# AC 2008-2176: AN OFT-OVERLOOKED RESOURCE: UNDERGRADUATE STUDENTS CAN BE A VALUABLE ASSET TO HELP IMPROVE THE CURRICULUM, FACILITIES, AND PEDAGOGY

**Gene Harding, Purdue University**

GENE L. HARDING is an assistant professor of Electrical and Computer Engineering Technology at Purdue University, where he has taught for 5 years. He also worked in industry for 3 years with Agilent Technologies, and has over 22 years of combined active and reserve service with the United States Air Force.

**Benedict Kazora, Purdue University**

BENEDICT KAZORA is a May 2008 graduate of the Electrical and Computer Engineering Technology program at Purdue University.

**Robert Smethers, Purdue University**

ROBERT A. SMETHERS is junior in the Electrical and Computer Engineering Technology program at Purdue University.

# An Oft-overlooked Resource: Undergraduate Students Can Be a Valuable Asset to Help Improve the Curriculum, Facilities, and Pedagogy


## Abstract

Many college campuses do not have graduate students to use as a resource for teaching, research, grading, and other pedagogical activities. These schools include some satellite campuses of major universities, many private colleges that focus on undergraduate education, and community colleges. Although they do not have graduate students, they are replete with undergraduates, and some of those students can be great assets for improving the local educational environment. Why not capitalize on that opportunity?

This paper describes a project that used two volunteer students, both upperclassmen, to do most of the work developing a pair of lab manuals at one of Purdue University's satellite campuses. The lab books, totaling over 200 pages, were customized specifically for the labs used by the beginning circuits courses. We describe the genesis of the project, how each student became involved, the experience of managing and coordinating the work, the lessons learned by all three individuals, and the costs/benefits for all involved, including the students who used the manual in its initial form. The concluding section offers encouragement to other faculty and students who may be in similar situations, as well as suggestions to avoid some of the missteps by the authors.


## Introduction

The setting for this project was a satellite (referred to as Statewide) campus of Purdue's College of Technology. Life is a lot different away from the main campus. While Statewide professors typically have fewer committee assignments and teach smaller classes, they have other challenges: They teach more classes, advise students, and have responsibilities to perform high school and/or industry engagement. Moreover, graduate assistants are not available, and technician support is sometimes less effective. These limitations can make pedagogical development very difficult.

Nevertheless, there may be a solution readily available, albeit from a perhaps unexpected source: undergraduate students. Many authors have written about various topics concerning undergraduate student research, including making the research effective,[1,2] benefits of the experience,[3] using it as a transition to post-graduate studies,[4] combining it with industrial collaboration,[5] and combining it with scholarship.[6] In 2007, a student-centered, web-based resource called WebGURU was set up for undergraduates interested in research.[7] It makes sense that this type of student could also help develop pedagogy.[8]

In this project two such students teamed up to produce a pair of lab workbooks using Microsoft (MS) Word, Visio, and Paint; and Cadence PSPICE. The final products totaled over 200 pages and were customized for the local campus. The remainder of the paper describes how the project began and each student became involved, how it was managed, lessons learned, and

costs/benefits for everyone involved. The conclusion offers encouragement and advice for others in similar circumstances who may be contemplating such an endeavor.

## Project Genesis

This project has its roots in the first-year two-course sequence in analog electronics at Purdue University's College of Technology. Although the professor initially used the published lab workbook, it did not work well for the Statewide location. Over the first few years of teaching the course, the he developed what he called "Expectations Sheets" for each lab. These sheets listed modifications required by differences in lab equipment, corrected errors in the published workbook, and noted other changes to improve effectiveness at the local campus. Nevertheless, it was frustrating not to have lab workbooks specifically tailored to the location, because those could be changed whenever required to maintain relevancy. The professor wanted to produce them but simply did not have the time.

The project got a kick start when an upperclassman decided to retake the first semester course in order to raise his GPA. One of the two weekly days of lecture, however, conflicted with a required senior course, so the student needed some accommodation. The professor offered to make that accommodation in return for help writing the lab workbook over the summer. The student not only agreed, but said he would be willing to help even without that "compulsion." Somewhat later, a second upperclassman indicated his willingness to help. The claims proved true for both students.

## Managing the Project

The first task for the professor was getting the publisher's permission to model the custom lab workbooks after the published workbook. Although this took a little negotiation, it did work out. The key to winning this permission was emphasizing the fact that the associated textbook was required for all students taking the course. It is worth noting that since the custom lab workbook did not match the published one verbatim, the professor asked the publisher how much the workbook would need to be changed to obviate the need for permission. The publisher chose to grant permission rather than answer the question, which worked out well for everyone.

The first student got started on the project shortly after the spring semester ended. Most of the communication with the professor was by email, with occasional face-to-face meetings. Each week's lab instructions constituted one milestone in the project. The student started the first week's lab instruction write-up, the professor provided feedback to adjust it, and the result was a template used for subsequent instructions. Shortly thereafter the second student indicated a willingness to help and joined the effort. The first student divided up and coordinated the work, communicating with his classmate by phone and email. Each of them stopped by the lab on occasion to take digital photos of equipment for use in the instructions.

The professor reviewed each product for quality and consistency, and assembled the individual instructions into a single workbook for the first course. For the second course's workbook, the

student leader took on the task of assembling the full document, so the professor only had to review and edit the final product.

**Lessons Learned**

This project was very edifying for the professor. His most encouraging lesson learned was that his former students were committed and could provide highly effective assistance. They were motivated by a combination of desires to: give back to the school, help the professor, learn, and co-author a published paper (this paper).

A second lesson, learned later, was that Purdue has a special course designed for such projects: ECET299. This directed project course can be from one to three credit hours, depending on the magnitude of work required. The student must submit a proposal for the course describing the purpose of the project, general steps to be completed, and deliverables. The proposal is signed by both professor and student as a requirement for registration, and the proposal is kept in the student's permanent file. Moreover, one of the deliverables is a final report detailing the results of the project and any deviations from the original criteria presented in the proposal. The final report also becomes part of the student's permanent file. The ECET299 course allows the professor a good deal of latitude as long as the primary purpose is to benefit the students. Since this lesson was learned later, the professor set up an "after-the-fact" ECET299 course so the students could get formalized credit for their efforts.

There were two other heartening discoveries by the professor. First, the publisher was willing to grant permission to use the published lab workbook as a model for the custom lab workbooks. The only conditions were to require the textbook for the course and acknowledge the publisher in the study guide. Second, some of the freshmen students, who were using it, helped with feedback to correct errors and improve the newly minted lab workbook. Although the professor learned several good lessons, this project also proved to be an excellent learning experience for the student workers.

Both students noted a substantial improvement in their proficiency with the software packages. In particular, they learned a lot about formatting with MS Word, arguably moving from casual- to power-user status. Although much of the work was transcription rather than original composition, they nevertheless gained a greater appreciation for the importance of technical writing skills. On a slightly different note, the student leader encountered some limitations in the student version of OrCAD (Cadence) and observed that Visio was a more flexible tool for generic engineering components.

Additional lessons involved project management issues. They both discovered how easy it is to underestimate the magnitude and/or complexity of a real-world project, the challenges of coordinating efforts between multiple parties, and the importance of planning beforehand and managing their time throughout. The second student added that he learned the importance of keeping an open mind when working in a group environment.

Both students reported better appreciation of the importance of standardization and consistency, and more understanding of the course development process. They also gained insight into why errors exist in texts, workbooks, handouts, etc.

The student leader had a very interesting perspective during the workbook's initial trial with the class. Since he was retaking the course to raise his GPA, it gave him the opportunity to experience the effect of his own mistakes, and hear the criticism directly from first-year students who had no appreciation for how much work he had invested in it. Although both student workers were disappointed at the number of errors in the workbook, the professor encouraged them not to be. He reminded them that even professional publications have mistakes, and pointed out that the benefits of their effort far outweigh the impact of a relatively few typographical errors. Moreover, because the project was successful, the mistakes can now be corrected in a straightforward manner (in fact, most of them were corrected on-the-fly as the course was administered).

Finally, during the writing of this paper both individuals learned one approach to co-authoring a conference paper.

**Costs vs. Benefits**

There were costs and benefits for everyone involved, including the professor, both student workers, and even the first-year students, who were the "guinea pigs" using the lab workbooks for the first time.

The professor had to spend more time doing project management, coaching, and editing, but made that up many times over in time saved in raw development work of the lab workbooks. This allowed him to accomplish much more than he would have working alone, and to focus his energy on tasks that required his expertise. A tremendous benefit for everyone now is the ability to easily modify the workbooks to make corrections, improvements, or other changes.

The student workers paid a price in terms of the time invested: dozens of hours of work for each of them. On the other hand, they both reaped a number of rewards, which can be divided into two basic categories: direct personal benefits and intangible benefits. The former includes all of the lessons learned about using the software tools, project and time management, reinforcing the basic technical material (contained in the workbooks), getting the work formally documented on their transcripts, being co-authors on a published paper, and being able to list the accomplishments on their résumés.

The intangible gains were also quite significant for both students. Each of them noted a strong sense of ownership concerning the lab workbooks, fulfillment in giving back to the school, and pride in knowing their contribution will be used by future Purdue students for years to come. Moreover, they shared some excitement over the prospect of doing something a little different and more "real."

The last group involved consisted of the lab students who used the first version of the new lab workbooks. Their cost was some increased frustration dealing with the errors that slipped through the production and editing process, but they also reaped some benefits. First, the custom workbook was less expensive than the one sold by the textbook publisher. Moreover, the new workbooks were tailored to the local lab, including photos of the lab equipment where appropriate. Finally, for the few students pointed out errors and possible improvements, they gained a small sense of ownership in the project, as well.

## Conclusion

The most significant maxim from this endeavor is that it was worthwhile. Although there were costs involved for all parties, the benefits far outweighed those costs. It was a win for all involved, including the professor, student workers, and the school as a whole.

It is worth mentioning a few suggestions for the potential benefit of others contemplating a similar venture. First, it is important to be proactive. The professor should build a good rapport with his/her students, think about project possibilities, maintain a list of them, and ask students if they are interested in pursuing one.

Second, do not underestimate student interest in publishing, or their willingness to "give back" to their school. These can both be strong motivators for many students.

Third, consider formalizing the work. Many schools have courses made specifically for such special projects, which gets the student's work officially documented on his/her academic transcript. Also, when appropriate, it is wise to investigate funding. There may be internal or external grants available for certain types of development. Alternatively, corporate funding may be an option in some cases.

The details will vary from project to project, professor to professor, and school to school, but the results of this effort will hopefully be an encouragement to others, and the aforementioned suggestions helpful.

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