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OutReach Initiative for Education of Future Industrial Designers

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Abstract: *This paper discusses a program undertaken to educate high school students about the Industrial Design profession. An innovative OutReach program model is presented where design professionals, academic (college-level) and high school students are brought together to conduct a real life experience project. Urbanism is a designated topic for the program model. Findings are also presented, supporting success of the initiative.*

Keywords: outreach, industrial design, high school

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Introduction

Growth of the industrial design discipline continues to grow in universities across the United States. Awareness of the Industrial Design Discipline among high school students, however, still remains compromised. Most high school students are not educated and presented about the function and impact of the discipline in society. Most high school institutions attempt to present the discipline through "shop" classes, if resources are available. Other institutions present the discipline through computer or graphics design courses (Henry W. Grady High School, 2013). Even though efforts are made towards educating high school students about Industrial Design, they are limited in the understanding about the scope and broadness of the discipline.

New innovative models for educating high school students are necessary to guarantee successful awareness of the Industrial Design discipline. Real life experiences and the opportunity of practicing design with experts in the field can have a significant impact not only on educating high school students, but also preparing them to respond to the needs of the profession. In response to these needs, an "OutReach" program was developed. Designed as a 2-week event, professionals, academic and high school students joined efforts towards designing products.

The OutReach program was sponsored by the Industrial Designers Society of America (IDSA) and organized by the local IDSA Atlanta Chapter, with the help of local higher-level institutions including the Georgia Tech School of Industrial Design, Auburn University and a local high school.

IDSA is the world's oldest, largest, member-driven society for product design, industrial design, interaction design, human factors, ergonomics, design research, design management, universal design and related design fields [Industrial Designers Society of America, 2011). As stated in their website, "IDSA organizes the renowned International Design Excellence Award (IDEA) competition annually; hosts the International Design Conference and five regional conferences each year; and publishes Innovation, a quarterly on design, and designBytes, a weekly e-newsletter highlighting the latest headlines in the design world. IDSA's charitable arm, the Design Foundation, supports the dissemination of undergraduate scholarships annually to further industrial design education." Absent from that is the goal of educating high school students about the discipline. The significance of this OutReach program as part of IDSA is not only to increase the awareness of the discipline but also to promote industrial design specifically to students interested in design in general. As such, this program provides a needed venue for the organization to have an impact on and recruit young future designers.

About the Program

Design professionals, academic (college-level) students and high school students were brought together to conduct a real life experience project. The program was structured such that they worked together for 2 weeks designing products aimed at responding to a local governmental need, also involved in the program (see figure 1).

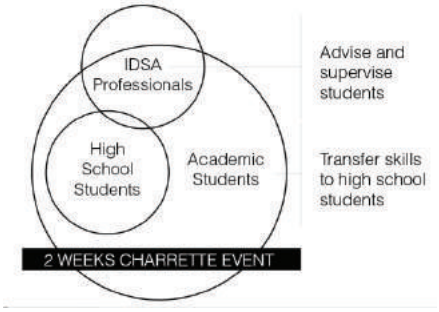

Figure 61. OutReach program model.

Design professionals were recruited from the IDSA Atlanta Chapter membership database. A total of 9 professionals from the Atlanta area volunteered and enrolled in the program. College level students were recruited from the School of Industrial Design at the Georgia Institute of Technology. Both graduate and undergraduate students were invited to participate in the program. A total of 9 graduate students and 7 undergraduate students volunteered and enrolled in the program.

High school students were recruited form a local institution. The high school is committed to excellence in public education, especially through one of the four small learning communities: Communication and Journalism. This learning community is highly interested in teaching students about creativity, design and design processes. Through one of the classes offered at the institution, 24 high school students were recruited for the outreach program.

Program Topics

Urbanism was a designated topic for the program. The project topic was chosen to address local urban needs. Moreover, it was an approach to work with local entities interested in improving the use of urban outdoor spaces. As such, the major goal was to expose students to designing devices for outdoor spaces with the intent of creating social impact. They were expected to design products and/or system prototypes that could potentially be implemented in order to have a positive impact in the city of Atlanta and promote better use of outdoor urban spaces.

The local entities included the Atlanta BeltLine Inc. (ABI), which is formed by the Atlanta Development Authority. This entity is tasked with planning and executing the implementation of the Atlanta BeltLine in partnership with the BeltLine team including City of Atlanta Departments. The Beltline project aims at providing “a network of public parks, multi-use trails and transit along a historic 22-mile railroad corridor circling downtown and connecting 45 neighborhoods directly to each other” (Atlanta Beltline, 2011). The Beltline is a work in progress project, where certain sections have been partially completed. Social awareness and involvement on these spaces is paramount for the success of the project.

The local High School campus was also included as an urban setting to design for. Their outdoor campus has been facing underutilization due to the impact of students using computers indoors. Likewise, the campus of the Georgia Institute of Technology was also included as another urban setting (Georgia Institute of Technology, 2011). New bridges to link east and west sides of campus have been developed with outdoor

landscaping. Even though open green spaces are available, they remain underutilized.

Lastly, designing for the metropolitan Atlanta area was also part of this program. The Livable Communities Coalition was included as the fourth urban setting (Livable Communities Coalition, 2011). The Livable Communities Coalition aims at improving "the quality of life in metropolitan Atlanta by sharing and promoting smart growth principles, advocating public policy that promotes smart growth, and supporting projects that accelerate smart growth". The Livable Communities was formed in 2005 and it has been working with over 50 organizations to meet their goal. Projects are varied focusing on land use or density, transportation, housing choices, and conservation of open green space and natural resources or environments.

Design Drivers

Having identified the topics, a total of four aforementioned entities, the program set three shared main premises for the projects and urban settings. These premises operated as design drivers for participants to meet.

- Integrating communities and generations by design
- Motivating people to move by design
- Making cities more livable by design

Participants were divided into teams and randomly assigned one of the four urban settings. Professionals were briefed on the allocated urban setting in advance so as to be prepared to lead their teams at event kick-off. The high school students were introduced to the topic when the event started and groups assigned.

Team Composition

Program participants were divided into teams of mixed industrial design experience. A total of 8 teams were set up, comprised of one professional, one graduate student, one undergraduate student and three high school students (see Figure 2) (though some teams had more graduate students than others). The goal was to have half of the team members knowledgeable with the design discipline, and the other half to be taught about the discipline. Meaning, a ratio of one design related member for one non-design related member.

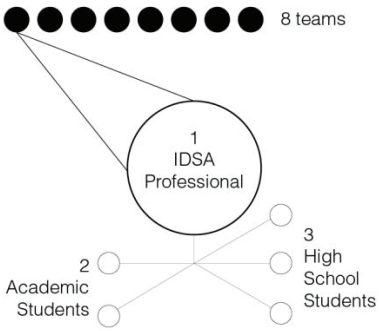

Figure 62. Team composition.

The program was structured such that design professionals functioned as their

team's project leads. Their goal was to kickoff the program with brainstorming activities, lead the scope of the project and supervise the project development. Students had access to professionals but their availability was limited and reserved for major milestone meetings or via e-mail for other tasks. Industrial design college students worked directly with the high school students and facilitated day-to-day design development, supplementing the professionals. With this structure, high school students are exposed to the entire design process from conceptualization to execution.

Design Parameters

Design parameters were set up in advance so as to serve as a logical guide for professionals and students to operate under. The parameters presented included the following:

- The product(s) must be designed for the outdoors within the assigned urban setting.
- Design a product(s) with simplicity and major social impact.
- The product(s) design should address the program's "design drivers" issues:
- Integrate communities and generations by design.
- Motivate people to move by design.
- Making cities more livable (specifically the assigned urban environment) by design.
- Design a prototype(s) that can be realized with $500
- Design a prototype(s) that can be realized/replicated in a short period of time (e.g. 2 weeks)

Motivational guidance

Besides the aforementioned design parameters given to the teams, organizers educated teams with additional guidelines. These guidelines included a set of actions to be taken during the 2-week program, referred as to "motivational drivers" intended to encourage participants towards achieving a successful experience in the program. The motivational drivers included:

- Be curious
- Observe
- Sketch
- Photograph
- Keep a journal
- Don't discard wild ideas
- Discuss
- Communicate often
- Ask
- Collaborate
- Work hard
- Keep focused

Documentation of the project and work-in-progress was strongly encouraged. Teams documented their processes by taking pictures, having the high school students keep a daily journal, and using social media, such as facebook, for uploading project status.

Design Outcomes

Teams were tasked with following the entire design process from ideation to product fabrication. The outcomes of the program were functional prototypes. The goal was not only to expose students to the complete design process but also to potentially place their outdoor designs in the assigned urban settings. The designed products were to be produced on a small-scale using desktop manufacturing techniques, such as laser cutting. The rationale was to limit the need of specialized skills for fabrication. If special fabrication were needed, academic students and professionals would compensate for the skills needed.

Fabrication Support Capabilities

The Georgia Tech School of Industrial Design's fabrication capabilities were available to any of the teams wishing to fabricate design models and/or components outside of the high school student's classroom capabilities. Georgia Tech's design shop is outfitted to support product and architectural modeling and furniture production needs of students and faculty. The shop is divided into four areas: assembly area, paint area, modeling area and rapid prototyping area. The modeling area is equipped with the following capabilities:

- General hand tools
- Wood working (cutting, shaping, finishing and joining)
- Plastics cutting
- Some metal fabrication
- Spray booth for adhesives and material finishes

The rapid prototyping area is equipped with four 3D printing machines: two ABS plastic Dimension FDM 3D printers and two powder-based Z-Corp 3D printers.

Additionally, participants had access to laser cutting equipment for use on paperboard, chipboard, cardboard and wood veneers (up to 24"x36").

As a general guideline, only shop-approved personnel who had completed a basic orientation session at the School were allowed in the shop, for example academic students. Guests were allowed in the assembly area only, away from heavy-duty fabrication machinery.

Program Events

The Design Charrette started on a Thursday evening and unfolded over two weeks. Teams met the first day to start the project and concluded with a final event presentation of posters and prototypes. In addition, a special exhibit was scheduled to present the final designs during a local "Atlanta Design Week" event.

In detail, below are all event activities and milestones performed by the teams.

Week 1

On the first evening of the project, a Kickoff event was held at the high school. The kickoff event was an informative and educational public event open for all participants, parents and the general public. The kickoff educated the public about the design process and introduced inspirational work on urban outdoor products, products designed for social impact and product design employing desktop manufacturing. It

also outlined the event structure, team compositions, urban settings assignments, activities/milestones and general expectations. Each program participant was given a handbook that detailed program scope, team contact information, urban settings specifications and schedule/due dates for all activities.

Figure 63. Group meeting during program kickoff.

Once all materials were presented, teams meet for the reminder of the session to perform brainstorming and mind mapping activities and preliminary problem identification of the assigned urban setting (see figure 3 and 4). Professionals lead the sessions, teaching high school students about brainstorming and mind mapping activities. They also brought materials to guide the session. At the end of the meeting, teams were tasked with delineating a set of directions in order to conduct focused ideation over the following days.

Figure 64. Team leader guiding brainstorming during program kickoff.

Over the course of the project, graduate and undergraduate students met with high school students during high school class times to help them ideate. On the fifth day of the program, teams (except professionals) were tasked to meet at the High School classroom to identify viable ideas/concepts. The goal was to set up a direction to start performing concept modeling and study modeling in the following days (see figure 5). High school students were given examples of what a study model looked like as well as given supplies to work on them.

Figure 65. Student study models.

By the end of the first week, all teams, including professionals, met for a mid - project review to assess the work done to date and get feedback for upcoming refinement and development phases.

Week 2

The design development and prototype fabrication were performed during week 2 of the program. Design prototyping was required to be completed by day 15 for presentation at a concluding exhibition event.

On the 8th day of the programs, teams started the concept refinement based on the feedback provided during the mid-project review. After 3 days of concept refinement under the supervision of graduate and undergraduate academic students, teams started the prototype construction (see figure 6).

Figure 66. Prototype construction.

Each team was given a budget of $200 for supplies. Materials were bought and prototypes were constructed using the high school students' classroom and support facilities from the School of Industrial Design at Georgia Tech (see Fabrication Support Facilities section).

Prior to concluding the program, teams were asked to dedicate a day developing a final presentation of their product and finalizing all details for the final delivery (see figure 7).

Figure 67. Digital modeling.

Final Delivery

All teams were required to have the following deliverables for the concluding event:

- 1 design prototype
- 1 digital presentation (e.g. PowerPoint) describing the product design and process.

Specific directions were given to develop the final presentation, including:

- Description of the final concept
- A statement and justification for each the “design drivers” issues
- Brief explanation of the process including imagery
- 3 perspective views of the concept making reference to the scale of the device(s)
- The concept in use
- List of materials
- Cost, budget justification for the device(s)
- Manufacturing schedule (personnel/time)
- Summary lessons learned in the event

The final presentation was hosted at the College of Architecture at Georgia Tech so as to motivate the high school students to feel part of an academic environment.

Products Special Exhibition

In addition to the final delivery, high school students were tasked to prepare deliverables for presenting their products at an additional special exhibition during “Atlanta Design Week”. They had an additional week to design a poster for a public event. Their posters needed to contain the following:

- A short description of the final concept
- An statement and justification for each the “design drivers” issues
- 3 perspective views of the concept making reference to the scale of the device(s)

- The concept in use
- List of materials

First time presented in the city, "Atlanta Design Week" was a concentrated sequence of events intended to promote the value of design and Atlanta's vibrant design community. The goal was to challenge designers in Atlanta to consider their collective role in making Atlanta a better place. Participating in this week of design events was envisioned as a way for high school students to feel part of a growing design community.

Program Results

The program concluded with the expected outcomes, where teams presented their final prototypes and presentation. Eight inquisitive and distinctive products were designed and delivered. Two products per setting (Atlanta Beltline Inc., High School Campus, Georgia Tech Campus and Livable Communities Coalition/Metropolitan Atlanta) were showcased in a three-hour concluding event, described in the next paragraphs.

Team 1 developed "Trash n' Smash", an interactive trashcan that encourages high school students to reduce pollution at their school by offering an interactive disposal experience through music and by giving them something valuable in return. As students used the trashcan, they collected points to tune music of their choice.

Team 2 developed "Around the Blox", an improved interface for the newly implemented Atlanta parking system. After user research, their concept was based on designing a better and friendlier interface, a shell which helps to resolve weather exposure, screen glare, visibility from a distance as well as street and side walk surrounding the box itself, making the path and information more apparent. Their proposition was an economical solution that used vinyl decals mounted in plastic and existing parking systems (see figure 8).

Figure 68. "Around the Blox" interface design.

Team 3 developed "History Station", a platform to Atlanta's past, located along the Atlanta Beltline. Their concept was based on providing a display box that showed the history of Atlanta's trains (see figure 9), encouraging people to walk the beltline as an open-air public museum.

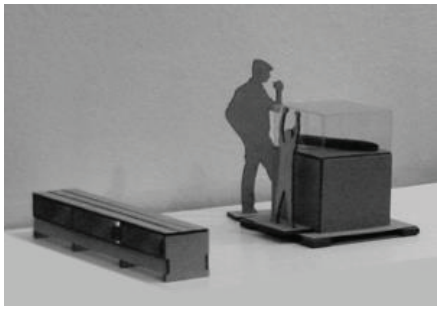

Figure 69. "History Station" concept design.

Team 4 developed "Tech Bench", a seating design for the Georgia Tech campus. Their focus was to create more social areas within the green spaces at the campus (see figure 10), and based their concept on the aesthetic properties of biological systems such as hives to allow multiple and flexible configurations. Integrated solar power and electrical outlets allow the seating system to accommodate plugging in multimedia devices outdoors.

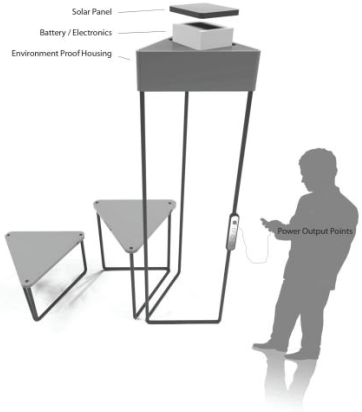

Figure 70. "Tech Bench" seating design.

Team 5 developed "Knight Life", a physical interactive display system for the High School. Their concept addressed the issues of poor advertising of school events and lack of school/student spirit. The interactive system was based on the idea of collecting tickets for a monthly raffle to win the opportunity to design and display unique ads in the display system called shields.

Team 6 developed "Walk Waves", a stylish barrier serving as a safety device found around metropolitan Atlanta. Their goal was to create a versatile product for the community that is modular, visually appealing and durable to be placed as safety barriers to the bridges of metropolitan Atlanta. In addition, they proposed the devices to operate as information system by allowing the incorporation of maps on them. Their proposition consisted of shape mold concrete materials.

Team 7 developed “Search and Seek”, an interactive game for the Atlanta Beltline. Their concept was based around an annual one-day scavenger hunt event. Their goal was to raise awareness about the Beltline through a learning game experience; getting people to moving through physical games around the Beltline; and connecting generations in a fun way.

Team 8 developed “The Leaf”, a seating design for the 5th Street Bridge at the Georgia Tech campus. Their concept was based on transforming the bridge into a destination. Their focus was to design a seating area that is inviting and comfortable to attract people to the area. Their proposition provided an aesthetical appeal alluding to the classic wooden bench swing (see figure 11).

Figure 71. “The Leaf” seating design.

Program assessment

A survey questionnaire was conducted to assess the overall performance of the program. The survey was composed of 10 questions completed online in approximately 10 minutes. The online survey was sent to all program participants including the professionals, the graduate students, the undergraduate students and the high school students. For the purposes of assessing the program, organizers were excluded from the survey. As such, a total of 49 participants were included in the survey. A total of 42 participants (86%) successfully responded to the questions. Out of all respondents, 60% were high school students, 17% graduate students, 13% professionals and 10% undergraduate students (see Figure 12).

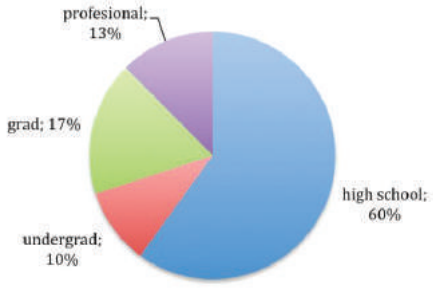

Figure 72. Survey participants.

Overall, 98% of the participants reported the program should be repeated next year. The majority of the thoughts about the program were positive (76%), where only 7% had negative comments. The majority of the comments towards the program were encouraging as respondents stated:

> "This was a wonderful experience. It opened an opportunity to us that every designer dreams of. Also, I learned many new things about the world of industrial design."
> "I loved working in the program and I loved working in a professional setting. Overall it was a memorable experience and got me used to working under a deadline."
> "The OutReach program was a good experience. Because I have never gone through the process of industrial design before, it was challenging. However, I learned a lot about the design process that I was not exposed to before the project. I enjoyed the program, and thought it was neat to learn from professionals and hear their feedback."
> "Great idea & very revealing to all levels of participants."
> "Education has found a valuable design ally. It was useful, effective, and awakening to all involved. To mentor, to guide, are the cornerstones of building enthusiasm for any profession."

Participants were asked to list three concepts that were learned during this program. High schools students reported different concepts from responsibility, sacrifice, presentations, making things, questioning, etc. Among all 10 identified categories of concepts, the most frequently described keywords were time management (17%), teamwork (14%), sketching/ideation (10%), brainstorming (8%) and production/constrains (8%). In general, students reported to learn "the full, intricate process of designing, and then mocking [up] a full sized industrial project as well as how to work efficiently under pressure and tight schedules".

Time constrains were reported to be inappropriate. The majority of the participants (76%) stated that 2 weeks was not sufficient for the program. Many recommendations included extending the schedule to 3 weeks. Other recommendations included scaling down the topic, where 76% reported the scope not to be appropriate for the allocated time and purpose of the program.

The majority of the participants stated that the program was well structured in terms of milestones (71%) and that team size structure was highly appropriate (95%). In terms of rating the program, high scores were given to the organizers availability as well as the program organization, settings, materials and resources (see figure 13).

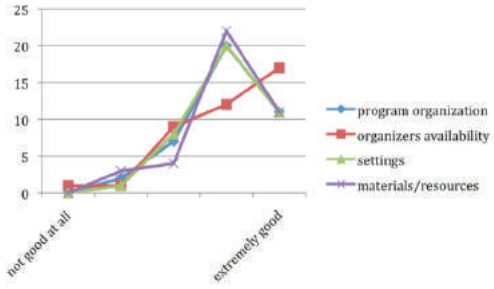

Figure 73. Program assessment.

Discussion

Overall, the participants at all levels of the OutReach program (organizers, professionals, college students, high school students and parents) considered the endeavor a success, with some changes suggested to be implemented for a second staging. The design professionals (team leaders) found valuable mentoring experience and learned to lead teams with a broad range of capabilities and maturity. Graduate and undergraduate college students saw design education from "the other side" and came away from the program with a greater appreciation for articulation of the design process and for teaching design concepts (much to the joy of a few participating professors!).

Additionally, by supplementing the design professionals, academic students were able to develop a rapport with the professionals and network for future job opportunities.

The structure of the program was found valuable, as mentioned previously, and serves as a model for other disciplines to implement outreach programs, such as: engineering, computer science, interaction design, etc. The key element is to include practitioners/professionals that can serve as a pragmatic guide to students, both academic and high-school. The second element is to integrate academic students into working groups with the high school students. In this role, the academic students clear the roadblocks involved with making and prototyping (transfering specific skills needed to realize the final product) and coach high school students through the design process.

There were identified issues, however, with the program that requires improvement. In regards to project scope, it was found that many high school students had difficulty relating to the size and scope of the environmental and open-ended design tasks presented to them. It is recommended that activities are restructured to be more product focused to allow better hands-on understanding of problem contexts by the high school students. Additionally, problem scopes need to be better prescribed initially, allowing the project teams to focus on 'how they are going to solve the problem' and less time on 'figuring out what to do.' It is believed this will lead to more robust project outcomes.

Part way through the program, it became apparent there was a missed opportunity with the structure of the program - a lack of focus on parents of the high school students. The parents were very supportive of the OutReach program and were more eager to be involved than the organizers had foreseen. At the conclusion of the program, many parents expressed that they too wanted to learn more about industrial design as a profession. This is a very important audience for industrial design to engage, as parents play a major role in their children's career direction and choice of academic institution. In the future, program planning will include special focused sessions for parents. These sessions will take place during the launch of the two-week program with presentations describing industrial design and the role of designers and will allow parents to engage the organizers, IDSA officers and professionals directly.

Budget was an issue with the program. The majority of funds, around $1,000 USD, were sourced out of the IDSA-Atlanta chapter's operating funds, accounting for approximately three-quarters of the operating budget for the year. This allocated money went towards acquiring materials for brainstorming tasks and ideation, and for

materials for model and product fabrication. It was reported that budgets were tight for what each team wanted to accomplish. For a second staging of the program, it is imperative that additional sponsoring funds be secured. A suggested operating budget, given the same number of teams and similar operating structure, is closer to $2,000 USD. Recruiting a 'title' sponsor would also help towards defining the focus and direction of the OutReach program and provide additional material support.

Through this program, several collaboration issues arose, including: time, expectations and responsibilities. Due to alternating class schedule at the high school (classes alternate every other day and every other week), it was not always possible for all academic students to meet with the high school teams during every scheduled class time, due to the fact that academic students have a fixed schedule. Second, there were some cases of mismatched expectations. In these cases, the high school students had an expectation the academic students would serve to advise and guide, rather than supervise. At the same time, the academic students expected the high school students to be more explorative on their own, rather than needing as much direction as they did. Lastly, in terms of responsibilities, there was some confusion on the specific responsibilities of each member in the team. For example, at one point the responsibility of fabricating the design prototypes shifted to the academic students rather than the high school students as was intended by the program coordinators. In a second example, there was a lack of "homework" on high school students' part. Academic students would expect the high school students to work on projects between meeting periods, but little work was actually done.

Conclusion

This paper discussed an innovative program undertaken and sponsored by the Industrial Designers Society of America (IDSA) to educate high school students about the Industrial Design profession. Professionals, academic (college-level) and high school students were brought together to design urban outdoor devices to impact the city of Atlanta. Through teamwork, time management, brainstorming, sketching, development and fabrication, high school students were exposed to a successful learning experience of the complete design process. Survey questionnaire studies were conducted to assess the efficacy of the program with high school students, and academic and professional designers having a role in the k-12 educational system. Results indicate a successful performance of the program model to be refined and replicated across high schools. The program not only helps high school students to gain a meaningful understanding of Industrial Design, but also mainly gives an opportunity for design professionals to give something back to the design community. The goal of this IDSA-sponsored OutReach initiative is to inform high school students about the profession of industrial design, and for academic and professional designers to have a role in the k-12 educational system.

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