

**Industrial Design Outreach Program:
Case Study in Collaborative Education**

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“High school students’ performance is dramatically affected when they are regarded as part of the projects community, rather than a separate component of associated parts.”

—John Dewey, *Democracy and Education*, 1916

Many American high school graduates lack the fundamental skills and knowledge to be effective in modern society and the workplace. There have been many reasons cited, including a lack of curriculum offerings that are relevant and engaging for contemporary students. Concurrently, programs promoting creative thinking such as the visual and performing arts, music, and industrial arts, have been cut throughout public education. My organization, the Industrial Design Outreach (iDo) organization, attempts to reintroduce creative thinking in the classroom and thereby positively affect students’ classroom experiences through a program that delivers engaging and relevant learning experiences for today’s youth. iDo’s organizational model relies on collaborative educational relationships.

An exemplary collaborative education model underpins iDo’s success. The Industrial Design Outreach organization brings together many partners including university professors, university students, design professionals, industry experts, high school principals, guidance counselors and teachers. Collaborations with funding organizations generate financial support allowing delivery of the iDo curriculum free-of-charge to the high school system. The university mentor-to-high school student exchange is the foundation of the program, affording in some cases, a 1:1 relationship of university mentor-to-high school student instruction.

iDo Introduction

The Industrial Design Outreach Program (iDo) promotes the field of design and uses design methodologies, enhancing the education of both high school and university students. iDo delivers the program free of charge to high schools during in class and after school programs. Through hands-on interdisciplinary projects, iDo provides high school students with experiences fostering curiosity, promoting creativity, and building self-confidence. Through these learning outcomes, high school students acquire a framework for study beyond high school, within any of the creative disciplines. Since inception, iDo projects have included the design and fabrication of product packaging, illustrated books, musical instruments, lighting and apparel.

Reciprocally, by developing and delivering design curriculum to high school students, university students gain experiences that promote teamwork, enhancing communication, organization and presentation skills (Figure 1). Through the execution of projects and the delivery of curriculum, iDo provides both high school and university students a venue to give back to their community. iDo further extends its outreach by providing expanding numbers of retired design professionals a venue for mentoring both the university and high school students. These retired designers gain tremendous satisfaction witnessing the passing of knowledge to younger generations of designers.

The program has been successfully launched at five high schools over the course of five years. During this time, iDo has reached over 500 secondary school students. Over 75 university students have participated as mentors, and a growing pool of professionals and industry experts are benefiting from their ongoing contributions to the program.

The current Industrial Design Outreach program project, Community Bench, introduces high school students to the process of designing and fabricating a bench. This product integrates ergonomic, semiotic, and manufacturing subject matter into a cohesive, hands-on learning experience. Sophomore, junior, and senior high school students are introduced to computer design programs, rapid model making and prototyping, and usage of power equipment, in the fabrication of the Community Bench parts

manufactured from plywood and veneer materials. Portions of the bench are manufactured within San Francisco State University's computer numeric control manufacturing system, providing high school students the opportunity to witness advanced technology in the realization of their product. Upon completion, the Community Bench is presented to the student designer's school. For the high school student, it provides a sustained legacy of their experience; as an object it invites a continual expression of community through the act of human gathering.

Primary Partnership

iDo's primary partnership is between Martin Linder, iDo Founding Director and Associate Professor of Design and Industry at San Francisco State University (SFSU), and the SFSU Graduate and Undergraduate students. This partnership provides a unique vehicle for teaching design education to high school students. In order to succeed within this partnership, it is critical that all stakeholders work well collectively and individually. The duality of group cooperation meshed with individual ownership fosters extraordinary commitment from the participants. However, this is often a tricky endeavor, demanding a high-level of commitment from the program director and mentors.

The program director brought many years of developing teams to the iDo organization. During the creation of the Community Bench project, the iDo director began the process of team building by working closely with the university mentors in the establishment of a general set of learning outcomes for the project (Figure 2) and identifying the general project-type able to meet the learning outcomes. This initial work resulted in very lively debate amongst the iDo team. The director carefully listened to everyone's input, considered all the team members' ideas, and at times, gently navigated the group towards appropriate directions. The use of humor was also established early in the project by the director, ensuring an enjoyable work forum. The director focused on guiding the group towards decisions that united rather than distanced team members. The iDo mentors eventually used similar strategies as the director's in building and working within a team. iDo's primary goals are to foster the creation of community within high school, learn creative thinking processes, and develop a final work of high quality, instilling self esteem to all the participants. It was a surprise to many university mentors that through the process of developing the project vision, they too built a highly functional partnership that contributed greatly to the program's success.

Mentoring Mentors

It is also the director's responsibility to guide the mentors during the curriculum development phases so that mentors identify and create relevant lectures, demonstrations and skill training exercises, supporting the primary project objectives. It is critical in the early phases of curriculum development that each university mentor selects topics of personal interest. By having each mentor own their own area of the curriculum, they bring a deeper level of ownership and commitment to the project. With this commitment, the university mentors research, develop, test and deliver the curriculum with creativity, passion, and quality, resulting in strong scholastic engagement of the high school students.

This approach is not without risk. Because the university mentors are volunteers, some may not be able to commit adequate time to the curriculum development process. Also, the mentors have little or no experience in developing curriculum and delivering the curriculum to high school students. To ensure an appropriate outcome, the iDo director and the high school teacher collaborate with the mentors, providing necessary support throughout the course of the iDo experience. Also, sustained encouragement from the director to the mentors allows for a positive collective spirit, enhancing mentors' teaching confidence, and ultimately, self-esteem. The careful and sustained guidance from the iDo director, along with feedback from the high school teacher, at key project milestones render a curriculum of relevance and quality.

High School Partners

One of iDo's key tenets is delivering design education within public high school environments. This is in contrast to developing a high school design program at a location outside of the high school environment. To create and maintain the opportunity of implementing iDo at the high school location requires relationships with a number of high school personnel, including the principal, guidance counselors, teachers and students.

iDo strives to enhance the culture of the high school experience within its locale. Bringing iDo to the high school location is important because many high school students are disengaged and disenfranchised within their day-to-day high school experience. The limited availability of relevant and dynamic curriculum offerings available to high school students may be a factor. By entering the school classroom space or leading an after school program at the school location, iDo delivers an alternative for disengaged students, creating an opportunity to rejoin and reengage in the high school experience. We have observed that the positive reinforcement of the iDo project experience engages students in a manner that produces general attitudinal improvements that have transferred to other coursework.

To earn the opportunity to deliver the iDo program to schools is a challenging one. It requires the iDo director to make many presentations to high school administrators, telling (and selling) the story of iDo, the methods and successes, and gaining the high school administration's confidence. In the case of San Francisco public high school Thurgood Marshall, iDo's Director, Martin Linder, made these requisite presentations to both an outgoing and incoming principal, complicating matters.

Through Linder's sustained efforts, incoming Thurgood Marshall Principal Guillermo Morales became so intrigued and excited in the program, that he suggested ways to expand the program at his school. These suggestions were carefully considered by the iDo team, demonstrating a clear willingness to listen to and work with the administration. This discourse established a healthy collaborative relationship resulting in unexpected opportunities, such as the designation of onsite iDo facilities at the high school.

Morales' offer of a designated workroom at Thurgood Marshall, for the iDo Community Bench Project, provided excellent storage facilities, natural lighting, and a great environment to stage equipment, including band saws, drills, hand tools, gluing stations, etc. The iDo workroom provided a sense of place and pride for all the participants. This space resulted in a higher level of learning by the high school students, and increased the contributions from the iDo mentor team.

Another exciting outcome from iDo's collaborative relationship with the Thurgood Marshall principal is the development of new curriculum that joins iDo with a literature class. When Martin Linder mentioned to Principal Morales the development of a new iDo project focusing on kite design, Morales excitedly suggested the fusion of this project with a senior a literature class reading *The Kite Runner*. The new project will have the literature students communicate a central theme of the book into the skin of the kite. Upon completion, the book's author, Khaled Hosseini, will be invited for a kite flying celebration. The healthy partnership between iDo and high school principals has contributed greatly to the project's successes.

Teacher Partnering

There have been two primary models that iDo has formulated for high school students. The first of these being after-school programs, which iDo was solely responsible for the creation, delivery, and management of the class. The second model involves iDo collaboration with a high school teacher during the school day in existing classes. We have found that collaborating within the classroom structure, in partnership with a high school teacher, is a stronger model.

There are many challenges and benefits in collaborating within a class that is instructed by a certified high school teacher. Working with a high school teacher allows the iDo team to benefit from the teacher's experience as an educator and manager of a high school class. The teacher provides best methods for delivering class curriculum, offers advice to mentors as to how it can best be received by the students. The teacher knows the classroom student personalities well, often indicating students whom are outstanding, or whom have learning or behavioral challenges.

The high school teacher also holds authority to effectively manage the class. Administratively speaking, the teacher will take care of attendance, lateness, inappropriate behavior, etc. This assistance allows the iDo team to focus on delivery of learning experiences, developing strong ties with the high school students, and in general focusing on the work at hand—which is to connect with the high school students. The authority of the high school teacher also facilitates grading of student work. Although the iDo team would like to think that their inspiration alone can motivate the high school students, we have observed

that the delivery of a final grade by the partnering teacher contributes significantly to keep all the students on track, particularly during difficult moments in the project.

Tera Freedman, computer arts teacher at Thurgood Marshall High School, has proved to be one of iDo's exceptional partners. She has not only accepted us willingly into her classroom, but she participates with iDo as an equal partner. She has often dealt with the difficult student in class, provides insightful input to her students on design related issues, and contributes to the continual honing of the curriculum. Ms. Friedman has been so successful within the iDo framework, that the 2008-2009 Thurgood Marshall school year will have a new class titled Product Design, which will attract students specifically interested in the iDo experience.

With every benefit there are some challenges in collaborating with a high school teacher. For example, the teacher may have an agenda that they would like to implement that does not coincide with iDo's. The teacher, at times, will impart information that is not germane to the project, or even in direct conflict with the information being delivered. In one iDo project, the facilitating teacher was also the high school students' biology teacher. Many times during the iDo class, the biology teacher met with her students in class to go over their biology work and grades. The actions by the teacher were disruptive to everyone in the class, diverting the students away from the iDo curriculum. This resulted in difficulties to build a cooperative, trusting and creative culture in the classroom. There can be confusion as to who leads the class, the high school teacher, mentor, or the iDo director. We have observed times that the iDo mentors provide better design feedback than the high school teacher in charge of the course; however, high school students will listen to a less qualified teacher because the authority held by the teacher delivering the final course grade.

Best Practices for Partnering with a High School Teacher

So, what is the best course of action when partnering with a high school teacher? Primarily, the iDo director should screen any potential collaborating teacher. Through an interview process, the director should assess the potential of the teacher to collaborate in an effective and constructive way. The director should also ensure potential collaborators are willing and available to be involved with iDo during the pre-classroom stage of the curriculum design. iDo university mentors spend the summer months creating and refining their curriculum offerings. It has proved invaluable to the semester experience that iDo informs and involves the high school teacher in the iDo summer curriculum development work sessions.

During the school year, the partnership is most effective when iDo meets with the participating high school teacher weekly, planning the week's objectives and reviewing the previous week's results. Results produced by our recommended best practices, i.e., a strong collaborative relationship between iDo and the high school teacher, lead to better organization and delivery of the curriculum. A strong spirit of trust and teamwork is thereby formulated, improving delivery of the iDo experience to the high school students.

Mentor/Student Collaboration

At the core of the iDo experience are the partnerships developed between the iDo mentors and high school students. There are a number of factors that have led to the success of the mentor/ student collaboration success. Many of the iDo university mentors are just a few years older than the high schoolers, allowing for an easy connection between mentor and student. One of the first and most successful iDo organization mentors, Travis, sported a series of tattoos on his arms, and walked with a swagger—reminiscent of the high school students' walk. High school students found it easy to relate to Travis, resulting in an instant and deep connection between Travis and the students.

In addition to being of a similar age, the iDo university mentors are diverse in terms of race and cultural background. This conforms well to the diverse cultural population of the high school students. For example, most of the public high schools iDo visits in San Francisco have large Asian and Hispanic populations, similar to the San Francisco State University demographic. This facilitates openness between university mentor and high school student and, importantly, this provides a condition in which the high school student sees themselves more readily as university students, through the example of a university mentor being similar race and culture. This has led to one of the greatest achievements that iDo has enjoyed: A participating principal approached iDo's director, and stated that a number of the

students participating in the program have, for the first time, indicated an interest in attending university. This achievement reflects well on the curriculum iDo delivers, and moreover, the connection built between university mentor and high school student of similar age, culture, generation, and attitude.

Student/Student Collaboration

iDo's collaborative structure echoes John Dewey's idea, "High school students' performance is dramatically affected when they are regarded as part of the project's community, rather than a separate component of associated parts" (Dewey, 1916). Many of the most successful outcomes of the program have been due to the successful investment students have made into the community built through the project experiences. Through the introduction of teamwork methods, the high school students begin the process of collaborating with each other, resulting in a healthy collaborative community. Many of the students have little, if any, experience working with others on projects. Most students initially indicate a preference to work alone. However, we have observed, as the iDo experience progresses, many wonderful examples of student-to-student collaboration occur.

At one particular moment in the Community Bench project (Figures 3 through 10), a student, Jesse, ran into difficulty gluing components of his panel together. This situation produced an event in which four of his peers took initiative to help Jesse resolve the issue. Without this cooperative moment, Jesse's model would have been ruined, causing the student to lose work and time. This experience taught the group the importance of planning, and the necessity of collaborating with others during a difficult manufacturing process. Another example includes Stephen, a student with reduced communication capabilities. He always had a benchmate, Gordon, working hand-in-hand cutting, sanding, and gluing of project components. This greatly helped Stephen. Stephen, in turn, greatly aided Gordon's work. Stephen possessed a high skill level in working with handsaws to complete detailed elements for the Community Bench Project. Stephen's peers witnessed his methods, and those around him embraced his procedures, leading to improved manufacturing of their own parts. Due to Stephen's strong commitment and careful mentoring by the mentors, he was able to develop and deliver a formal verbal presentation of his design during the final critique. His teacher, Tera Friedman, stated that to her knowledge, this was the first time Stephen presented verbally in front of a class.

The peer collaborations taught the high school students the power of working together, and their final project outcomes were of a higher quality due to these collaborations. Wilson Wu, a 16-year-old Thurgood Marshall High School student, best illustrates this point: "I learned a lot from this project. The biggest thing I learned is that we might never be able to finish some things alone – we may need the help of others. I also learned that we need to cooperate and stop being selfish to get something done – even if we dislike what others think. We need to have some tolerance and see things from other perspectives." Wu's reflection illustrates how the iDo program builds community among peers. As 17-year-old Raymond Chiang states, "I learned that community is about being one group instead of being individuals, and this community of many is stronger than the individual."

iDo's Next Steps

iDo has many plans for the future. iDo is developing an online tool that allows iDo to partner with other high schools throughout the world. This tool would post curriculum and provide project kits so that partnering teachers could deliver the experiential educational projects with the materials needed.

The graduate program is in the process of developing a new emphasis in the master's degree program focusing on design education. Lastly, iDo has the dream to bring design education to every public high school student in the state of California.

Appendices

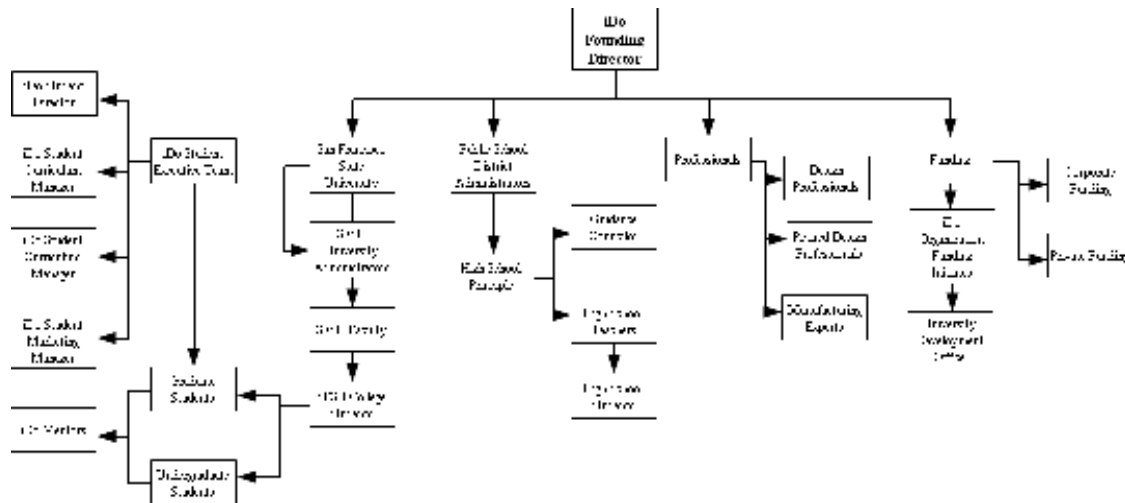


Figure 1. Industrial Design Outreach collaborative resource diagram.

Learning Outcomes
1. Exposes the student to learning from natural consequences, mistakes, and successes.
2. Students will develop observational and documentation techniques through the identification and definition of problems related to seating within a high school context.
3. Students will be exposed to design research through the gathering and analyzing of ergonomic, material and manufacturing information.
4. Students will develop applied writing skills in the creation of performance requirements and the writing of a design brief.
5. During presentations and critiques, students will hone their presentation and communication skills.
6. Working in teams, students will develop group decision-making skills.
7. Principles of geometry and mathematics will be integrated during the process of structural and manufacturing engineering.
8. Through the introduction of brainstorming strategies, students will develop their ability to think broadly, resulting in innovation ideas.
9. Through the introduction of hand drawing techniques, students will develop skills to record, communicate, and develop their design concepts.
10. Students will be introduced to computer aided design software resulting in their exposure to current tools in the field design and engineering.
11. Through the introduction of computer automated manufacturing equipment in the manufacturing of the community bench will expose students to modern manufacturing tools and methods.
12. Students will be introduced to group conflict-resolution techniques
13. Students will be introduced to the determination and delivery of tasks, and schedules, improving their organizational skills.
14. Learn constructive criticism methods and techniques.
15. Presentations on product design trends will improve the students awareness of what a product is, resulting in improved consumers.
16. The Community Bench Project will introduce a number of design related career possibilities.

Figure 2. Community Bench Project student learning outcome.



Figure 3. Student drawing a design commemorating his deceased brother.

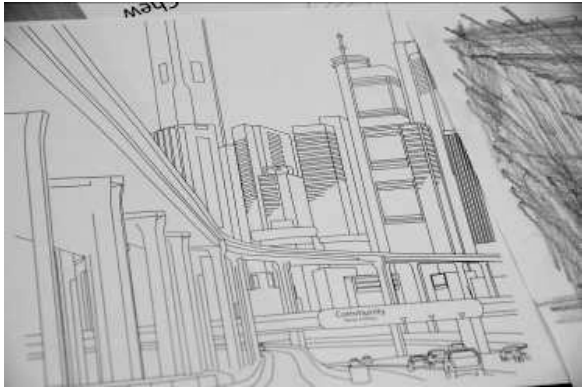


Figure 4. Student drawing of a design celebrating his urban architectural culture.



Figure 5. Mentor and student.



Figure 6. Student-to-student collaboration.

Community Bench Panels
Maple plywood and mahogany veneer; 9 inches by 9 inches by 3/8 inches thick.



Figure 7. Hands/Feet.



Figure 8. Cityscape.



Figure 9. Memorial.



Figure 10. Completed iDo community bench 2007–2008.