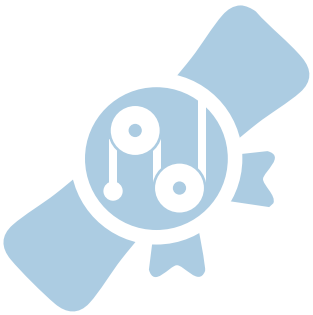
The results from 26 participating STEM educators were very impressive. When asked how Plasma Games helped combat learning loss, **96%** of the teachers agreed that Sci-Ops: Global Defense was a valuable tool. When asked about the impact of Sci-Ops: Global Defense on their students' STEM interest, 100% of the teachers reported an increase in student STEM interest. Furthermore, when asked about the impact on their students' STEM career interest, **100%** reported an increase. All the teachers reported that Sci-Ops: Global Defense helped engage their students and ensured they received a quality STEM education.



+19% in Chemistry Knowledge

+6.5% in Chemistry Major Understanding

+49% in Physical Science Career Awareness



+32.5% in Physical Science Major Understanding

These results are important when students show a decrease in STEM interest beginning in middle school. It is also important to consider implementing Sci-Ops: Global Defense to supplement science instruction as part of a flipped classroom methodology. Adults often report their earliest interest in STEM began in an out-of-school setting (Crowley, Barron, Knutson, & Martin, 2015). Engaging in a science-based game as part of a flipped classroom model outside of school changes interest and efficacy in science.

In conclusion...

the remarkable results of this study highlight how the program effectively supports middle and high school students in achieving academic success while motivating them to explore STEM career pathways. The high-quality, realistic, and cutting-edge gameplay is a key factor in its impact, fostering a deeper understanding and interest in STEM fields. With engaging, hands-on learning experiences, Sci-Ops: Global Defense not only makes complex STEM concepts accessible but also empowers students to envision themselves in STEM careers. Plasma Games' commitment to excellence and innovation is evident, and its program has proven to be a valuable addition to the STEM curriculum, driving both educational success and career motivation among students.

*I love that Plasma Games has created a product that requires minimal preparation for the teacher and maximum engagement for the student. As a company, they are incredibly responsive and truly care about the educator's experience when using their resources. I have been using Plasma Games since 2019. No matter how many times I listen to their training, I'm always finding out about new features they've added. As a company, Plasma Games *sees* teachers and responds to their needs and feedback to create a product that truly enhances students' engagement in learning physical science while helping students see *themselves* in potential STEM careers.*

Katherine Gasper: 7th Grade Science Teacher, Wake County

I have found Plasma Games to be a great resource in the science classroom. Teaching chemistry and physical science while using Plasma Games to provide variety and reinforcement improves the classroom experience. I have found that students who complete the assigned Plasma Games activities are very successful when completing Chemistry & Physical Science end-of-year testing.

Jim Davis: Science Teacher, Haywood County Schools, NC