Receiving that document was a fabulous ‘Pioneers’ group, a teachers’ advisory board changemaker initiative’s prospects for growth. clear to students from a very early age that continues. “With coaching, scaffolding and expressing interest in Brookwood’s efforts of the Problem Bank at the museum during company Ultimaker has named Lehrer to its solving process, Caron explains, and it’s space for reflection, kids can do far more says Lehrer. 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.”

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 Sleep 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 printouts to the museum and students used PlayDoh 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.

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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.”

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 newest 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. Lehrer makes 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 a 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 find myself in uncharted waters, and it’s exciting. The initiatives I’ve seen taking place in education today, especially with a focus on student-centered learning, is remarkable.”

Makerspaces: curiosity-charged zones filled with tools, computers and digital fabrication devices such as 3D printers and laser cutters that harness student’s 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 talismans to serve Brookwood’s ‘mission in practice,’ which emphasizes communicating: collaborating; thinking critically, creatively, and globally; honoring differences; taking risks; and taking responsibility.
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.

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 pursue other projects that created authentic solutions to real world 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 Harborsight 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 concepts, 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, 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 envisage a willingness to step into the uncertainty of that. It’s easy to identify kids who have been ‘problem-generators’—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 these ideas—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 linearly 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 grit—Johnson contends, 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.”

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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, learning 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 for this to be put in other locations.” By the end of the project, first graders had played an integral part in creating Braille signs that were mounted around campus.

Young people can accomplish mighty things

“Problem finding is actually quite a sophisticated process,” observes Head of School Laura Carson. “It requires perspective and a sense of the other—you need to see how someone else 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, learning 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 for this to be put in other locations.” By the end of the project, first graders had played an integral part in creating Braille signs that were mounted around campus.

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Where there’s smoke, there’s fire

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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.

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