



BROOKWOOD
SCHOOL



CHANGEMAKERS

AT BROOKWOOD

BY LORI FERGUSON

Makerspaces: curiosity-charged zones filled with tools, computers and digital fabrication devices such as 3D printers and laser cutters that harness students' imaginations and encourage problem solving through a collaborative, hands-on process of designing, experimenting and building. They're increasingly popular in education today and appear tailor-made to serve Brookwood's 'mission in practice,' which emphasizes communicating; collaborating; thinking critically, creatively, and globally; honoring differences; taking risks; and taking responsibility.

And Brookwood has embraced this exciting approach to learning, with an important twist. Here, students aren't just working together in a lab to design and fabricate the neatest widget possible on a 3D printer, simply for the sake of doing so. Instead, they're acting as *changemakers*, identifying real-world problems and seeking authentic solutions that make a difference. "Our students see themselves as agents of change who can have a positive impact both in the school and in the community at large," Rich Lehrer, Brookwood's Director of Innovation, observes proudly.

This shift from makerspace to changemaker space may seem like sleight of hand to some, but for Lehrer, it has profoundly affected the way he views education. "I'm in my 29th year in education, and my first 22 years were spent in a very conventional environment. Now, I often find myself in uncharted waters, and it's exciting. The initiatives I've seen taking place in education over my career represent a serious paradigm shift. Teachers are no longer just dumping content into a child's head. Learning has become much more interactive and collaborative, and Brookwood is demonstrating just how powerful that can be."

Where there's smoke, there's fire

Lehrer taught internationally as a middle school science teacher before arriving at Brookwood in 2007. In 2011, he once again found himself heading abroad, this time to Rwanda for a summer teaching fellowship that explored how education can be used to alleviate poverty. Seeking ideas to carry with him, Lehrer contacted Amy Smith, the founder of MIT's D-Lab, an innovative enterprise that challenges students to employ STEM (Science, Technology, Engineering & Math) skills to find practical and collaborative solutions to global poverty challenges.

Upon returning to Massachusetts, Lehrer initiated the Cookstove Project, uniting Brookwood eighth grade science students with peers in Brazil, Uganda and Rwanda to build a safe, efficient biomass stove. The students learned about energy and humanitarian engineering—Brookwood middle school student Alex Emerson's film about the project was singled out for recognition by President Barack Obama—and Lehrer learned about project-based learning's powerful ability to enliven education. In many ways, that snowball has been gaining velocity ever since.

In 2012, Lehrer was selected—along with colleague Sven Holch—as an Amory Parker Chair, a designation that allowed him two years to explore opportunities in project-based learning (PBL) with fellow faculty members. "My own education was bereft of opportunities to use learning in interesting ways, so I have a heightened awareness as to the educational impact of this approach," he says candidly. While searching for ways to engage his students, Lehrer happened upon a YouTube video detailing how to make a prosthetic hand using 3D printing. He was intrigued—his three-year-old son Max had been born with symbrachydactyly, a condition that prevented the fingers on his right hand from growing. Lehrer decided he had his project; he would task 12 of his eighth-grade science students with fabricating a mechanical hand.

The robohand project was a success and an important turning point for Lehrer and for PBL at Brookwood, paving the way for students to pursue other projects that created authentic solutions to real problems. Technology can be seen as cold and clinical, but used authentically, it enables students to move from identifying a problem to thinking of a solution and then *creating* that solution. And when students are creating authentic solutions to real-world problems, they're motivated to do well *not* to generate a grade or please a teacher, but to honor a relationship they've established.

What was needed now were more authentic problems, so in 2014, the Problem Bank was launched to crowdsource problems from within the Brookwood community. Several years later, Brookwood decided to amplify students' problem-solving experiences through "D-Zign Girlz," a Steep Week course in which Upper School students visited Harborlight House, an affordable senior-living facility in nearby Beverly. The girls met with five residents, identified problems they faced, brainstormed solutions, and then designed and created assistive devices to solve those problems. The results were astounding. After working through multiple iterations of their proposed devices, the girls not only came up with solutions but also forged relationships with the residents that persisted past the project's conclusion.

Authentic solutions foster affinity for citizenship

The experience, says Head of Upper School Annie Johnson, was a game changer. "When kids engage in authentic problem solving with other human beings, they have to engage in honest relationships," she explains. "As a result of this and other changemaker projects, I've watched our students become more facile with initiating conversations and honing their relational skills. When kids have an opportunity to walk in other people's shoes,

SIXTH GRADERS

in the 2016 Steep Week "D-Zign Girlz" course worked with senior residents at Harborlight House to formulate, design and create an array of assistive devices, from key holders to iPad stands.



they learn to respect the core of the human being sitting in front of them, and it alters their affinity for citizenship.”

The changemaker process has also made students more astute problem *finders*, Johnson continues. “I’ve witnessed our students become more adept at identifying problems within their wheelhouse and then evince a willingness to step into the uncertainty of that. It’s easy to identify kids who have been involved in changemaker projects—they can see the problems that need to be solved and they know they can be the agents of change.”

Being comfortable with risk-taking is another valuable takeaway for students in changemaker projects, says Johnson. “Kids have to iterate—they fail, and they often fail multiple times. It takes a gritty kid to want to do something eight, nine, ten times, but our students do it again and again.” Helping students grow “comfortable with discomfort” is an integral part of the learning process. “That’s where true learning happens. Pushing through that sense of unease goes hand in hand with risk-taking, and it literally grows neural pathways in the brain. If you’re not moving outside your comfort zone, you’re not learning.” And the reason they’re motivated to step into the grittiness, Johnson contends, is because they see the human being who’s behind the solution. “They realize the impact of their actions and they know someone is depending on them to find an answer.”

The idea of citizenship is a vital thread in the fabric of Brookwood, Johnson says. It’s a quality that’s particularly important for Brookwood eighth graders, she asserts. “They’re the leaders of our school and they’ll be heading off to secondary school, so we want to equip them with the education and skills they will need to make a difference in their new communities. I think we’re onto something here in terms of the way we teach our students about community and citizenship, and I want to do my part to push this through pedagogically.”

This commitment to authenticity, empathy and relationship-building isn’t restricted to the Upper School; it runs through every division at Brookwood. For example, faculty in the Lower School lay the groundwork for authentic problem-solving by nurturing students’ individual development while simultaneously cultivating a sense of community. “In these early years, we focus on creating a community of inclusion and developing students’ sense of respect for others,” says Head of Lower School Nancy Evans. “We also give them the freedom to choose how they effect change and ensure that they know it’s okay to take risks. Students learn to look outside themselves and think of ways to include others in change initiatives, and as they grow, they are eager to demonstrate ‘This is what I’ve learned.’ They become the teachers and eagerly seek authentic partnerships with others.”

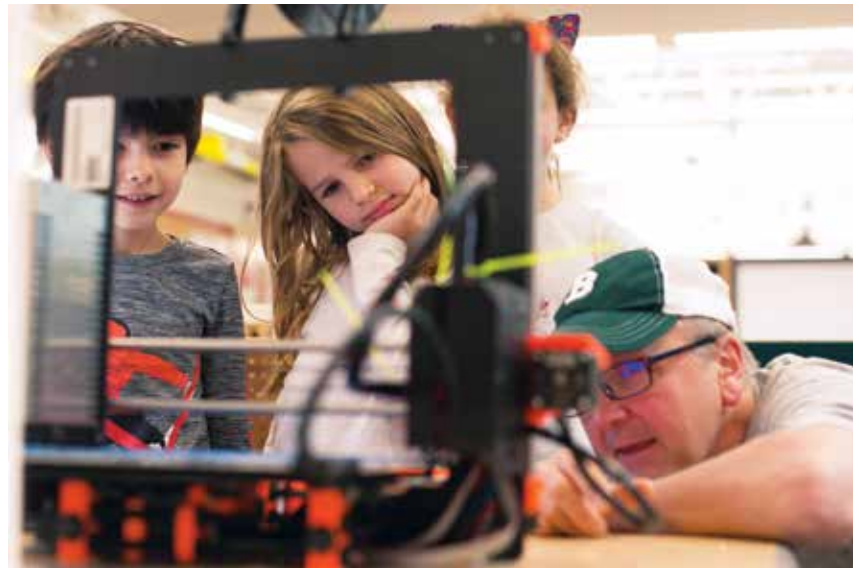
Faculty in the Middle School build upon these lessons, says Middle School Coordinator Lisa Johnson, encouraging students to engage in practical, hands-on, team-based projects that value collaboration and demonstrate that failure is not an end-point. Instruction is guided by Dr. Howard Gardner’s nine multiple intelligences, with students self-identifying their specific intelligence through a series of exercises. “The idea is, ‘The more I know about myself, the more I can address my needs and bring my most informed self to the task at hand,’” explains Johnson. “For fourth and fifth graders, changemaker projects manifest as ‘How can I use my influence to make the world a better place?’”

Young people can accomplish mighty things

“Problem *finding* is actually quite a sophisticated process,” observes Head of School Laura Caron. “It requires perspective and a sense of the other—you need to see how someone else

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—LAURA CARON,
HEAD OF SCHOOL



FIRST GRADERS presented a proposal to create Braille labels for placement around the school to make the environment more welcoming and inclusive for all. Their letter, in part, read: “Braille is like a code people read with their fingers. It was named after Louis Braille. He got poked in the eye with a sharp tool and lost his sight. On Dot Day, we had done some writing in Braille using foam dots. When Mr. Lehrer saw this, he asked if he could come in and tell us about creating Braille signs using 3D printing. We started by learning about 3D designing and printing from Mr. Lehrer. Later we made Braille plates. We investigated places in our school that already have Braille and some dangerous places that didn’t have Braille. We would like to ask permission to make and put up Braille signs in these locations.” By the end of the project, first graders had played an integral part in creating Braille signs that were mounted around campus.

is perceiving a situation and then step into that space. This requires empathy, a quality we foster across the Brookwood community.”

The other powerful lesson gleaned from Brookwood’s community-wide commitment to authentic problem solving is that young people can accomplish mighty things, Caron continues. “With coaching, scaffolding and space for reflection, kids can do far more than you might think.” Teachers make it clear to students from a very early age that they are equal contributors to the problem-solving process, Caron explains, and it’s having an impact.

A case in point, first graders submitted a proposal to Brookwood’s leadership team to create 3D Braille signage for the school. “Receiving that document was a fabulous moment,” says Caron. “Not only were the children identifying problems that would make our community more inclusive, the adults in the classroom were holding space for reflection, allowing students to think about what outcomes they were hoping for and how best to effect change.”

Looking ahead, Brookwood faculty and administrators are enthusiastic about the changemaker initiative’s prospects for growth. “We look forward to broadening our work, finding more partners, and moving beyond the 3D printing projects that have largely defined our programs up until now,” says Lehrer.

Outside organizations continue to express interest in Brookwood’s efforts as well. MIT’s D-Lab remains a source of inspiration, Google reaches out periodically seeking examples of technology being used in the service of good, and leading 3D printing company Ultimaker has named Lehrer to its ‘Pioneers’ group, a teachers’ advisory board that collaborates with the company.

The Boston Children’s Museum also invited Brookwood to mount a demonstration of the Problem Bank at the museum during

this year’s Steep Week. Brookwood’s “World Piece Project” centered around creating replacement pieces for board games, providing students and museum visitors with the opportunity to collaborate using their ‘maker’ skills in a meaningful and authentic context. The school took 3D printers to the museum and students used Play Doh to create a solution, scan the object with a specialized app, and then create a new game piece with a 3D printer. The week proved rewarding for visitors and students alike.

Moving forward, Brookwood faculty envision expanding changemaker projects beyond digital fabrication. Up until now, work for the Problem Bank has mostly involved 3D printable solutions, but students can also code apps, build websites, create high-quality videos, sew, build, plant, etc. The power of the Problem Bank lies in crowd-sourcing problems, Lehrer explains, and there’s no reason to restrict solutions to technology, or to local venues. Thus, the Problem Bank could expand to address queries on a global level. “Kids can create profound solutions to problems if we just empower them to use their problem-solving skills by identifying the problem, formulating an idea to deal with it, and creating an actual solution,” says Lehrer.

The act of identifying problems and encouraging students to be problem finders and solution seekers need not be confined to the digital realm, agrees Caron. “There are many experiences from daily life that students identify as needing improvement, for example, ‘How could we make the hallways less crowded?’ or ‘How might we make the lunch lines move faster?’ Students’ ability to recognize an opportunity for improvement, iterate and then make recommendations for change is broad-based.”

Teachers are no longer expected to have all the answers, Lehrer observes, and that is fine by him. “Why not embrace that shift and work as a coach or a mentor rather than just dispensing knowledge in one direction? Be open to serendipitous moments. Hire good faculty, trust good ideas, and then give people the space and time to do the work, as Brookwood has done. The students, parents, faculty and staff here are amazing, and I truly believe we can make a profound contribution to the way education is done.”



Caron concurs. “The more that we can empower and scaffold students in the classroom, allowing them to co-create how they move through their studies, the deeper their educational experience. Student agency, like that fostered in our changemaker projects, is critical.” The more that faculty engage students as agents in their own learning, the greater the opportunity for deeper learning and far deeper facilitation from teachers, Caron continues. “When teachers say to students, ‘What are you seeing? How might you approach this? Let’s put our heads together and find solutions,’ it’s a beautiful set-up,” she concludes. “It places everyone on an equal footing for finding problems and creating solutions to make our world a better place.” •



SEVENTH GRADERS,

eager to honor the relationships formed with their Harborlight friends, engaged in a Storycorps project this past year to interview residents and preserve their stories.

