



Designing Little Free Libraries for Community Partners in a First-Year Graphics and Design Course

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Introduction

This Engineering Graphics and Design course incorporates community collaboration in a project. The course is populated mostly by first-year engineering students, so this project gives students an early introduction to working with clients and meeting design requirements.

Dr. AnnMarie Thomas has taught Engineering Graphics and Design and created the concept of this community engagement project since Spring 2010. “In all semesters, the students are asked to create a design that meets an organization’s requests.” Past semester projects have included designing the kids’ space in a local library, a new playground for a park, an amphitheater, bike racks, and a pollinator path garden bed/bench area. The final design proposal for these past projects included CAD models and drawings that were given to the organization.

This semester’s project is designing Little Free Libraries for the community partners. “Little Free Library is a nonprofit organization that inspires a love of reading, builds community, and sparks creativity by fostering neighborhood book exchanges around the world. Through Little Free Library book exchanges, millions of books are exchanged each year, profoundly increasing access to books for readers of all ages and backgrounds [1].”

The Partnerships

The partnerships with the organizations were all created differently. Two of the organizations (Metro Deaf School and Minnesota Children’s Museum) are current partners with the Playful Learning Lab. The Playful Learning Lab at the University of St. Thomas is a research group led by Dr. AnnMarie Thomas. The team of research students, affiliated educators, and collaborators work together to create engaging, hands-on experiences for PK-12 students and educators, with a focus on fun. The Playful Learning Lab has partnered with Metro Deaf School (MDS) for about the last 4 years providing STEAM exploratory workshops. The lab also collaborates with the Minnesota Children’s Museum, where Dr. Thomas has a 5-year residency. These two organizations were an easy decision to partner with for this project as there is already a history of collaboration with them.

The Pollinator Path at the University of St. Thomas was the only recurring partner for this Engineering Graphics and Design course’s design project. The Pollinator Path is a series of gardens providing food and habitat for pollinators for students and the community to study. This partnership was introduced by working with the Sustainable Communities Partnership at the University of St. Thomas. They work to “develop multi-year partnerships with communities to integrate a set of community-identified sustainability projects into St. Thomas courses across disciplines, engaging students in real-world, applied research and innovative problem-solving [2].”

While the three organizations above are a continuation of an already existing partnership, the fourth community partner was brand new. The University of St. Thomas hosts a Community Partner and Volunteer Fair; this community partner fair was how the partnership was created with the local Big Brothers Big Sisters organization, the fourth community partner.

The Project

The first project in which the Engineering Graphics and Design course was paired with external partners was in Spring 2010 when we did a collaborative project with the Ordway Center for the Performing Arts, Macalester College, and the Diavolo dance company. That year, students designed possible set pieces for the dancers, and the chosen design is still being used to this day by Diavolo [3].

The Little Free Libraries were chosen for this semester's design project for a number of reasons. First, Little Free Libraries have been growing and many can be seen in St. Paul, where the University of St. Thomas is located. Little Free Library has recorded more than 90,000 libraries in over 90 countries [1]. It was attractive to choose a project goal that students could easily walk around the neighborhoods surrounding the university to see examples. Second, the libraries seemed to be a manageable project in terms of costs and manufacturing feasibility.

The design project was presented in four phases, as shown in Appendix A. Phase 1 is the information gathering phase. This consisted of the project launch where all the community partners joined the class to introduce their organization and discuss with the student groups their requirements for a design. The students had the time in class to learn the partner's design requests and to ask questions for further understanding. They could also ask the partners questions through the lead teaching assistant later on.

Phase 2 of the project consisted of market research of the partners to guide the students in understanding who they are designing for, design constraints, and requirements. This was assigned to the students to complete outside of class hours.

The deliverable for Phase 3 was sketches of the student groups' preliminary concepts and the final concept selection. The students were asked to provide detailed concepts and reasons for their choices in their final design.

Phase 4 was the final phase for students to turn in their deliverables of CAD files, a bill of materials, budget, and a write-up of how their design meets their partner's requirements. The partners were invited back to campus to see the student groups present their final design concepts.

This semester's project is unique to past projects for two main reasons: partnering with four community organizations instead of one and receiving a grant to build a Little Free Library for each organization. Collaborating with four community partners meant students would be introduced to more organizations and to a bigger variety of organizations—they could display engineering work that was tailored to the variety of groups. The grant to build a design for each partner adds a greater sense of importance to the project because, in addition to providing concepts, we were able to deliver a product. This also added another dimension when designing the libraries, as the students had to ensure they stayed within a budget and design for manufacturability.

Results

From project launch in Phase 1 to presentations in Phase 4, the students had about four and a half weeks to design the Little Free Library for their community partner. Following the presentations, the community partners filled out a survey to gauge their experience and satisfaction with the student designs and, finally, to select the library they wanted built.

Following the semester, the students had the option to help participate in building the Little Free Libraries that were selected by each partner. The CAD screen captures below in Figure 1 provide a glimpse into the student designs each partner selected.

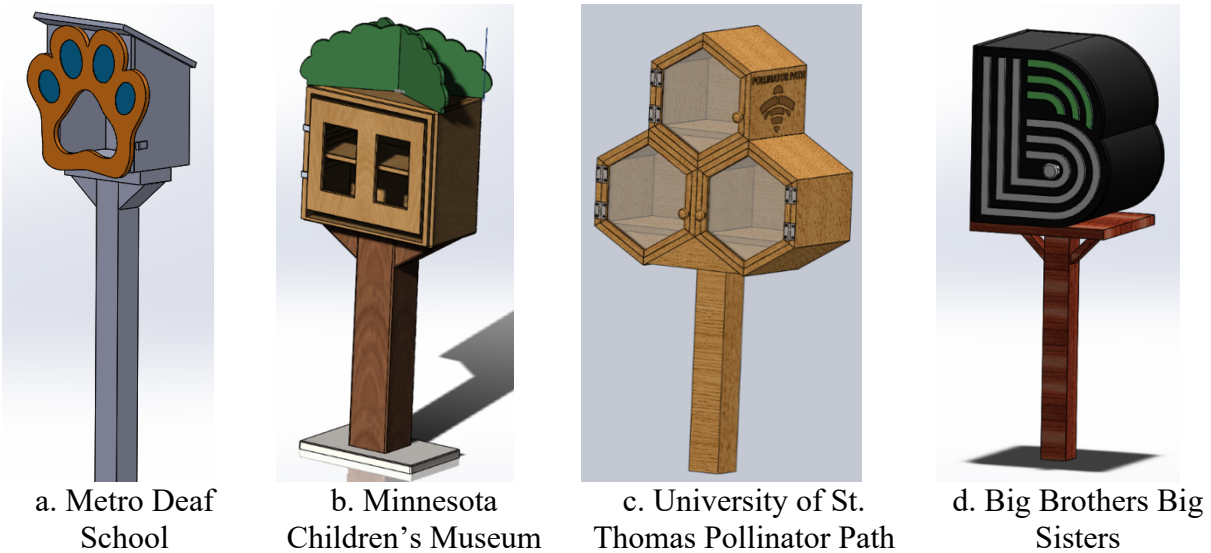


Figure 1 (abcd). CAD models of Little Free Libraries selected by community partners.

While the physical results of the student groups' design concepts were important to their learning and understanding of the Engineering Graphics and Design course, feedback was also important to gauge impact. An optional survey was given to the students with questions ranging from how much they feel they impacted their community to their level of enjoyment of the project.

A survey was also sent to the community partners to gauge their satisfaction with the design concepts, interaction with the students, and to select the student design to be built. The feedback given in each survey was beneficial to understanding what went well and what could be improved from both the student and community partner perspectives.

Student Feedback

There was a lot of positive feedback from the students after the project. 79% of the students were willing to participate in an optional anonymous survey about their experience with this project. On a scale from 1 to 4, with 1 being little community impact and 4 being a large community impact, 86% of those who filled it out ranked a 3 or above, signifying that they felt they had some impact on the community organization they were partnered with, shown in Figure 2. Many students commented at how "cool it was that these libraries will allow the organizations to connect with the greater community."

Student Impact on Community Partner

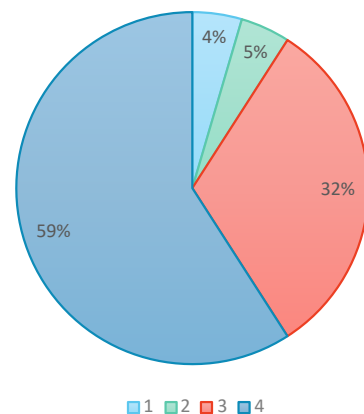


Figure 2. Student feedback on how much of an impact they felt they had on their partner.

Each student gained a lot through this project, including an opportunity to strengthen skills. Many benefits include (but are not limited to) teamwork, communication, ability to prioritize needs and wants, working with a client, design experience, and CAD. One student wrote, “I gained real working experience, both with a group and with a client. This project stressed the importance of actually providing our client with a piece that could be functional, as it had a chance to be created and was worth more than just a grade.” The students enjoyed the design process, being introduced to the creative side of engineering and working with a real client. When asked what they would do different, students’ most common answer was along the lines of planning better, using a timeline, and following a more detailed design strategy.

Community Partner Feedback

The stakeholders in this project were the four partners: Metro Deaf School, Minnesota Children’s Museum, the University of St. Thomas’s Pollinator Path, and Big Brothers Big Sisters. All the stakeholders gave positive feedback following the student design presentations. One of the partners specifically stated that they found this project most beneficial because we received the grant to build this semester. Compared to previous semesters of only producing design concepts, this specific project was beneficial because the student’s designs were brought to life.

All four community partners said they would be willing to participate in this project again. A few of the partners provided feedback on what they would have changed with the student interactions. Two partners stated that they wished they had given the students a handout of relevant design objectives and clearer notes on the location and expectations of the library. One partner suggested students in the future should create a design proposal and meet with them part way through for help, guidance, and improvements before they were finalized. One partner commented that they didn’t think the students’ designs “reflect[ed] all the effort they seemed to put into it! If I’d seen the drawing earlier on, I think I could have helped them push their ideas a little further.”

In addition to surveying the partners to see if they would be willing to participate in the project again, they were asked if they would recommend partnering with this course’s project to other groups or organizations similar to theirs. Three of the four partners said “yes,” and the fourth partner said “maybe” and commented that, “it depends on whether there is funding to build the project. If there were funding [in future projects], then definitely yes.” This willingness to participate in a similar opportunity in the future and recommend it to other organizations demonstrates that we have made an impact on our community.

Challenges and Opportunities

One challenge faced during this project was ensuring the student groups understood and met their partner’s design expectations. Each community partner had 3-4 student groups designing for them. The reason this was difficult was because each partner had unique requests, modifying the project for each student group. The different requirements for each partner were addressed at the project launch in Phase 1. During this time, the student groups had about 45 minutes with their partner to ask questions and get a better understanding of what they wanted in their library. To ensure this was a productive use of time, each group had a teaching assistant to facilitate conversations with the partners. Having someone who understood the project to help facilitate these conversations with the partners ensured the students were actively engaging the partners and asking questions.

Another challenge appeared only after receiving feedback from the partners, saying they were not satisfied with all of the student group designs. During the project timeline, it looked like things were going smoothly. Only after receiving the community partner's feedback (after phase 4) was the challenge brought to light. Two of the four partners provided feedback that they should have provided the students with a handout or been more specific with their expectations and design objectives. While this challenge was not brought up until after the project ended, it provides good insight on how future partnerships should work.

A future partnership would include the four phases aforementioned and a Design Review phase would be added. The Design Review phase would align with Phase 3 where each student group would meet to present their final design concept and the community partner would give feedback. Adding this phase would ensure the students are meeting their partner's design expectations before creating the actual CAD model of their final design. The Design Review phase would also introduce students to the Design Review process utilized in industry.

Summary

Designing Little Free Libraries in the Engineering Graphics and Design course gave students the opportunity to learn about the design process and working with a client. It also allows them to encounter the creative side of engineering while still meeting specific requirements. The component of designing to build the libraries was another element added to this project and students' learning experience. The students had the opportunity to help build the libraries after the semester, as shown in Appendix B. This specific experience in a partnership will help the class in the future by knowing that more communication can be had between sponsor and the students to better the final product and expectations of the outcome.

We believe in the importance of providing engineering students with early exposure to collaborating with partners in the "real-world". Students get the opportunity to learn and grow in not only working with their peer groups but also meeting their partners' requirements. Incorporating community engagement in this first-year Engineering Graphics and Design course has been received well by our community partners and the students in the course.

References

[1] Little Free Library. 2009. *About Little Free Library - Little Free Library*. [online] Available at: <<https://littlefreelibrary.org/about/>> [Accessed 1 October 2019].

[2] University of St. Thomas, M., n.d. *About SCP | Office of Sustainability Initiatives – University Of St. Thomas - Minnesota*. [online] Sstthomas.edu. Available at: <<https://www.stthomas.edu/osi/scp/>> [Accessed 1 October 2019].

[3] AM. Thomas, A. Miller, and H. Spicuzza, "Dance + Engineering: A Collaboration for Freshmen Engineering Design Students," proceedings of the ASEE North Midwest Section Meeting, Mankato, MN (2010).

Acknowledgements

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Appendix A. Project Guidelines

The second project for the semester is designing Little Free Libraries for some exciting partners.

Project Partners:

- Partner name
 - External links.

Final Deliverables:

- A proposed Little Free Library for your client that addresses their user needs:
 - SolidWorks parts and assemblies for the entire design
 - A Bill of Materials
 - A budget
- A write-up explaining how this design was chosen, and how it addresses the user needs that your group identified.

Phase 1 – Information Gathering

This project will be announced in class at the Project Launch. Students will meet their project clients.

Deliverable: No deliverables due for this phase, but the information affects the rest of the project.

Phase 2 – Develop Background Information, User Profiles, and Product Requirements [*due 1.5 weeks after Phase 1*]

Deliverable: For this stage, you are submitting a document that includes the following information:

1. **USERS:** After identifying what your group believes to be all of the user groups relevant to the library please choose 3 specific groups of users to focus on.
 - Describe each of the three user groups (you've chosen to focus on) that will interact with the library.
 - Identify the user needs for each of these groups.
 - List the assumptions you are making in writing the above profiles.
2. **OPPORTUNITIES:** After researching Little Free Libraries and your client organization, what are 3-5 big opportunities you see for this project? Specifically, what ideas/questions are your project group interested in pursuing?
3. **CONSTRAINTS:** List all of your project constraints (e.g. space limit, regulations, etc.)
4. **DESIGN REQUIREMENTS:**
 - List the design requirements you have identified for this project, based on what you learned doing the background information phase. Prioritize by which requirements are a must-have versus those which would be nice to have.
 - Each requirement must be complete, unambiguous, consistent, verifiable, and independent of the specific design.
 - Separate requirements into categories based on form, function, performance, reliability, maintenance, etc.
 - For each requirement, list the user need(s) which are satisfied if this requirement is met. Note that this document is not an essay – it should be short, to the point, and clear.

Phase 3 – Develop Preliminary Concepts and select one *[due 2 weeks after Phase 1]*

Develop two high level concepts per person such that the concept designs meet the product requirements you developed. The concepts should consist of sketches and text descriptions with enough details that a person outside of your group can understand the concept.

Phase 4 – Final Concept Document, Model, and Presentation *[due 4.5 weeks after Phase 1]*

- Submit final deliverables
 - Create a plan for a Little Free Library for your client that addresses their user needs. Final package should include:
 - SolidWorks parts and assemblies for the entire design
 - A Bill of Materials
 - A budget
 - A write-up explaining how this design was chosen, and how it addresses the user needs that your group identified.
- Each group will give a 5-minute presentation on their project.

Appendix B. Built Libraries



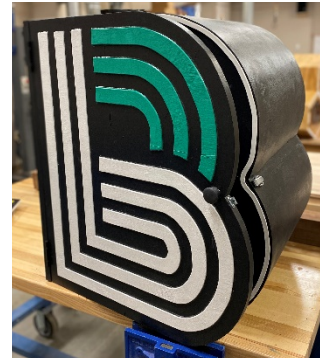
a. Metro Deaf School



b. Minnesota Children's Museum



c. University of St. Thomas's Pollinator Path



d. Big Brothers Big Sisters