Making Sense of InnoWorks

Innovative Science and Engineering Programs By Students For Students

"Let's get it started in here!"

The electrifying rhythms of the Black-Eyed Peas radiate out of the InnoWorks "control center" in what has become our second home—Fitzpatrick Center Auditorium. Taking the cue, Daniel Kaplan begins an interactive presentation with 44 enthusiastic middle-school InnoWorkers and 40 undergraduate staff and mentors. It is early August and the "Making Sense of Senses" program[i] we have been preparing for over a year is underway. I knew when I entered the ranks of Pratt engineers three years ago that I was in the company of amazing peers, but I never imagined the creativity, resourcefulness, dedication, and exhilaration that was possible when we joined together as a team—to make a difference in the lives of so many young students.

As another workshop winds down and the students are safely on their way home, the mentors and staff are happily exhausted but eager to discuss the day's events and brainstorm possible improvements. We then divide into teams to tackle various challenges in preparation for tomorrow. Vineet Agrawal leads a group in testing the circuits for our Fiber Optics Mission. Matthew Mian organizes cups and pipettes for the Simulated Epidemic Mission. Thirty some helpers compile a list of materials and Allen Lee volunteers to make a run to Home Depot. When Allen returns with hardware components, Matt and I join his team to construct a maze for the Radioactive Waste Disposal Robot Mission. A quick break for dinner at El Rodeo. Vineet starts dancing Bhangra whenever he thinks we're not looking. Nerf™ darts for the Monkey Banana Toss Activity whistle 30 feet across the audi-

(Left) William Hwang prepares a team's rocket for angled launch.
(Center) Blastoff!

(Right) The 2005 Duke InnoWorks mentors, staff, and students outside the Fitzpatrick Center auditorium.

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BRITTANY WATSON, 11

torium. The Fitzpatrick Center project rooms are packed. Every power tool is humming. Rocket launchers. PVC "trees." Our engineering education is coming alive. While helping me update the scoreboard, Melissa Qazi treats everyone to her eclectic music collection and long bursts of infectious laughter. It's true. Everything is funny at 4AM.

Despite all the hard work, the rewards were even greater. We worked together through fun and frustrating times alike, and the wonderful memories will remain etched in our minds forever. The 70+ underprivileged middle-school students we worked with this year were appreciative of the opportunities we gave them. Chris Thompson, 13, of Team Blue Devils said, "I'm having a great time, and I'd like to thank all of these great people [InnoWorks mentors and staff] for coming out of their way and putting their lives on hold to be with us young folks. Thank you!" Our vision of interdisciplinary science and engineering exploration through group learning activities and team-based competitive missions is making a difference in the students' perspectives on education. Brittany Watson, 11, explained, "They're [mentors] really protective and they care about you a lot. I liked science but I didn't think it would be as fun so I didn't really pay much attention to it, but now I realize that science is much more than boring."

InnoWorks is a dynamic hands-on science and engineering program designed by volunteer college undergraduates for middle-school students from disadvantaged backgrounds. The primary goals of InnoWorks are to (1) provide underprivileged students with an opportunity to explore the real-world links among science and engineering disciplines, (2) to foster teamwork, enthusiasm, and career interests in science and engineering, and (3) use cutting-edge neuroscience and educational research to develop mentoring, teaching, and learning methods that build student confidence in problem-solving.

ABOVE: Chris Thompson proudly displays the trophy he earned. Students were rewarded for team and individual performance; every student that completed the InnoWorks program received at least one trophy.

LEFT: Vineet Agrawal conducts the "Smell of Taste" Station while mentor Adam Schmelzer helps his team.

InnoWorks is unique among extracurricular educational programs for several reasons. First, it is developed and conducted entirely by volunteer undergraduate students from around the country eager to share their passion for learning. Second, InnoWorks curricula are exceptionally interdisciplinary, encouraging students to understand connections among different scientific fields and how they relate to their own lives. Third, InnoWorks personalizes and creates novel mentoring and teaching methodologies by utilizing cutting-edge cognitive neuroscience and educational psychology research. Finally, InnoWorks programs are offered entirely free of charge for students nominated by their schools and community centers.

This past year, the human senses served as the program theme and each program ran for approximately one week. Every day focused on a sensory subtheme (e.g., Vision, Hearing, etc.), using concrete sensory experiences as the impetus for learning sessions modeled on Kolb's experiential learning cycle. Each subtheme began with group activities as the primary learning experiences, followed by competitive missions in teams of four students, each with one or two undergraduate mentors. Mission topics included robotics, rockets, electronic filters, simulated epidemics, microscopy, fiber-optics, and crime scene investigation, all designed to inspire students to use and extend the knowledge gained from the group-learning activities.

More than 20 Duke students collaborated to publish two books on InnoWorks mentoring, learning, research, and curricula and we are writing several research papers for peer-reviewed journals and conferences. Our abstract for the 2006 American Society for Engineering Education Conference was recently accepted. Currently, InnoWorks has chapters at Duke University and the

Lori Hu and Amit Patel mentor their teams during the Radioactive Waste Disposal Robot Mission.

Emma Tomlinson ponders reflective questions designed to encourage students to think "outside-the-box" after each activity and mission. Teams earn points if all team members answer each question.

University of Maryland, with over 80 undergraduate volunteers and multiple efforts to expand to a national and international level.[ii]

Our first meeting of the new school year was both a nostalgic homecoming and the opening of a bright new chapter in InnoWorks history as we welcomed our new members. We excitedly brainstormed and discussed how to further improve InnoWorks. When I asked the InnoWorks' veterans, "What does InnoWorks mean to you?", Vineet responded: "Anyone interested in the ideals of shaping the leaders of tomorrow, I urge you to consider InnoWorks. Very few other organizations can offer you such a well-rounded and fulfilling experience." There are opportunities for everyone to make a significant contribution—whether you enjoy working with students or potential sponsors, developing curricula, writing and editing books, designing and analyzing creative ways of mentoring and teaching, to name a few examples. The aspect of InnoWorks that Matt and Dan find most exciting is the fact that we are truly an organization of students; we make all of the pedagogical, organizational, and financial decisions—"impossible" is not in our vocabulary and no ideas go unheard. InnoWorks is meaningful to Jessica Manson because "We're all so blessed to be able to attend Duke. We did not get here by accident, nor did we do it alone. These kids, and everyone for that matter, will not make it alone either—they need guidance and role models just like we did. Through InnoWorks, we are able to help fulfill this need."

Though the staff and mentors[iii] will inevitably diverge on various paths, we have forged a bond through InnoWorks that is destined to last a lifetime. We achieved because we believed; a full-time commitment to school, jobs, and extracurriculars does not preclude making a positive impact on others—these are only artificial boundaries that should not and will not hinder us. We will always work together to pursue our dreams of improving educational opportunities for youth without access through innovation, passion, and devotion; if this sounds like an exciting opportunity, we invite you to join the InnoWorks family and together we will redefine the realm of the possible.

The day will come when InnoWorks students become mentors for InnoWorkers of another generation. We will smile at each other and know in our hearts we made a difference – our efforts truly make sense.

William L. Hwang is a senior triple major in Biomedical Engineering, Electrical and Computer Engineering, and Physics with a minor in Chemistry. He co-founded United InnoWorks Academy, a 501(c)(3) non-profit educational organization, in December 2002 and serves as CEO and program director. Hwang was selected as a Rhodes Scholar in November 2005.

For more information on InnoWorks, please visit www.innoworks.org. If you are interested in joining InnoWorks, please contact our Chief Administrative Officer, Jessica Manson (jem21@duke.edu).

[i] *The InnoWorks programs were made possible by the generosity of numerous sponsors, including Cisco Systems Foundation, GlaxoSmithKline, and the National Science Foundation MSP VIPK16 Grant. I would also like to express our appreciation for several individuals that really went out of their way to help InnoWorks: Professor Gary Ybarra, Dr. Ahrash Bissell, Dean Kristina Johnson, Mr. Paul Klenk, Dr. William McNairy, Dr. Annette Golonka, and Ms. Linda Broughton.*

[ii] *New chapters are being established at UPenn and Georgetown. We are improving the "Making Sense of Senses" program for implementation at these new chapters. We are developing a new curriculum based on "Exploration" for the 2006 Duke and Maryland programs.*

[iii] *2005 Mentors and Staff in the Pratt School of Engineering: Vineet Agrawal (BME/EE, '06), Edward Chu (BME/EE, '06),* Michael Garcia (EE, Graduate), Lori Hu (BME, '06), William L. Hwang (BME/ECE/Physics, '06),