

Broadening Implementation of High Altitude Ballooning in Undergraduate Classes

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During the fall of 2010 a marketing survey was conducted by Taylor University as part of the NSF CCLI award #1047557. The High Altitude Balloon Research Survey and Report were designed to accelerate learning concerning High Altitude Ballooning at educational institutions. The survey was sent to two and four year colleges in the United States and its territories and analysis was done at Taylor University in January 2011. The undergraduate institutions indicated that hands-on activities are a valued asset to any learning experience. Survey findings however, pointed to the lack of knowledge regarding near space opportunities and the role high altitude ballooning can have as a hands-on learning tool. Next steps to improving the level of knowledge and expanding the use of high altitude ballooning in undergraduate curriculums include broader dissemination of knowledge beyond the discipline specific journals and traditional fields of study.

I. Introduction

Over the past three years, Taylor University has disseminated information about the High Altitude Research Platform (HARP) to faculty from 51 universities through a Nation Science Foundation CCLI award (#0717787). Under the current National Science Foundation award #1047557, the High Altitude Balloon Market Research and survey were commissioned by Dr. Don Takehara and Dr. Hank Voss. StratoStar LLC, a company incubated at Taylor University and spun off from the original HARP technology developed by Dr. Hank Voss and Mr. Jeff Dailey, acted as a consultant on the survey development. Subsequent to this and other related projects, Taylor University's Center for Research and Innovation is disseminating information about the High Altitude Balloon and implementation into undergraduate classes among United States universities and colleges. Ultimately, Taylor University will leverage available resources in order to expand the number of universities and colleges utilizing HARP in undergraduate classrooms and research projects.

The High Altitude Balloon Research Survey and report are designed to accelerate learning concerning High Altitude Ballooning at educational institutions. Participants answered twenty-five questions pertaining to hands-on education and High Altitude Ballooning as a potential learning tool at their institution.

The survey results support the continuation of research and funding for expanding the High Altitude Ballooning field. Several key points have been identified as barriers to implementation as well as the best channels of dissemination. The project documented the current level of knowledge and interest regarding near space technology.

Key findings include:

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1. Interest in hands on learning is high and considered an important recruiting tool for potential students.
2. Funding is a key factor in successfully implementing any type of educational tool.
3. Institutions use conferences, seminars, academic journals and workshops to remain current in hands-on learning.
4. Knowledge of near space and atmospheric study is poor.

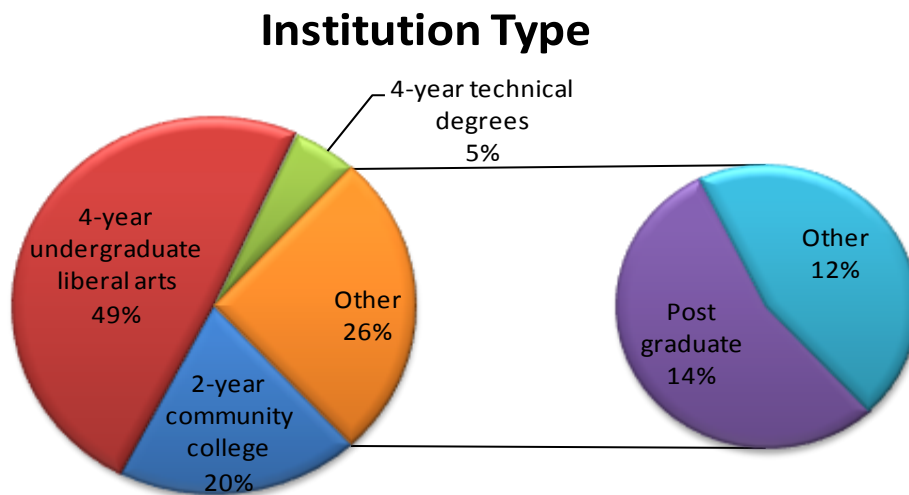
II. Purpose and Demographics

Key objectives for the survey included:

- Determine the best channel for communicating HARP technologies to a broad audience
- Estimate the potential growth rate of STEM technologies across the United States.
 - If STEM technologies are growing then describe the communication process to continue growth
 - If there is little to no growth in STEM technologies segment identify key reasons for the slow growth rate and potential avenues to gain market share back.
 - Identify barriers to growth
 - Target likely users and identify a precise way of reaching them with HARP materials.

The electronic survey was sent to two and four year colleges and universities in the United States and its territories during the fourth quarter 2010. The recipient list, purchased from the Higher Education Directory (HED 2011 online) included division chairs, directors and deans of schools. Key demographics of the respondents are:

- 74.11% of respondents listed their primary role as “administration” however many are or have been faculty.
- 67.7% or 241 educational institutions completed the survey.
- 49% of the institutions responding identified themselves as undergraduate liberal arts, 20% stated the institution was classified as a 2 year community college, 14% post graduate, 12% other, and 5% 4 year technical.
- Of the faculty who took the survey, 28.22% identified their discipline as natural and environmental science, 15.77% were business, 12.86% were education, and 10.33% engineering.

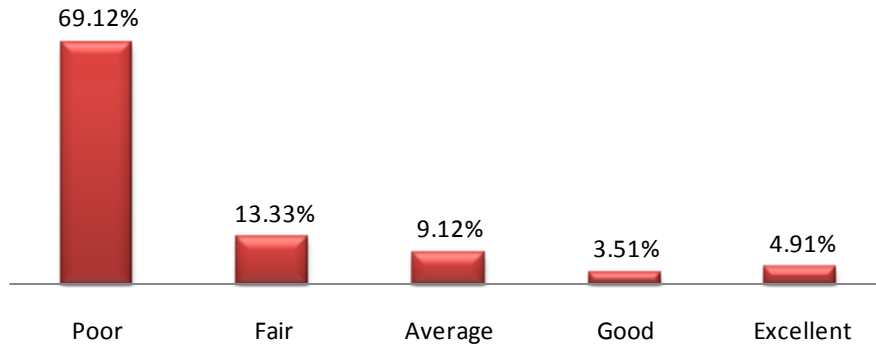


III. Level of Knowledge and Interest

When asked to rate the level of interest in conducting experiments 20 miles above the earth, almost 65% of respondents were mildly to strongly interested if there was an easy, low cost way to do the experiments. This aligns well with the level of interest many institutions showed on using hands on education in the classroom (73.2% moderately to strongly interested) and the level of an institutions use of hands-on education in the classroom (39.8% sometimes and 54.61% often). . Hands on projects are also seen as a strong recruitment tool for high school students (69% said it was moderately to strongly important).

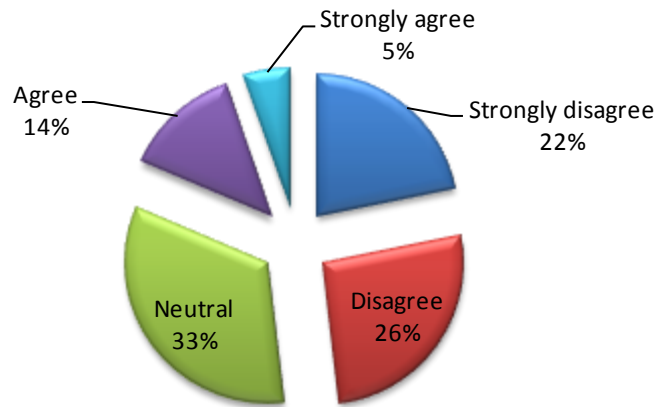
However, an overwhelming number rated their current level of knowledge regarding high altitude ballooning as poor (69%) and another 13% said only fair.

Current level of knowledge regarding high altitude balloon



The survey respondents also reported that near space or atmospheric study is not a high priority to many of them. One third of the institutions responding considered the emphasis on near space of neutral importance and another 48% disagreed strongly that atmospheric study was a high priority to their institution.

Importance of Atmospheric Study at Institutions



Only 18.5% considered near space and atmospheric study a high priority. To develop greater interest in high altitude balloon and increase the number of users, a broader audience needs to be shown how the balloon can be utilized in studies other than atmospheric and near space.

IV. Funding and Other Concerns

Funding is a major concern for most institutions. To implement the HARP system into undergraduate classes, sources of funding need to be identified. Of those who responded to the survey, 40.75% thought they would need external grants to fund the high altitude balloon program. Only 12% would utilize department funds and almost equal numbers (14-15%) would use institution funds/grants, sponsored research or fundraising outside the institution to cover the cost of the balloon program.

Once funding issues have been addressed, other concerns including curriculum, ease of use and support must be addressed. Among those who responded to the survey, 24.36% rated having curriculum strongly important and almost 41% said it was moderately important. Since a large number of respondents gathered information about new

teaching tools through conferences or seminars, workshops and academic journals, providing adequate information about funding and curriculum needs to be addressed during dissemination efforts.

V. Expansion of HARP and Relevance to Current Users

Of the survey responders, 52% saw the HARP system used in natural and environmental science departments and 20% said engineering (multiple selections were allowed). To expand the HARP system into these areas and beyond the space science and physics/engineering disciplines should more intentionally share their experiences and results in general science journals or higher education publications.

What is the relevance of this expansion on current HARP users? Why is this information important to those who have already integrated the balloon into Physics or Space Science courses? Expanding the use of the HARP system can provide opportunities for cross disciplinary research projects. With greater participation, shared flights can lower the cost of class flights. Piggy backing biology or chemistry classes on an engineering or physics flight distributes the cost of the flight across several class budgets.

With the expansion of the balloon into non-science courses, such as social science or education courses, the use of the balloon as an aid in teaching may be expanded. Among Taylor University psychology students, the balloon program's impact on student learning has provided Assessment Research training. Under the current National Science Foundation award, Ball State University and Taylor University pre-service, education majors are learning how to incorporate the balloon as a teaching tool for 6th – 8th grade students. Through the award, they are learning how to write curriculum, evaluate the impact the hands on tool has on student learning, and engage young students in hands on projects.

The continued implementation of HARP into STEM classes, as is currently being done, will certainly increase visibility of high altitude ballooning as a tool to engage students in science and engineering. As curricula are developed by faculty and shared among colleagues, more faculty at other institutions will see how ballooning can be implemented into their classrooms. A proactive program for communicating and disseminating these curricula and results will yield in an increase in the knowledge of high altitude ballooning and the subsequent increase in implementation of HARP in undergraduate STEM classes.

Conclusion

The survey did not identify likely users or the potential market size. Instead it found that there are some large barriers which must be overcome before growth can occur. First and foremost, overcoming the lack of knowledge must be addressed by using broader dissemination tools. Papers in science or education journals which highlight the use of the balloon and the potential influence it can have on student learning is needed. Sharing of information among campus colleagues may be an easy entry point to collaborations. Workshops and seminars targeting broader, less technical audiences may also support this effort.

Acknowledgments

This material is based upon work supported by the National Science Foundation under Grant No. 1047557. Any opinion, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.