EVOLVED TEACHING PRACTICE
A DESIGN EDUCATOR'S EVALUATION OF A HIGH SCHOOL DESIGN CURRICULUM

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A PROJECT CONTINUES: DESIGN CURRICULUM TO CREATE LEADERSHIP

In the 2013-2014 academic year, Philadelphia schools saw major changes to their under-funded school system: arts programs and school nurses were being cut and over 20 schools were closed, which resulted in students being moved to other buildings around the city. Inspired by this changing landscape, a designer sought out opportunity to use design to empower Philadelphia students. She found it by partnering with a new magnet high school, the Science Leadership Academy, also known as SLA. The school opened the doors of its West Philadelphia location in the fall of 2014. It successfully used its start-up budget to transform the building's crumbling walls and broken lockers, but had to settle with gathering unwanted furniture from other schools for its classroom use. SLA has proven successful with its unique pedagogy, a STEM curriculum in which the students work on their school provided laptops completing individual and collaborative project based assignments. The design educator saw this as the perfect opportunity, in the pre-existing framework of the school's "mini-course" sessions, to lead 4 groups of 9th grade students sequentially through the design process to create furniture specific to their school's classroom needs. Each mini-course is an 8 week course, lasting 90 minutes every Wednesday. The mini-courses are only available to SLA's 9th grade students, and the students are able to choose which mini-course they take each quarter.

After teaching the first mini-course the designer had high expectations and planned to see students jump with enthusiasm for the opportunity to work through this design project. She suggested that all students would develop design skills, leadership skills, and an understanding of the design process, through the service this project provides to their school. However, throughout this project, she evolved the design curriculum to address the real life problems that come with teaching high school students and restructured the curriculum to help finish a real world project. She then used the evaluations of this design project, titled ID for Early High School, to develop an extracurricular design curriculum for high school aged students.

SUMMARY AND DEVELOPMENT OF MINI-COURSES

The design educator broke up the design process for this curriculum so a large project could be tackled by a collection of small, extra-curricular courses. By doing this, the curriculum allows industrial design to be taught to high school students outside of a structured class time, while still completing a collaborative project. In Philadelphia, CHAD (Charter High School for Architecture and Design) teaches industrial design, but as structured classes, requiring pre-requisites. Two years ago, Compete 360 began teaching design thinking as an extra-curricular program, but with a general design education application, not specifying on the design build process of industrial design.

In the ID for Early High School curriculum, the design educator planned for each group of students to learn a selection of design skills while they work on a new part of the design process. In the first mini-course, the design educator made a projected curriculum plan for the 4 separate courses. However, the curriculum evolved resulting in: Group 1: Research, Brainstorming, and Initial Concepts; Group 2: Concept Development; Group 3: Development and Testing; Group 4: Evaluation and Building.

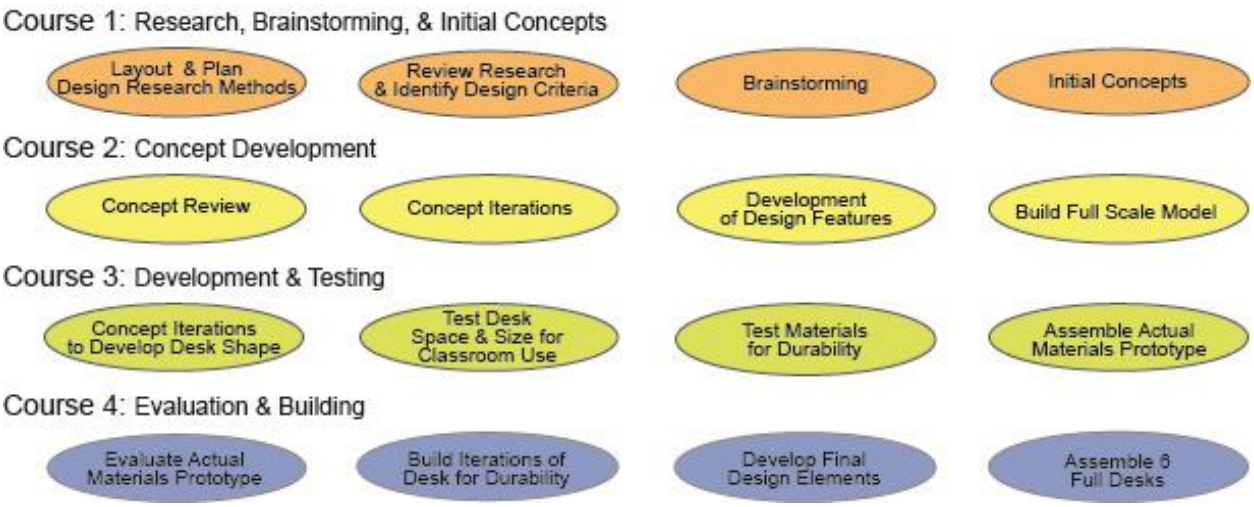

Figure 1: This graphic breaks down the activities of the design process for each mini-course.

MINI-COURSE 1: RESEARCH, BRAINSTOMING, AND INITIAL CONCEPTS

In the first group, students jumped at design opportunities, were excited to know what was happening next, and came interested in design. With this group, the design educator was able to work flexibly, and worked towards creating a studio environment with conversation and music. The students offered opinions and took initiative with ideation. They developed diverse concepts, which was encouraged at the time, and were most successful of all groups in developing creative, applicable ideas that performed ideation. The students displayed a great understanding and connection to this project serving their peers.


Figure 2: Above are 4 initial concepts in foam, created by Group 1.

MINI-COURSE 2: CONCEPT DEVELOPMENT

The designer led Group 2 into the project by sharing the concepts from Group 1. Some ideas stayed and were developed, while others were discarded. Initially, the students did not seem interested in their peer's previous work. A fellow designer suggested giving each group something to "own", so they felt invested and proud of their part in the project. However, at the end of the second mini-course, the students said they did value building off of ideas from Group 1. As the project was explained to the new group of

students, the designer moved them into more concept development with model making. One student, Mike, asked if he could make anything he wanted to, and the designer encouraged him to be wild with his ideas. He finished the day making a bridge, and the design educator realized she needed to be clearer with the project scope and focus his attention back on classroom furniture. However, Nick and Robbie also explored wild ideas and finished the first day working on an interesting, elevated collaboration pod with charging capabilities and storage.

This second group of students possessed a drastically different personality than the first. The students were consistently responding with blank stares, and the majority of the students seemed uninterested in what was happening in the class. A studio environment was hard to cultivate, especially with some disrespectful behavior from the students. Despite that, there were a handful of individuals who worked to push the project further. The designer was able to get participation and input from almost everyone in this group, but it had to be drawn out individually. After each class, she questioned how to push a certain group of female students further, as they had mastered doing the bare basics with absolutely no enthusiasm. The designer would propose ideas, but they would take that nugget and have no interest in running with it. She would assign a certain number of concepts, putting the students in groups with specific topics to develop a design, and showed them how to get inspired by another person's work. She shared examples of her own work to show them that rough sketches and models were an important part of the process. Unfortunately, the mini-course set up worked as a double edged sword. The mini-course instructors were not in a position to assign homework. The relaxed environment of the class allowed the designer to teach as she chose, but left little control over the involvement of the students. Because of this discouraging experience, strict rules were put in place to prohibit cell phone and computer use that was not for the design assignment. While this, and the reminder of mini-course grades, encouraged students to be respectful, it was not inspiring.

The students in Group 2 also focused strongly on sketching and model making. The design educator led numerous sketching exercises, and the students were expected to move further in concept development in each class. Only about half of the students were comfortable with sketching. After a 40 minute sketching exercise, 6 of the 12 students were really excited about getting their cube to look "right" and draw a 3D shape, such as their initials, in their cube.

After struggling with engaging the students of group 2, the design educator consulted Alex Gilliam of the Public Workshop an organization that connects youth with opportunities to transform their city through design. He explained his method of thinking fast, which meant moving quickly through the process. He shared his practice of taking a heavy role as a designer of the object and then inspiring the students he works with by opening their eyes to the process, possibilities, and impact of their designs. After this discussion, the design leader took a stronger hand in the design of the furniture. She moved towards individual student desks that could be combined for group work. She created pieces for a full scale cardboard model and brought them to the students. They were timid at first, but then drove into the assembly of the desk models. Through this they made decisions about the design and structure and were finally able to see the interaction they could have with this furniture design.

By the end of this mini-course, the group had a full scale cardboard model. When the designer led the group in a critique, asking why should something be a certain way, the students were able to answer which furniture leg option is better and why, demonstrating space for bags, laptops, and student legs. They ended the mini-course by deciding what the next group should tackle. This changed the designer's curriculum plan from a pre-planned week by week plan to "What's next!", and "How far can the group take it today?" The process evolved into letting the building lead the direction of the design. From this process, the students developed the connecting basket concept which was carried through to the final model.

Figure 3: Students in Group 3 assemble a cardboard model. They developed a materials basket design, which is shown in the middle of the group of desks.

MINI-COURSE 3: DEVELOPMENT AND TESTING

The designer led the first class of Group 3 by introducing the new students to the full scale cardboard model that was created in the previous mini-course. At first the students were not interested in getting out of their seats to look at the model, but once they did, the design engrossed them! They were ready to run with this design, unlike Group 2, which was not interested in carrying any design from Group 1 onward. A few students came in very absorbed in design. Once the design educator pulled out laser cut patterns for a decorative element of the desk, Morgan and Santana lit up, and began working them into the cardboard models. Because of this, the designer saw the need to try more diverse warm-up activities to show different areas and skills of design, such as creating logo and pattern designs. Additionally, in the group, two other female students, Jess and Taylor, seemed particularly confident with design skills. They both were comfortable jumping into model making and tinkerCAD, an introductory web based CAD program. Two other students, Nick and Robbie, from Group 2 stayed to move the project forward. This was the first group that was able to have second time students. Many students from group 2 stopped by the classroom to see what the new group thought of their design. Interestingly, most of these students were the female students who showed no interest in their mini-course, which demonstrates that what the designer interpreted as their lack of interest may have actually been shyness of the design based class activities.

Early in this third mini-course, the design educator began to see the value of organized chaos compared to a curriculum that has each student doing the same assignment. An example of this is when Nick and Robbie would focus on editing the design on the full scale model, while Santana and Morgan would work

on smaller models. Atilliano and Donmir preferred to work in CAD and explored a charging unit design option using that program. This also allows the students to change their focus if they get frustrated with the activity.

Figure 4: This graphic illustrates what a class day looked like with Group 2, in a strongly structured curriculum, and Group 3, with organized chaos. The numbers on the left represent an individual student.

Since the students were still developing the design, it was important for them to be able to express themselves through sketching. The design educator led the students through a cube sketching exercise used in the previous mini-courses. Some students really enjoyed it, while others did not see its value, particularly Robbie, who had already done this activity in Mini-Course 2. Santana drew something complex for just learning how to draw a cube, and Attiliano, who mostly worked on tinkerCAD during these classes, began sketching and coming up with designs for a charging unit. The sketching activity proved to be successful in drastically boosting his confidence level, making him feel comfortable expressing and developing ideas on paper. He also used what he practiced in this sketching exercise in a logo design later in the course.

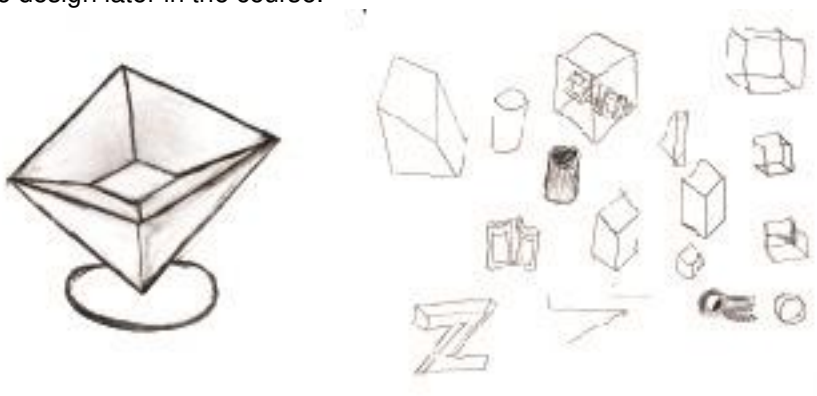

Figure 5: The sketches above are examples from the sketching exercise done in Mini-Course 3. The first sketch is by Santana, referred to above, and the second group of sketches are what most students were achieving when first learning to sketch.

Throughout the design process, the school's teachers were consulted. As the furniture moved into full scale, they brought up concerns of size, particularly to fit desks for 30 students into a classroom. Overall, the teachers were very excited about the desk design. As Group 3 progressed, the students were able to construct the first full scale, actual material prototype. They identified the stability and visual issues with the desk and left notes to pass onto Group 4.


Figure 6: The images above show the first full scale, actual material prototype completed by Group 3.

MINI-COURSE 4: EVALUATION AND BUILDING

The final mini-course group started much smaller, with only 8 students, and all began engaged and excited to move the project forward. After two classes, 4 more students joined the mini-course, coming with excitement and ready to personally invest. The majority of Mini-Course 4 was focused on perfecting the desk structure. Wesley and Robbie enjoyed working with tools and, through the process of trial and error, were able to see the value of the proper screw. Both of these students were very interested in solving the issue of the stability of the desk and took on the role of testing ways to make it more stable. However, other students, Shadiyah and Brandon, were not as interested in the actual construction. So, they explored spray painting the logo on some desk prototype pieces. Through this they developed the logo further, exploring layering and layout, drawing out the desk elements, while learning about 2D design and craftsmanship. Other students joined in, using stencils and markers to suggest other logo possibilities.

The school's engineering teacher was very excited about the project and during the first class, he brought in a group of teachers to show them the progress. Robbie, who had been in the earlier 2 mini-courses explained the design to the teachers, without the design educator prompting him. He took ownership for his peers for the desk design they had created. One teacher suggested adding a whiteboard for the students to share their work with their peers during class. This concept was discussed earlier in the process and was immediately added to the desk surface design, showing the students the opportunity to continue developing the design.

Throughout this mini-course, the students and designer continued to advance the design of the desk. Stability was a major issue which was solved by weighing down the desk legs. After consulting the teachers, a storage shelf was removed. The teachers and students noticed that open spaces like that act as trash containers, resulting in students not wanting to place laptops and books in the space.

While the group continued to work in an organized chaotic fashion, tackling various aspects of the design in each class, the designer showed the students the value of convening to make design decisions together. With limited time to complete the desk construction, the students met to critique work that had been done in the earlier mini-course classes and set a timeline to complete the desk. The project was fortunate enough to have raised adequate funds for these students to build a group of 6 desks, to show the possibilities of various group sizes.

PROJECT OUTCOME

Through this collaborative process, the 43 students created the Petal Desk, an individual desk for the Science Leadership Academy student. This desk can meet side face to side face with other desks for collaborative work. The faces allow groups of 4, 5, and 6 to fit snuggly, and a net can be stretched between the groups of desks to hold collaborative project materials. A whiteboard was created to be handed out by teachers for a social work tool. It can be placed under the desk during class time when it is not being used. While there was adaptation and struggle to engage the students to keep them excited, they successfully moved through the process of designing appropriate furniture for their school's specific needs. Early in the research, the students found the need for both individual and group work space, and easy rearrangement, which has been achieved by their final design.

Figure 7: The desks can meet, with surfaces touching, in groups of 4, 5, and 6. A net can be attached to the hooks on the end of the desk and stretched between the desks to hold collaborative work materials. Under the desk, a white board can be place while it's not being used during class time.

The project ended with 6 final constructed desks, to show the group work possibilities, and documentation to allow the school to construct more of these desks. The school's principal and teachers were so thrilled with the custom furniture, they charged the mini-course students to make 150 more desks for classrooms in their school. Fortunately, coinciding with this project, a grant allowed another mini-course to build a maker space in the school, which provides a place and the tools for students and teachers to continue to build this furniture.

Ultimately, the project fulfilled the projected outcomes of personal and academic development, even while the design educator was unable to see that clearly throughout the project. While not every student showed great interest or growth, the following chart shows the development the students felt they made.

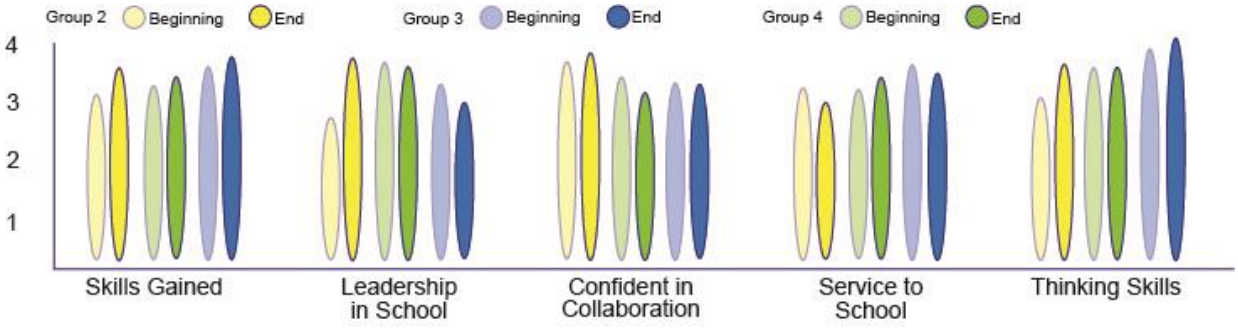

Figure 8: This graph shows how students evaluated themselves at the beginning and the end of their mini-course session. The evaluation system was created after Mini-Course 1 was completed; therefore, it's not included in the comparison.

While the students' perceived growth shows success for the majority of the project, personal accounts strengthen what the designer set out to accomplish with this curriculum. When Attilliano voluntarily moved from computer work to sketching his ideas, he gained skills and confidence in expressing himself in a new way. When the mini-course groups gathered with their groups for critiques, they collectively made decisions about what is best for their peers, their teachers, and their school work. They were confidently working in collaboration, and providing a service to their school. All groups of students consulted with peers and teachers to edit their design to serve the needs of others, showing both leadership and service. And as the students learned to use new equipment and work through the design process, they gained new ways of thinking and problem solving. By working through many iterations of a built desk, the students saw the power of details, and experienced the hard work that goes into their everyday objects. Even though the design educator struggled to engage every student in the design work of the mini-courses, many students return to the classroom to see the progress of the desk and take ownership of the research, design, or small choices made to aid in the best design construction. The design educator saw how high school students craved this type of activity based learning, and creating something for their school. The students have proven with their behavior and feedback that they fulfilled the expected personal development that the design educator suggested: responsibility, leadership, pride, and ability to process constructive criticism. In the end, this project shows great promise in demonstrating how implementing an extra-curricular design curriculum in high schools can empower students to become better leaders and more confident and invested in serving their communities.

FURTHER CURRICULUM DEVELOPMENT

As the designer evaluated the series of courses, she saw the benefits she would have had if the students possessed basic design skills and understanding of the design process. In the future application of this high school design curriculum to create leadership, she plans to first teach design through small personal projects, ones where the students are fully invested in designing for themselves. They would learn drawing, model making, CAD and production while focusing on one small project from beginning to end. Then, a later year of high school, they would work on a segmented, collaborative, community impact design project, being able to understand where in the process they were jumping in. While she found that it was difficult for students to develop good skills while they were moving through different parts of the process and working on different parts of the project, the designer saw its impact and plans to use the edited curriculum to continue to empower students in extracurricular design projects.