

NEAR-SPACE BALLOON COMPETITION (NSBC): PROVIDING HANDS-ON STEM EDUCATION TO

MIDDLE AND HIGH SCHOOL STUDENTS. M. E. Saad¹, K. Jackson¹, R. Fevig¹, S. Seelan, S. Bieri,

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Introduction: The global market of the twenty-first century is driven by science and technology advancements. Unfortunately, the United States is not providing adequate science education, and failing to keep up with our European and Asian competitors [1]. Therefore, we need to provide quality science, technology, engineering, and mathematics (STEM) education to be able to keep up with the high-tech economy.

In the past decade, the number of students enrolling in high school STEM classes has risen, according to the Federal Interagency Forum on Child and Family Statistics [2]. The number of undergraduate students enrolled in four-year institutions has also risen. Despite these advancements, the rate of increase lags behind other developed countries [3]. Over half of the Natural Sciences and Engineering doctorate degrees earned in the United States since 2006 were awarded to Asian students [1].

Numerous initiatives have been established across the United States to encourage STEM education within curricula as early as middle school [4] [5] [6] [7].

Procedure: Over the last twenty years, all four STEM education subjects have experienced multiple ongoing educational reform efforts, as a response to the competition [8]. President Barack Obama's campaign, *Educate to Innovate*, places STEM education as a high priority throughout the next decade [5].

In an effort to promote STEM learning, the NASA North Dakota Space Grant Consortium organizes an annual Near-Space Balloon Competition (NSBC) for students in grades 6 - 12. These students learn through an active, inquiry-based style that will prepare them for real-world engineering and critical thinking jobs. All students across the state of North Dakota have the opportunity to launch experiments into a near-space environment.

In small groups, the students learn how to write a proposal, design a payload, and analyze data once the launch is complete. Through this active learning style, students are able to boost their self-confidence, improve collaborative skills, and hopefully are less intimidated to approach STEM subjects later in life.

The number of student payloads launched varies by year. The 2012 launch consisted of one balloon and five payloads, and the scheduled 2013 launch will transport eight payloads on two balloons. The balloon reaches its peak altitude in the stratosphere, residing above 99% of the Earth's atmosphere.

Applicability of NSBC to Planetary Science:

Students involved with NSBC are proud of their experiments and work diligently throughout the year. Their work has a sense of purpose, similar to the past or future balloon missions to Venus. This program brings the education out of the classroom, making the experience unforgettable to the students. With some foam, string, and bright ideas, these students can reach a space environment without having to work at NASA. They can investigate some of the same concepts as planetary scientists: temperature, pressure, ozone, and visible light. A gas chromatograph mass spectrometer that measures gases on Venus is also applicable in the student's experiments, studying different aspects of Earth's atmosphere. They learn our planet is dynamic and fragile, protected by such a thin atmosphere.

A GPS receiver is used along with a HAM radio for the students to track the balloon. A popular area of study includes remote sensing. They launch still cameras or video cameras, observing landmarks of rivers, farms, field plots, towns, and other features of the North Dakotan landscape.

Future Endeavors: The grand-prize winner each year will win a trip to the John D. Odegard School of Aerospace Sciences at the University of North Dakota. They will tour the Space Suit Laboratory, fly spacecraft simulators, and visit the UND Observatory. This is a great opportunity for middle and high school students to visit a school that could potentially continue their education in fields such as planetary science, human factors, space policy, and aerospace engineering. College students have the opportunity to present their research and inspire the younger school children.

We hope the students learn valuable skills needed to succeed in their future academic career. They will be less intimidated to pursue math and engineering if exposed to such fun and exciting STEM projects.

Other Space Grant programs across the country can implement similar projects, using the hands-on learning method to help spread STEM education outreach. This is a low-cost approach that can be replicated numerous times a year. Continuing science and technology methods such as this will the United States advance in the world of harsh competition.

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