THE SMU MAKER EDUCATION PROJECT

A TRANSFORMATIVE PARTNERSHIP

How Lamplighter School Used Maker Education and Design Thinking to Challenge Itself at a Pivotal Moment in Its History

The farm animals are the visitor's first clue that the Lamplighter School in Dallas is unique. At recess, the private Pre-K to fourth grade school's students stray from the playground and over to the chicken coop, where a plumed, burgundy-feathered rooster struts around and calls out. A pig trots around her pen while a cow rests in the shade. The goats can't seem to stop climbing up to the top of their barn.

The animals are essential to Lamplighter's holistic approach to education. Fourth graders care for the hens and collect, package, and sell their eggs. Potatoes from the school's garden and hydroponic plants used in a study for science class go into the students' soups and salads. Fourth grade literacy teacher Jody Stout says the school is always looking to innovate. "Lamplighter has always encouraged teachers to think outside the box in support of strategies to advance the mission," she says.

In the last two years, that has meant expanding maker education in the school's curriculum. In maker education, students learn skills and content by designing and creating tangible, sharable objects. Head of School Dr. Joan Hill says, "The reason maker education is so important to us is that it fits with Lamplighter's longstanding approach to learning.

> "Maker education allows students to have agency over their own learning."

And at the end of the day what we really want at Lamplighter is for students to become independent, to think critically, to ask questions, and to be able to answer those questions."

Lamplighter also added a new 10,000 square foot building, the Lamplighter Innovation Lab, which has become the hub of maker, experiential, and project-based learning. Vicki Raney, Assistant Head for Academics, says that the school wanted to ensure that its new space would be neither over-utilized nor underutilized, and with the focus always on learning. While the Innovation Lab was still under construction, she says, "our question was, what is the experience going to be like for teachers? What were the anticipated outcomes and challenges here?"

These questions led the school to forge a multi-year partnership with the SMU Maker Education Project team that Hill describes as "transformative" for the school.

Raney and Lamplighter faculty met the team at a design thinking workshop in summer 2015. Design thinking is a process that uses a human-centered approach to solving problems in the world.

From that first meeting, the school sought to build a relationship between the institutions to help incorporate more maker education into the school's curriculum and use design thinking to plan how to make the best use of the Innovation Lab. Raney found that that SMU Maker Education Project team members "would be the perfect partners because they understood the tenets of progressive education. They talk like we do, and their approach is similar to our school's."

"We knew that SMU had the expertise and the interest in working with a school like Lamplighter to advance our mission, which is really about innovative thinking, hands-on learning and allowing children to develop a sense of independence around learning," Hill says.

Teachers DIG into Design Thinking and Maker Education

Lamplighter and SMU agreed to collaborate on two related professional development projects: one in maker education, and one in design thinking. As Hill sees it, the two approaches go hand in hand.

> "Design thinking is a philosophy. It's a way of thinking about the world. It's a way of approaching problems and materials. And maker education is the vehicle for solving."

"It's having access to the tools that will allow the child to solve the problems." The SMU Maker Education Project team developed and carried out training workshops, coaching sessions, and debriefing sessions for each project over the 2016-2017 academic year.

In August of that year, the Maker Education Project team came to Lamplighter and introduced

faculty and staff to maker education by asking them to redesign the morning commute in the congested Dallas-Fort Worth region. During this activity, participants built low-resolution prototypes of their solutions out of materials like cardboard, modeling clay, Lego, and yarn.

A few days later, Lamplighter faculty spent a day at SMU learning about maker education and design thinking at the Deason Innovation Gym (DIG), SMU's collegiate makerspace, and at Harold Clark Simmons Hall, where teachers learned how to use computer-aided design software to create digital models of prototypes they made previously. Second-grade teacher Ana Owens says the training got her out of her comfort zone and that the Maker Education Project team "made people feel like they mattered because of the focus on empathy."

Librarian Patricia Vermillion says she was not sure what to expect going into the daylong workshop, but "all the teachers were so excited and engaged, and at the end we learned so much. We all came away ready to start the process." Teachers say that the maker education workshops with the SMU Maker Education Project team offered them a structure for implementing SMU's model for Maker-Based Instruction, which centers on "Maker Sprints," and a deeper understanding of design thinking.

Hill says that once she learned about the kind of training the Maker Education Project team members could offer at the DIG, she saw the value it would have for Lamplighter's faculty and students. "The partnership was set up for teachers to meet in grade level groups to understand how to bring the core principles of design thinking to students, so that would become part of how they approach the world," she says.

Second-graders with Serious Skills

The second-grade teachers applied what they learned at the DIG by leading their students through several maker-based projects. One was to design a landmark for one of the fifty states. "We knew what we wanted to do through using Maker-Based Instruction," Lakeshia Peters, a second-grade teacher, says. But until the professional development with the SMU Maker Education Project team, "we didn't know which steps to take first."

The teachers used the SMU Maker Education Project's planning pages resource to guide them through their pedagogical design. The landmark construction project started with learning how to make shapes. The students looked at pictures of well-known Dallas structures to learn "what shapes buildings are made of and how you can make shapes to create one," says Anne Yarbrough, another member of the second-grade teaching team.

For students to build the landmarks, teachers taught them to use hot glue guns. That may seem ambitious for seven-year olds, but Maker-Based Instruction embraces the idea students should have opportunities to develop skills with a variety of tools and materials from an early age. By developing skills in a structured way, "you're inspired to see your own worth and what you can do," Peters says.

Designing and building the landmarks, which were filled with artifacts from the states, "added meaning to the state project," Owens says. For example, one of the landmarks, the Maine Museum, was shaped like a lobster, and another landmark, the Alaska Museum, featured a 3D Iditarod sled race. Owens reports that in addition to creating meaningful landmarks, the students became

more confident risk takers as "they took a lot of ownership of the project."

The second-graders' skill-building didn't stop with hand tools. For a later project, they learned to use the computer-aided design software TinkerCAD. The students quickly immersed themselves in learning the software, which "sets the stage for them as third-graders to be ready to 3D print," Yarbrough explains.

The Maker Mindset

Over the course of the year, periodic coaching sessions with the SMU Maker Education Project team helped to integrate maker education and design thinking into the Lamplighter curriculum.

Kindergarten teacher Bianca Reyna found that with maker education, beginning with a plan ensures that she can effectively coach her students. "Anytime we gave our kids materials, they became so excited that they lost focus" on their projects, she says.

So Reyna "learned to introduce tools and materials slowly," she says. She learned to talk about the new materials first, "then step back, give the kids some time to explore, and then create." That way, the students developed confidence with a variety of tools and materials. She says they realized that "it's a process. It won't always work. They're becoming more reflective, thinking about that as they're building. They're learning to become problem solvers and to help each other."

The maker mindset is spreading throughout the grades at Lamplighter. First grade teacher Jessica Varela led her students through a project focused on small, battery-powered objects. The students followed a sequence in which they wondered about how the object works, took it apart to figure out how it works, and then reconfigured it to demonstrate the principles of its design. One pair

of students successfully turned an electric votive candle into a pocket flashlight with an on/off switch. "I was blown away that they were determined enough to keep going," Varela says.

Varela also took her students to the DIG, where they learned about two-dimensional design. She says the students were "inspired by the vinyl cutter, and designed logos to print on the vinyl cutter." In Maker-Based Instruction, she says, "students get to make something of their own" that they can show and share with others.

Science teacher Bill Burton asks his students to design and 3D print rocket capsules meant to carry organic supplies to a hypothetical Mars colony. Their payload design needed to stay within size and mass constraints. The students' first task was to think about the balance of products they would want to send: water, plants, and livestock. These units were represented by small pellets of varying mass. "What they put inside their rocket payloads is theirs to design – good or bad, flawed or not," Burton says. He emphasizes the authenticity of the project. "It put kids into the role of what scientists have to do, solving a problem, but on a kid's scale," he says.

The highlight of Burton's project is Rocket Launch Day, when the students head out to a field to see if their payload can go up and return in one piece. It's a fun moment, but the launch isn't the end of the project. Burton says, "one of the best things you can do after a project is debrief and reflect on it." His students, like all designers, learn from their product tests to improve the next iteration of the design.

Lamplighter's teachers report that their students make big gains not just in their skills with tools and materials, but in social-emotional areas like empathy, too. Many speak of the confidence their students gain by seeing concretely what they could make. Varela doesn't hesitate to name the main benefit of maker education for her students. "Engagement. They cannot wait until their weekly design classes."

The Body Language of a School

Beginning in the fall of 2017, maker education at Lamplighter has a new home. Next to Lamplighter's barn is a gently angled, copper-clad building, the Lamplighter Innovation Lab. Inside, it's filled with natural light. It houses dedicated rooms, separated by glass walls, for environmental science, physical science, woodworking, making projects, and cooking.

While the Innovation Lab was still under construction, the SMU Maker Education Project team and a core group of Lamplighter faculty worked together using Human-Centered Design principles to coordinate how the building would be used and to establish a culture that would promote students adopting maker mindsets.

Members of the SMU team often echo a tenet from Stanford University's Hasso Plattner Institute of Design: "space is the body language of an organization." Inspired by this idea, art teacher Pam O'Krent, who was part of the core team working to design the Innovation Lab's use, says she came to the building asking,

> ""What is the space telling me to do? How am I being directed by the materials and the layout?"

"What kind of feeling do we want our learners to have in the Innovation Lab space?"
Liz Curlin, a Pre-K teacher who served on the core team, learned about how to do a space analysis to understand how a space feels. As part of the SMU Maker Education Project team's training, Curlin went to a familiar space, her church. Entering it with the eyes of a designer, she began to see that design elements shaped "how you were to behave in the space."

After a training workshop, the core team and the SMU Maker Education Project team worked together for several months in spring 2017 to develop design principles. Burton, another member

of the core team, called the principles "mini vision statements" for the Innovation Lab. Among them were, "The Innovation Lab at Lamplighter will inspire the development of authentic learning experiences that are student-centered and collaborative" and the Innovation Lab will "be utilized by faculty and staff trained and supported in current and emerging teaching practices."

Those principles then led the team to come up with twelve "how might we?" questions for the rest of the teachers to brainstorm answers to. The questions included, "How might we accommodate multiple long-term projects running concurrently?" and "How might we support teachers to create authentic learning experiences in the Innovation Lab?"

One afternoon in April 2017, faculty and staff got their first look inside the building. They looked up and around as O'Krent, Curlin, Burton, and the rest of the core team asked them to imagine how they might use the space. The kitchen, hallways, and classrooms echoed with excited chatter as teachers filled big pieces of chart paper with their answers to the "how might we?" questions. Their answers exhibited the boundless, divergent thinking designers need at this stage. "Trial + error," "networking," and "guest chef appearances" all showed up as answers.

"There are no bad ideas!" one teacher assured her colleagues. Another said she was trying to let go of her preconceptions and "let my mind be open." "What if? What if?" was one refrain heard throughout the afternoon. "That'll work. That'll work," was another.

A Building Alive with Learning

On an early September morning, the Innovation Lab is in full use. Hill says that going through the design process, with coaching from the SMU Maker Education Project team, "has made the second week of school feel like we've been in the building for a long time." Fourth-graders stand with their teacher, Brian McCool, around a workbench learning about measuring wood in the wood shop. A row of saws hangs from hooks high on the wall, out of reach.

Down the hall, Pre-K students clap with delight as they learn firsthand about the properties of light, as red and yellow liquids in a plastic cylinder mix together and turn orange. And in the physics lab, Burton's fourth-graders are designing a machine that will move along a cord stretched across the room to a certain distance and then drop a ball into a basket, all choreographed by the computer code they use on their laptops.

The students are excited, too. "There's a real buzz among the children on the playground as well as at carpool," says Judith Mullens, Director of Early Childhood. "Today I overheard groups of children talking about woodworking in just an awed tone."

The partnership between Lamplighter and the SMU Maker Education Project continues during the 2017-18 academic year. The SMU team "will be invited into the classroom with the children, basically guiding and mentoring the teachers as they continue to develop and refine the academic program," Mullens says. The team is also meeting regularly with third and fourth-grade teachers in a design cohort, to coach them through making and designing with their students.

Lamplighter's leaders say they're glad to continue working with the SMU Maker Education Project team. Vicki Raney, the Assistant Head for Academics, who has been at Lamplighter for 14 years,

calls the partnership "one of my favorite things that has happened over the years."

Hill sees the collaboration in terms of the school's entire history. "With a school of 65 years, Lamplighter has always been a leader in progressive education. It is woven into the DNA of this institution to stretch and question, and find new ways for children to experience teaching and learning," she says. Working with the SMU Maker Education Project team has kept Lamplighter leading innovative best practices in early childhood and elementary education.

To Hill, shared goals are what make the partnership between Lamplighter and SMU succeed. "The Maker Education Project team's goal is to advance understanding of design thinking and maker education," she says. "Ours is to ensure that our students understand what design thinking and maker education are and how they can be used in their daily lives. Having the shared goal with SMU has made our partnership I think one of the most special things that we do at the school."