The LIFT Project: High-Altitude Ballooning Opportunities for K-12 Science Education

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Abstract

For the last five years, the Wyoming NASA Space Grant Consortium (WSGC) has conducted a successful high-altitude ballooning program for K-12 teachers and students across the state. Through this program, students develop their own scientific payloads – taking into account space, size, and weight limitations – and launch them to near space with high-altitude balloons. Online software allows them to track the trajectory of the balloons and monitor atmospheric conditions (i.e., temperature, pressure, humidity, wind) in real time. Following the launch, many teachers and students also participate in payload recovery. These launches are typically single, one-off events designed mainly to generate interest in STEM. Thus, while they provide great hands-on experiences for the teachers and students, the science content tends to be rather limited.

To help address this, two teams of UW undergraduate student participants in the WSGC's LIFT Project (Learning to Integrate Fundamentals through Teaching) have been developing new citizen science scientific payloads and curriculum for high-altitude ballooning. These small-scale projects will eventually be made available for K-12 teachers to use for their own launches. During this activity session, undergraduate participants from each team will showcase their ballooning projects currently in development. In particular, they will provide a hands-on demonstration of how the project is carried out in a K-12 setting, discussing the payload items, pre- and post-launch curriculum, and data analysis. Ultimately, they will show how their projects seeks to further engage K-12 students in STEM learning and improve the science content of the WSGC ballooning program.

FOCUS

This session focuses on a new high-altitude balloon program run by the Wyoming NASA Space Grant Consortium (WSGC) known as the LIFT Project. The LIFT Project aims to improve the science content of the WSGC's current K-12 balloon program by engaging undergraduate research fellows to work on the development of authentic K-12 scientific projects and curricula for high-altitude ballooning. The session will showcase two science projects currently in development that focus on the topics of radiation and the speed of sound. Student presenters will use this opportunity to delve into the specifics of each project, including payload design, data acquisition, and the supplementary lessons or activities to be administered before or after the balloon launch. Participants will take part in at least one of these lessons or activities during the session. While the content is currently being geared toward middle and high school students, it may be applicable to other age groups as well.

LEARNING OBJECTIVES

During the session, participants will learn about the LIFT Project and get a hands-on preview of the two ballooning projects that are currently in development. This will hopefully not only generate interest in the LIFT Project but will also demonstrate how high-altitude ballooning and other citizen science projects can be great active learning tools for K-12 education (1,2). Presenters will seek feedback during the session by asking questions and encouraging participants to become engaged in both the discussion and the hands-on activities. There will also be an audience Q&A at the end if time allows.

After the session, participants will be able to take action in several ways. Any folks involved with K-12 education may express further interest in the WSGC ballooning program and wish to become directly involved with the LIFT Project as partner teachers. Others may be able to find ways to implement some of what they learn during this session in their own teaching environments. Either way, we expect the content that is presented to be relevant to anyone interested in learning about new, innovative approaches to K-12 science education.

INSTRUCTIONAL STRATIGIES

This session will utilize a mix of open discussion and interactive, hands-on instruction. By allowing the undergraduate students to guide much of the discussion and instruct the participants during the activities, the session will incorporate a "learning by teaching" approach (3), which is a major emphasis of the LIFT Project.

OUTLINE

We are planning for this to be a 60-minute session. Since our ballooning projects are still in development, this outline will necessarily be rather broad. Overall, the session will provide an overview of the LIFT Project and show how it expands the science content of the WSGC's

ballooning program, the latter of which has been ongoing for the last 5+ years. We expect the session to unfold as follows:

- Introduction (10 min)
  - Brief history of the WSGC ballooning program
  - How the LIFT Project fits into this program
- Science projects in development by LIFT teams (40 min)
  - Demo/activities related to the radiation project (Team 1)
  - Demo/activities related to the speed of sound project (Team 2)
  - Wrap Up
- Audience Q&A (10 min)

RMS ASEE TARGET AUDIENCE

One of the primary objectives of the WSGC LIFT Project is to improve the science content of the Space Grant's K-12 high-altitude ballooning program. Thus, this session would be particularly relevant to any educators or students interested in K-12 science education and outreach. At this time, the WSGC ballooning program primarily caters to schools and organizations in Wyoming, so any Wyoming K-12 educators attending the conference would be strongly encouraged to participate. Additionally, this session would be relevant to engineering faculty interested in engaging undergraduate students in hands-on, interdisciplinary activities that provide students with the opportunity to apply their engineering knowledge and to develop their communication and public outreach skills.

PRESENTER CREDENTIALS

Dr. Phil Bergmaier	Post-doc, UW
Dr. Trina Kilty	Post-doc, UW
Jeffrey Bell	Social Studies Education Major, UW
Mary Block	Astronomy and Physics Major, UW
Garrett Burrows	Mechanical Engineering Major, UW
Joshua Crips	Electrical Engineering Major, UW
Jacob Plowman	Astronomy and Astrophysics Major, UW
Tyra Relaford	Secondary Education / English Major, UW

REQUIREMENTS

Each team will bring a laptop as well as the small payload boxes they have designed for their projects. In addition, the radiation team will bring small sheets of various metals and plastics that participants will use during one of the activities to build radiation shields for the payloads. The speed of sound team will be bringing some household items (e.g., play dough, bowls, etc.) that will be used to build parabolic reflectors as part of another activity. Participants do not need to bring anything of their own. The ideal participant count is 20, with a max count of 30.

REFERENCES

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2. Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences, 111*(23), 8410-8415. doi:10.1073/pnas.1319030111.
3. Goodlad, S., and Hirst, B. (1989). *Peer tutoring: A guide to learning by teaching*. London: Kogan-Page.