AC 2011-252: GRANDPARENTS UNIVERSITY PROVIDING THE SPARK TO ELEMENTARY STUDENTS

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Grandparents University – Providing the Spark to Elementary Students

Abstract

Michigan State University's (MSU)Grandparents University is an opportunity for grandparents and grandchildren (ages 8-12) to come together for a 3-day educational experience while spending time together on the MSU campus. Participants enjoy the college experience of living in the dorms, attending classes across campus and sampling the many highlights of MSU. Grandparents University gives alumni a chance to relive their college days while exploring campus and creating lifelong memories with their grandchildren." With this description of the summer activity of Grandparents University at MSU, the Department of Mechanical Engineering began the process of bringing impressionable youngsters into the department to get an early look at mechanical engineering and their possible futures in the discipline. Over 2600 students and grandparents have participated in Grandparents University, with over 1400 targeting college of engineering activities. In the third year of participation in the program, the department has decided that the effect upon the youngsters has been very positive and worthwhile. It is more and more evident that in order to excite youngsters into becoming engineers, that these youngsters must be influenced early by the thrill of engineering, which can last well into their college years. Over the past three years 320 grandparents and elementary students have specifically taken part in the Department of Mechanical Engineering's efforts in bringing engineering to the young. The belief in creating a program that is both educational and fun was critical when planning an activity for 8-12 year olds and their grandparents. The participants are engaged in learning about mechanical engineering, teamwork, and tower building. Details concerning the planning of the activity, the educational value, the work that is accomplished by the participants; impressions of the faculty, staff, and graduate students; and plans for the future will be presented. The importance of catching the attention of students at an early age along with the support of their parents and grandparents is something that all engineering schools must take into consideration when planning their outreach activities for K-12. The earlier the students are connected to engineering with positive approaches, the earlier they will start the road to seriously looking at engineering as a career. Surveys presenting the attitudes of participants will be provided, along with the details of other departments in the college participating in Grandparent's University.

Introduction

Universities around the United States are beginning to see the importance of starting to influence children at an earlier and earlier age into becoming aware of the opportunities of gaining a college education by focusing on their interest in areas as broad as English, forensic science, and engineering. The University of Wisconsin, Ohio State University, University of North Texas, and Western Washington University, along with Michigan State University have Grandparent University activities in place. Each of these institutions is banking on getting young students involved and grandparents refreshed in activities that take place on campuses across the country. Alumni are quick to sign up for a return to their alma maters coupled with sufficient time to influence their grandchildren in the joys of their institutions. They know that these experiences are vital for the future generations and they speak to this need. "Concerns about the lack of

exposure to engineering for all children and ensuring a larger, more reliable supply of future engineers have been accompanied by the realization that we have not yet determined the best way to expose children to engineering skills and concepts. We are still investigating which aspects of engineering are developmentally appropriate for children of different ages and what kinds of experience are most effective. Because engineering has not generally been emphasized in pre-college settings, the body of literature on how children learn engineering is small. However, a few of the critical findings that have emerged are synthesized in this article."[1]

> Grandparents who stress the importance of education to their grandchildren can now back up those words with actions.
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> Several colleges around the country have embraced a concept known as "Grandparents University," a program that offers grandparents and grandchildren the chance to take several days' worth of classes, live in a dormitory, eat in the cafeteria and experience college life — including, in some cases, "graduating."
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> Michigan State University and the University of Wisconsin-Green Bay are just two of the schools offering Grandparents University classes on their respective campuses in late spring and early summer. Michigan State's three-day session in June is already sold out, and the school is expecting more than 820 participants after drawing 542 last year (2009). *(For 2010 – numbers will be over 1,000)*
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> UW-Green Bay is still accepting applications for its two-day program July 24 and 25, and is expecting more than 100 participants.
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> "This is our third year, and each year we focus on different faculty expertise," said Barbara McClure-Lukens, UW-Green Bay's director of the Office of Outreach and Extension. "This time we're offering four different 'majors.'"
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> Just like college students, participants select a major, can choose whether to live on campus or commute (children and grandparents must stay together in the dorm suites), and can participate in a graduation ceremony at the end of the experience. The majors this year are computer science, art, human biology, and natural history and ecology. The classes are designed for children ages 7 to 14.[1]

The Plan

In 2007, with the above clear in the minds of members of the Department of Mechanical Engineering at MSU, there was no debate needed. It was necessary to provide time for alumni and grandchildren to, in one case to return to ME and the other case to experience a part of ME. Grandparents and grandchildren could both benefit from sessions being offered by the department. Sessions were slated to be 3 hours and every second needed to be utilized to interest all participating parties. "At MSU, the three-day experience includes two nights in the dorms for grandparents and grandchildren ages 8 to 12. There are three-hour classes in the morning and in the afternoon, and an evening program that runs the gamut of a college student's experiences, including ice skating on the same on-campus rink used by the nationally ranked MSU hockey team, bowling and billiards at the

Student Union, swimming at the natatorium, and movies at the dorm. MSU is a research university and much larger than UW-Green Bay, and therefore offers a list of classes for Grandparents University that is 11 pages long and includes instruction in everything from agriculture to education, engineering, social sciences, music, veterinary medicine, and more."[1] Within this three-day event the Department of Mechanical Engineering would have 4 sessions of 40 – 44 participants, thus impacting approximately 175 grandparents and grandchildren. As registration began, all four sessions were booked to capacity. When thinking about what to do in these sessions we follow the idea that, "Under the right conditions, young students can engage in relatively sophisticated engineering design activities long before they reach young adulthood."[1]

In the description of courses, the wording was compact and to the point, in our session, participants will be introduced to an overview of the engineering disciplines, along with the elements of problem solving. They will have a chance to discuss as a group how a problem can be approached, addressed with multiple solutions that might solve the problem, and specific solutions that are most workable for the group.

The group will then break up into their family groups to design, build, and test a drinking straw tower. The end product will be a tower that they can take home that shows their design skills.

The Process

As the sessions began, participants were given an overview of the major disciplines in engineering: mechanical, electrical, civil and environmental, computer science, agricultural, and chemical. For the children, quick discussion focused on understanding that engineers work with a wide variety of other engineers, and it is necessary to have a general knowledge of what others in neighboring fields do in order to understand all the working relationships that occur on the job. "Introducing engineers to children as people who solve everyday problems has been correlated with interest in engineering careers, and experience using engineering design to solve everyday problems appears to reinforce that perception and increase interest in engineering careers."[3] From that general overview, it was a quick movement to some of the mechanical engineering areas that needed to be uncovered:

- Mechanics - machines and structures
- Fluids – aerospace, processing, etc.
- Thermal Science – heating/cooling
- Controls – interface electronics and machines
- Manufacturing – material processing

The audience was given a wide variety of examples to show the above areas being utilized in the real world, then immediately moved into the core of the ME program – Design. The group was being prepped for the activity that was to follow, building a tower to support a given weight. They needed to know the design process:

- Know what the problem is and define it
- Brainstorm possible solutions
- Pick the most promising solutions

- Plan and build
- Test
- Change as needed

An example was provided to get discussion going:

Engineering design begins with a problem to define and questions to ask.

Problem Definition: "I want to fly around the world in an aircraft without refueling or stopping."

- How Far? Over 24,855 miles (circumference of the Earth)
- Engine? Jet Engine, Turboprop, Car Engine, Rocket, Ramjet?
- How Many? 1, 2, 3, or 4 engines?
- How Much Fuel? 10, 50, 500 gallons?
- Wings? Triplane, Biplane, Monoplane, Mid-wing?
- How Many Pilots? 1, 2, or 3?
- What should the plane possess and or look like?
- What do you think will work?
- And more importantly - How do you know?

The open-ended discussion continued with a simple problem – I need to get across the Grand Canyon. The 8-12 year olds became extremely active in wanting to present their ideas after they discussed some of the issues of the problem:

- How far across was the canyon?
- What materials could they use?
- Were they limited by budget – money constraints?
- How long did they have to build the solution?
- Did only they or many people have to cross?
- Were they limited in their ideas?

Following this they started to fire their ideas in a truly brainstorming fashion, with answers like:

- Build a bridge with steel, wood, plastic, or paper plates.
- Fill the canyon with rocks, bricks, sand, diamonds, and drive across.
- Build a rocket and shoot yourself across.
- Take a high powered motorcycle and jump the canyon.
- Dig a tunnel under the canyon, using very, very high explosives.
- Climb down, dam up the river, and wade across.

Stopping at this point, it was important to note that while we were trying to instill in these children a rudimentary understanding of the design method; we also had a secondary agenda going on. We felt that this age student needed to know that questioning, idea production, and listening were vital elements of an engineer's life. We stressed the fact that all the ideas presented concerning the crossing of the canyon were to be listened to as possible solutions to

the problem of crossing the gorge. No idea was to be dismissed out of hand. It was in the discussion of why certain solutions would work better for realistic situations that the group finally decided upon the one solution that everyone could accept. By discussing the many solutions, they came to consensus. Our charge to them was to go home and any time that they worked with others, or heard other ideas, or had to make decisions on how something needed to be done that they would always accept others' ideas without criticism. This idea seemed to radiate with the grandparents and hopefully, they will remind their grandchildren of the need to listen to everyone's ideas.

Design, Build, Test

The Tower Build began at this point with simple instructions:

> Using Straws and Tape you are to build a tower that will support a bottle of water The tower must be attached to a piece of cardstock. The tower cannot be attached to anything: chairs, tables, the ceiling, people, walls, or the floor. It must be free standing. Each team is trying to construct the tallest tower that will support the water bottle.

For almost fifty minutes, grandchildren and grandparents designed, worked on multiple ideas, built, and tested their towers. In the end there was a profusion of every conceivable form of tower. Some only measured 3 inches in height because the designers wanted a tower that would not only hold the water bottle but could hold an elephant. Some went for a very aesthetic look. Others attempted engineering marvels. After the towers were completed, time was spent in discussing the merits of the towers themselves and how they might be improved. Again the students got into the action and voiced their opinions along with graduate students who discussed why certain ideas failed to support the water bottle or could have supported much more weight with simple modifications. The one thing that was agreed upon by all was that every set of grandparents and grandchildren enjoyed the activity and would take home a souvenir of their engineering experience.

Current and Future Considerations

As we completed the third year in the activity, it was important now to start surveying the participants, both young and old to get a clear indication of how they perceive the merits of attending Grandparents University. By also tracking these students as they grow older, we should be able to see if their attendance in the program has influenced their future decisions to enter engineering focused activities and careers. The following indicates the reactions of the attendees to the program. 95% of attendees surveyed answered that the quality of the instructors was excellent or very good and 91% of attendees surveyed answered that the overall class content was excellent or very good.
And anecdotal information:

- Very well organized, excellent instructors
- All the instructors were amazing in the amount of information they gave and the way they gave it.
- The class very well organized and very hands on. The staff was VERY ready for us.

- The instructors were well prepared, presented excellent material and involved the students, resulting in an informative, interesting, outstanding class. We loved it and talked about it for a long time.
- Quality of instructors provided a true College experience.
- The teaching/development part was excellent! The hands-on participation of the kids was top notch hands on experience. It was absolutely the best learning experience they could have had.

Conclusions

Engineering departments can gain access to whole new audience by participating in activities like Grandparents University. By providing experiences for 8-12 year olds and their grandparents, a new generation can see the excitement that can be had in all the disciplines of engineering. With very little effort in preparation, a great deal of benefit can be seen that may impact student enrollment in engineering schools and possible help with the retention of students who have learned about engineering early in their lives and maintained an interest in the same. Comments like the following will keep the program going," Tower Building. My nephew loved making the tower, and Tower building was the best, as my grandson and I very much enjoyed the concept, execution, and outcome."

1. http://www.nae.edu/Publications/Bridge/16145/16214.aspx
2. grandparents.com http://www.grandparents.com/gp/content/newsoftheday/news/article/grandparents-university.html
3. Reynolds, B., M.M. Mehalik, M.R. Lovell, and C.D. Schunn. 2009. "Increasing student awareness of and interest in engineering as a career option through design-based learning." *International Journal of Engineering Education*.