

2006-2435: IMPACTS OF INDUSTRY EMPLOYEE VOLUNTEERING IN K-12 CLASSROOMS

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Impacts of Industry Employee Volunteering in K-12 Classrooms

Abstract

Engineering education has the potential to improve K-12 students' problem-solving and critical thinking skills while motivating them to learn science and math. However, for teachers to effectively implement hands-on engineering activities in the classroom, they may need additional adult support for curriculum content, classroom management, and technical support. Initial research findings in this area indicate that programs providing this support may not only impact K-12 students, but may also benefit the classroom volunteers. This paper presents an exploratory research study involving one such program run by National Instruments with a network of local schools. This program has placed nearly 250 employee volunteers in K-12 classrooms in Central Texas as support for classroom teachers. The "classroom mentors," the majority of who are engineers, help teachers bring hands-on engineering design activities into the classroom that focus on developing math, science, technology, and engineering skills.

The goal of this research is to produce a descriptive picture of the perceived outcomes of the program from the perspectives of those closely involved — the classroom mentors and the teachers. Surveys were developed for both of the groups and taken by 37 classroom mentors and 21 teachers. The responses were analyzed in order to evaluate the impacts made by the program and how these impacts are perceived across and amongst groups. The research aims to understand not only the effect on students and schools but also how the program has affected conceptual and attitudinal change in the classroom mentors and the company as a whole. The

results indicate benefits and pitfalls of the program, allowing for program improvement and recommendations for establishing a similar program. This research identifies the key relationships and program impacts that will guide the direction for future investigation.

Introduction

As technology becomes ubiquitous, it is increasingly important that all citizens become technologically literate^{1,2}. Professional engineering societies have also become concerned with the growing demand for a diverse pool of qualified engineers, and have begun to promote efforts to increase technological literacy at a younger age³. In an effort to address these issues, state and national engineering and technology standards are becoming increasingly common from elementary school through high school^{4,5}. Teacher education, however, often lags these political changes and many teachers, especially at the younger grades, have little experience in technical areas.

While many professional development workshops have been developed to address needs in K-12 engineering education, these experiences may not be enough for a teacher to successfully implement engineering and technology activities in their classrooms. Having volunteers in the classroom to support K-12 teachers as they adopt engineering activities and curriculum can make the difference between success and failure in the classroom. First, the volunteers can serve as an extra pair of hands to help students with design projects, replace the batteries in a robotic manipulative or reboot a computer that has crashed, giving the teacher more time to work with the students. Second, if the volunteer is an engineer, he or she can also serve as a source of

engineering and technical content knowledge for both the students and teacher. Third, scheduled visits (weekly, biweekly, etc) from the volunteer ensure that the engineering activities will continue to occur and not be lost among other curriculum. Finally, the volunteer is a role model and mentor for the students, introducing them to engineering as a profession, and encouraging them to pursue their interests.

Volunteers from Industry

Industry serves as a valuable resource for bringing engineering education to the K-12 classroom. Employees of engineering and technical companies, make ideal mentors and helpers in the classroom. Volunteer programs at these companies can support teachers in bringing hands-on engineering lessons to their students by providing volunteers as classroom helpers, making design projects more manageable. These volunteers are active in engineering and research on a daily basis, and thus are freshly knowledgeable with engineering concepts. The volunteer-teacher team collaborates to develop and implement interactive engineering lessons, with a focus on integrating the engineering content with the teacher's curricular goals. Preliminary research has shown that outreach provides many benefits to undergraduate and graduate students^{6,7} who participate in similar programs, and that teachers believe having volunteers in the classroom is very valuable in bringing hands-on engineering activities into their classrooms⁸. However, the impacts of outreach on employee volunteers have yet to be fully explored.

One such volunteer program is thriving at National Instruments (NI), a high-tech company in Central Texas. NI emphasizes a commitment to engineering education at all levels, from

elementary school through university. Employees had often volunteered their time in local schools to share their expertise. Roughly five years ago, NI began a formal program to pair employee volunteers, known as classroom mentors, with local students and teachers. The Classroom Mentor Program has placed over 250 classroom mentors during its existence, which is roughly 20% of their overall engineering workforce. NI partnered with the University of Texas to provide training to both the classroom mentors and the teachers. Classroom mentors are paired with teachers for at least one semester, with some teams working together for several years. While supporting engineering education at all levels and settings, this program has made a particular effort to support elementary school classrooms in the hope that all students will have access to engineering experiences at a young age.

Research Design

The data reported here are from the first phase of a large-scale investigation of the impacts the Classroom Mentor Program. While the study will look at how the classroom mentors have affected the K-12 teachers and students, its main focus will be on the effects the program has had on the company and its employees. In this initial stage, the aim of the research is to investigate how the major participants, the teachers and the classroom mentors, view the program. The results will direct future study using both qualitative assessments of the entire population, and fine-grained qualitative explorations with a smaller sample.

Active teachers and classroom mentors in the Classroom Mentor Program were invited to participate in the initial study. Participants took an online survey that asked for their perceptions

of the program's impacts. They were asked about the program's effects on the teachers, the students, the schools, the classroom mentors, and the company. The survey included both checkbox and open-ended questions, and took approximately 15 minutes to complete. Demographic data were also collected. Personally identifying data, such as the participant's name or school, were removed from the survey responses to ensure confidentiality. Participants were made aware of this precaution so that they could comfortably provide honest responses, knowing that their participation in the research would have no impact on their continued participation in the Classroom Mentor Program.

Sample

For this study, both the employee classroom mentors and the teachers from the Classroom Mentor Program were asked to participate. From the active classroom mentor force in the Fall 2005 semester (employees currently working with students), 27 males and 10 females completed the study. Of these, 23 were placed in public school classrooms, 7 in private school classrooms, and 7 in after school programs. 28 of these classroom mentors work with elementary students (grades K-5), 7 with middle school students (grades 6-8), and 2 with high school students (grades 9-12).

Among the teachers who currently had classroom mentors placed in the classroom, 21 participated in the study. 19 of these teachers are female, and 2 are male. 11 teachers work in public school classrooms, 1 in a private school classroom, and 9 with after school programs. Like the sample of classroom mentors, the majority of the teachers (14) work with elementary school

students, while 5 work with middle school students, and 2 with high school students. An overview of the characteristics of the study’s participants is presented in Table 1.

	Participants		
	Classroom Mentors: 37	Teachers: 21	Total: 58
Gender	Male: 27 Female: 10	Male: 2 Female: 19	Male: 29 Female: 29
Setting	Public classroom: 23 Private classroom: 7 After school program: 7	Public classroom: 11 Private classroom: 1 After school program: 9	Public classroom: 34 Private classroom: 8 After school program: 16
Grades	Elementary: 28 Middle: 7 High: 2	Elementary: 14 Middle: 5 High: 2	Elementary: 42 Middle: 12 High: 4

Table 1: Overview of Sample

Impacts on the K-12 Students, Teachers, and Schools

When the classroom mentors go into the classroom and after school programs, they work with the teachers to engage the students in hands-on engineering design activities. The goal of these activities is to promote learning and motivation in math, science, technology and engineering. The teachers and the classroom mentors agree that the students are in fact learning and having fun. 85% of the teachers and 83% of the classroom mentors report that the students have gained some knowledge of engineering, and 75% of the teachers are satisfied with the students’ learning while the classroom mentor is there (as reported by both the teachers and classroom mentors). The biggest impact for the school is that the students are having fun, with 90% of the teachers and 92% of the classroom mentors noting this.

The teachers’ testimony to the students’ learning is perhaps the most convincing evidence that this program has impacted the students. One middle school teacher writes, “I think this program is extremely valuable. My students learn to problem solve in a real world setting and most of all

learn to think on their feet.” This view was re-iterated by an elementary teacher; the activities implemented with the support of the classroom mentor have “made my students into better problem solvers, more willing to take risks and try another approach when one fails.” An elementary teacher adds that the program has allowed her to “reach all of my students in a new and fun way.” For another elementary teacher, the students’ learning has been wide-ranging: “the learning that can take place across the curriculum is invaluable.”

For the teachers, the great majority (75%) feels that participating in this program has given them a valuable resource, but a larger number of the classroom mentors (89%) believe this is the case. A quarter of the teachers feel that this program has increased their workload, but only 11% of the classroom mentors have noticed this to be the case. This indicates that communication between the teacher and the classroom mentor about the program and the burden of implementing new curriculum could be improved. While having an extra set of hands in the classroom in the form of the classroom mentor is certainly helpful for actually implementing the activities, the amount of work that goes into planning and designing hands-on activities, especially in a content area that has not previously been covered, should not be underestimated. This may be an area where communication between the teacher and the classroom mentor should be improved so that each party can take advantage of the other’s expertise – with teachers sharing their wealth of pedagogical knowledge and classroom mentors serving as a resource for content knowledge and connections to real world engineering applications.

Overall, the teachers seem to enjoy the program, as 85% report that they are having fun and would recommend the program to a peer. Some have already spread knowledge of the program,

with one recalling, “I have recommended the program to several peers, because of the impact it has had on my students.” The classroom mentors “have allowed me to tackle more complex projects than I otherwise would have.” One teacher fondly recalled her classroom mentor, saying “I worked with him for 5 years. He was an expert engineer and professional from the day he started. He not only taught engineering skills, but was a positive role model for my students.”

The Teacher-Classroom Mentor Relationship

While most teachers and classroom mentors report a great deal of success for the program, each classroom presents its own difficulties and challenges. Teachers who have only begun to include engineering activities may be reluctant to lead the activities by themselves, or may be so excited by the material that they develop a curriculum on their own. While the classroom mentors receive some training about pedagogy and classroom management, most view themselves as the content expert or technical support person for the classroom. This can lead to a number of different roles for both the teacher and the classroom mentor. About half the classroom mentors and teachers report that they share the responsibility of developing the curriculum and leading the activities, while the most of the rest say the teacher takes the lead role with both development and implementation. Two classroom mentors reported that they both created and lead the activities, though both were working with teachers in an after school setting who were fairly inexperienced with the technology (less than 2 years in the program).

The biggest challenge for the program appears to be scheduling. Teachers have very full days, and changes in daily schedules are largely out of their control. On the flipside, the classroom

mentors are also very busy, having to balance classroom volunteering with their jobs. Sometimes it can be very difficult to find times that work for both the teacher and the classroom mentor. While this appears to be a problem for some of the partnerships (“Scheduling times for my mentor is a conflict”), other classroom mentors have been able to find ways to be available during unconventional hours to help students beyond the classroom, such as judging school science fairs in the evening.

Scheduling conflicts aside, for many teachers this experience has yielded professional rewards. 70% of the teachers feel that they have gained some knowledge of engineering, and 70% also report being more comfortable using technology in the classroom. Only 15% of the teachers report feeling anxiety towards engineering. For the classroom mentors, 60% reported that the program has improved their respect for the teaching profession. The relationship between the teacher and the classroom mentor can also be very rewarding personally. In the words of one teacher: “the volunteers I had were great and not only did I get to have help in my classroom, I made 2 good friends in the process.” 70% of the classroom mentors reported that they have gained positive relationships with the people they have met through the Classroom Mentor Program.

Impacts on the Classroom Mentors and National Instruments

While positive impacts on the classroom are the major goal of the Classroom Mentor Program, it is important for National Instruments to also weigh the costs and benefits of the program for its employee volunteers. Working with the K-12 students can be very rewarding for the classroom

mentors. 92% report that they are having fun and that they are satisfied with the students learning. This classroom mentor explains the enjoyment he gets from watching the students learn: “It's been a great opportunity to help kids learn how to apply critical thinking concepts and watch them realize that they achieve more than they thought was possible.” While this classroom mentor simply says “it's a fun way to help out in the community and take a break from cube life.” Indeed, many mentors find that the Classroom Mentor program can be a refreshingly “nice diversion from the day-to-day.”

However, the classroom mentor survey also showed that there are a number of ways that this program has impacted them professionally. 63% of the classroom mentors responded that participating in the Classroom Mentor Program has given them a sense of satisfaction with their jobs; 40% have an improved view of the engineering profession. Both of these factors (job satisfaction and perception of career) have been found to contribute to job performance. Volunteering can also help new employees feel like a part of the company. One employee recommends that his peers become mentors “for at least a year. It's a great way to get involved in a different aspect of the company.”

The program has had an impact on skills that are important to job success as well. 34% of the classroom mentors feel that their communication skills have improved, an improvement noticed by an equal percentage of teachers. 29% report an increased knowledge of engineering concepts through teaching them, and 11% feel their computer programming ability has improved. One classroom mentor has noticed a number of benefits from the program that improve the way she does her job: “As a mentor, I've improved my skills: public relations, presentation, organizing

projects and materials, problem solving, working in groups, and so on. It's a fun way to teach someone basic engineering and simple programming.”

These results were also found with regards to the company with 57% of the classroom mentors reporting that the program has improved their view of NI (no one reported a lowered opinion) and 49% saying that participation has increased their identification with the corporate identity and mission. All of the classroom mentors feel that this program has been a way for NI to make a valuable contribution to the community, and 64% feel that there is an increased interest in K-12 education at the company as a result of the Classroom Mentor program. As one classroom mentor explains, “It's a great way to see the world from a different angle and feel like you are making a difference in the community. This program provides an outlet for kids that isn't present in typical classes and educates them in how to contribute to the world.” The vast majority (91%) of the teachers involved in the program feel that NI is making a valuable contribution to the community and they have a positive view of the company (the remaining 9% did not answer the questions regarding National Instruments). It is reasonable to assume that this program has increased the visibility of the company in the local community, though further research will be directed to look at this aspect of the program's impact.

As mentioned above, finding time to volunteer is often the biggest challenge. 60% of the classroom mentors found that participating in the program has decreased their availability at the office, and for 2 of the classroom mentor (6%) this has placed a tension of their relationships with colleagues. However, most classroom mentors seem to overcome these problems. In fact, 46% report that they have gained positive relationships with colleagues through the program.

The decreased availability at the office is troublesome for at least one classroom mentor who worry that his time away from the office may reflect poorly on him:

“While I have enjoyed [the program], it does impact my job in that I do spend time away from my desk. I'm also never fully sure how my time away is seen by my superiors. Do they view it as slacking off or helping [the company]? Makes it a bit scary at times.”

As this comment indicates, the employee is unaware of the management’s perception of the program. While this will likely always be a concern, an effort should be made to encourage an open dialogue between the employee classroom mentors and their managers. Indeed, this is a priority for NI as the program continues. For a majority of the classroom mentors, the sacrificed time at the office is worth it. One classroom mentor reports that the Classroom Mentor Program is refreshing: “While it takes a couple hours out of my work week, it gives me a chance to work with kids and I find that I'm more calm and less tense after spending an hour with the kids... Plus it's always exciting to see the kids figure out how to do something new and get their projects to work.”

Overall, 87% of the classroom mentors feel that their participation in the Classroom Mentor program has been worthwhile. Unfortunately, 11% of the classroom mentors feel that it has been a hassle to volunteer, largely due to scheduling conflicts, and 1 of the 37 classroom mentors feels that it has been a waste of time. Clearly, this program may not be feasible for all employees, and may be too great of a commitment for some who have very busy schedules. However, for the vast majority of the classroom mentors, the Classroom Mentor Program is a rewarding experience. For one classroom mentor, it was hard to contain her enthusiasm:

“It is a very positive and worthwhile experience. The students are wonderful to work with. I'm learning as much from them as they are from me. Seeing the smiles on their faces when they solve a programming challenge is very rewarding. You can absolutely see the difference the program makes on students from a teamwork perspective. It also builds their confidence and opens them up to considering engineering as an exciting profession. I could go on and on!”

Implications

The Classroom Mentor Program has had positive effects on the classrooms, teachers, and classroom mentors who have participated. While there are still improvements to be made to the program, the results from this survey are encouraging. It is hard, as of yet, to quantify or explain some of the impacts from the program. In the meantime, recommendations will be made to National Instruments to improve the program. For instance, improving and facilitating communication between teachers and classroom mentors should be a priority. This may be accomplished through both teacher professional development workshops, training sessions for classroom mentors, and sessions that bring teachers and mentors together before the semester begins that are devoted to establishing a plan for the classroom. Additionally, an effort should be made to educate management about the program through newsletters or quarterly updates to ensure that they are aware of the classroom mentors' efforts. Lines of communication between the classroom mentors and their superiors should be open so that both parties will be on the same page as far as the commitment of the mentors to their job and their K-12 students.

To address these concerns, National Instruments has partnered with the Tufts University Center for Engineering Educational Outreach (CEEEO) and strengthened its relationship with the University of Texas at Austin. The university collaboration will combine the experience of engineering and education faculty at the university level with the experience of the NI classroom mentors and the CEEEO's university level outreach program STOMP (Student Teacher Outreach Mentorship Program)⁶. Through these efforts, NI hopes that their program will grow stronger and a better understanding of both industry and university outreach efforts will be gained. Through the lessons learned by NI's Classroom Mentor Program, a replicable model for developing, managing, and sustaining outreach programs will be developed.

With further research, the depths of the impacts on the teachers and students, as well as on the classroom mentors can be described. More interesting for industry as a whole will be research into how this program is affecting National Instruments' bottom line. The results of this survey have indicated that, as this project continues, it will be worthwhile to explore the program's impacts on corporate identity (both internally and in the community), and employee availability, motivation, communication, and job satisfaction. These results will help to determine the feasibility of other companies adopting such volunteer programs.

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