March 12, 2014

Educational Benefits to Participants in Small Spacecraft Development

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Overview

The OpenOrbiter program [1] is developing a low-cost framework for the creation of spacecraft by researchers and educators worldwide [8]. In line with the objective of enabling future educational use by others, educational assessment [2,3] has been a key focus. Several areas were assessed: student spacecraft [4] developers were asked what types of benefits they sought from their participation [5], attainment of these and other educational benefits is ongoing. Work on the development of a set of designs that can be used to build a spacecraft with the cost of under $5,000 [13] using primarily COTS parts also continues.

What Has Been Determined?

A more detailed discussion of assessment activities can be found in [2,3,5]; however several key points are illustrated by the figures shown here.

• Significant benefit is shown in several categories of performance (see Figures 5 and 6). These areas include:
  • Technical Skill
  • Spacecraft Design
  • Presentation Skills

• Students also gained in their excitement about space and comfort giving presentations (see Figures 5 and 6).

• Benefits attainment is attributed to participation (Figure 7). This attribution is strongest for technical skills and space interest.

• Team leads and non-lead participants gain benefit from their participation (see Figure 8), with leads being shown to gain benefit in more (3 versus 2) areas.

• Areas where students believe that they can receive benefit from participation are numerous and varied (see Figure 1).

How Do Students Participate

Students participate in the OpenOrbiter program in several ways:

• Extracurricular activity
• Class project
• Academic capstone / design project
• Independent study course
• CSCI 297—Software Project Management through Experiential Learning course
• Paid worker

Students design, develop, manage, test and troubleshoot under all participation types, gaining valuable experience. Most participate in an area related to their major; some choose to gain experience in an alternate area.

Developing and Prototyping

We have created a simulation platform, called the ROOFSAT [24], the parts for which are shown in Figure 10, to facilitate spacecraft software development and testing concurrently with the spacecraft design and development. This allows students to gain the valuable hands-on experience in working with hardware that is sought by many private- and public-sector employers prior to hardware completion. The ROOFSAT costs under $2,000.

Scholarly Activities

The OpenOrbiter Program has been the subject of:
• seven peer-reviewed journal articles [2-8]
• ten conference papers [1,9-17]
• nine oral / poster presentations at national conferences [18-25]
• over forty local and regional oral / poster presentations [26-71]

The topics covered have ranged from technical presentations, discussion and analysis of the structure, software and other spacecraft elements, to papers considering the use of the spacecraft and its impact on space policy to papers evaluating the educational benefits of the program and participation in it.

References:

1. \[\text{Reference 1}\]
2. \[\text{Reference 2}\]
3. \[\text{Reference 3}\]
4. \[\text{Reference 4}\]
5. \[\text{Reference 5}\]
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