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— COVER STORY —

Reinventing high school

Textbooks are rare. So are traditional grades. Students progress at their own pace. See how one New Hampshire school is retooling education.

Melanie Stetson Freeman/Staff

Students in a Green Technology class at the Manchester School of Technology High School build a front patio at a home in Manchester, N.H., to help hone their vocational skills.

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By Stacy Teicher Khadaroo, Staff writer
@StacyTKhadaroo

MANCHESTER, N.H.

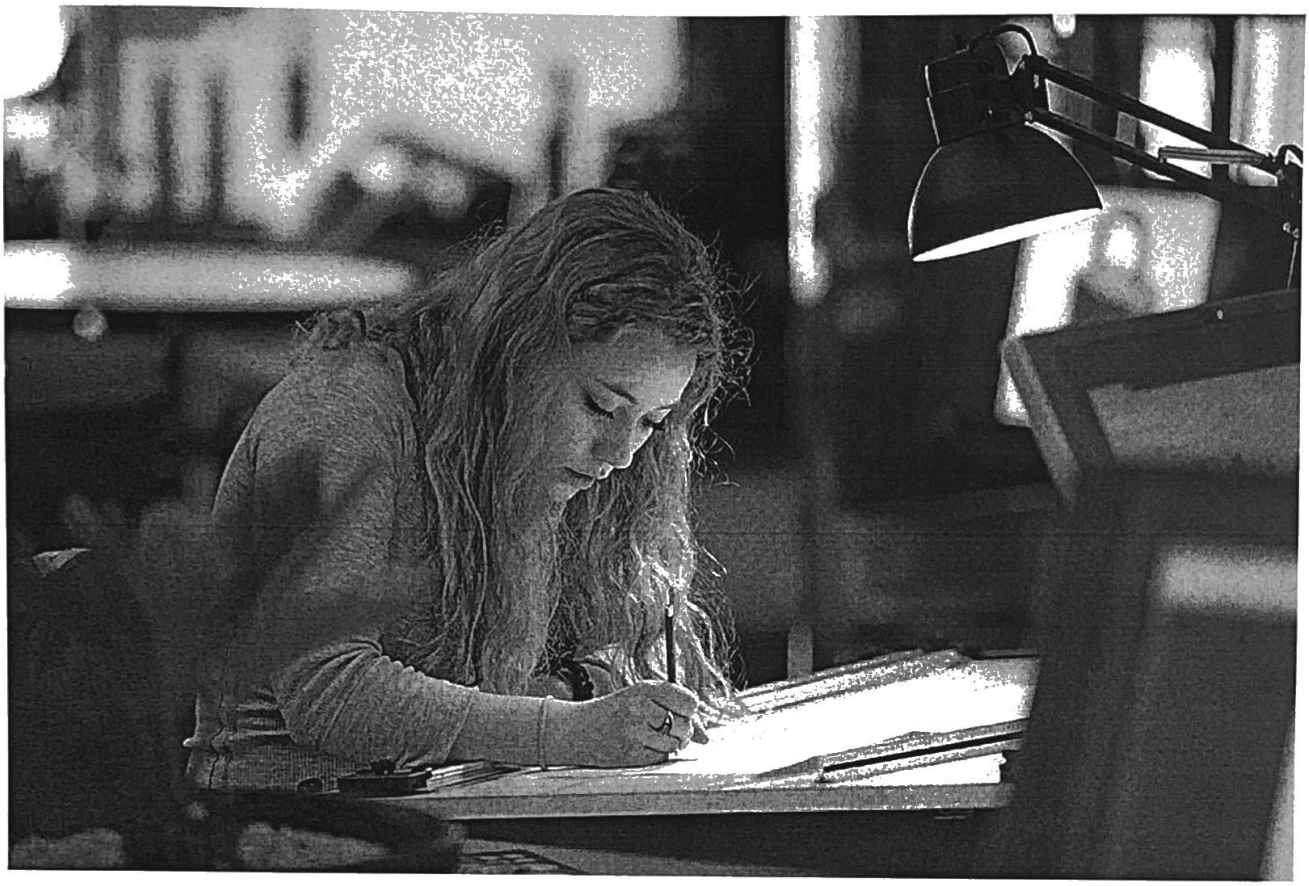
Two-dozen high school students are gathered around a large work table as manufacturing teacher Dan Cassidy holds out boxes of metal bars and gears. The students choose among the parts to build model bicycles.

"What else are we going to use today? Let me hear some vocab here," he says. When a student shouts out "chains," he nudges them until they recall another term for it: "linkage."

This isn't a manufacturing class. It's actually a combined geometry and physical science class. While clusters of students work at stations assembling miniature two-wheelers, others rotate through a lesson on the computer and reason through a problem about parallel triangles the old-fashioned way – with paper and pencil. Mr. Cassidy and co-teacher Athanasia Robinson, whose specialty is math, circulate and check on everyone's progress.

"I have a really hard time just sitting in a class and focusing on a teacher and writing notes," says sophomore Hope Nichols as she and a purple-haired classmate bolt together a bike. "But here, everything is hands-on ... or I can kind of teach myself, which I really prefer."

Students rarely see textbooks here at the Manchester School of Technology High School (MST-HS), a low-slung utilitarian building a few miles from the river where high-tech businesses occupy former textile mills. In most classes, they don't get standard letter grades. They don't automatically move on to the next level at the end of the school year, but instead advance once they have mastered the material. Students buttress their classroom learning with real-world experiences – such as building a house or working as a chef – to help prepare for future careers.



Melanie Stetson Freeman/Staff

Sophomore Tessa Arrigo learns drafting and geometric construction in a class taught by an architect.

Welcome to what, in some ways, may be a prototype of the high school of tomorrow. Here, vocational education meets cutting-edge academic innovation.

At the core of the school's curriculum is a wide variety of career pathways students can choose from – ranging from nursing to policing. The four-year public institution itself is embedded within a career and technical education center that has long served juniors and seniors from other high schools who come to take work-related courses.

While the focus on career development here is stronger than at most high schools, MST-HS is symbolic of efforts across the United States to make education more relevant and engage students with new approaches.

In an age of struggling public schools and rising global competition, education officials are searching for ways to break out of the pervasive industrial-age school structures – think 45-minute class periods, rote lecture-style teaching, and age-based grade levels. Some schools now wrap learning around community projects. Others have students create portfolios and do internships. Still others incorporate students into decisionmaking for how the school or classroom will operate.

Some of the boldest experimentation is going on in New Hampshire. The state has become a leader in the "competency-based" education movement – in which success is less about "seat time" in a classroom or passing traditional tests and more about students showing they can apply skills and knowledge to complex challenges.

Nationally, "there is a lot of interest in delivering education in new, more-flexible ways that address students' differing needs, differing learning styles, and the differing paces at which they acquire knowledge," says Thomas Toch, director of FutureEd, a think tank at Georgetown's McCourt School of Public Policy in Washington. "New Hampshire's commitment to the competency model is ... seen as a thoughtful and cutting-edge effort, though not one without its challenges."

Initiatives are popping up across the state. One district, in Rochester, N.H., has become a pioneer in allowing even the youngest students to make choices about how they are learning. Rochester and eight other districts are also part of a first-in-the-nation pilot project in which achievement is measured by performance on tasks created by teams of teachers, rather than on standardized tests. MST-HS has become its own showcase of innovation, created with students like Hope in mind, students who might not flourish in a traditional high school but enjoy learning math and other skills with the help of sprockets and spokes.

New Hampshire's quiet education revolution, if it proves successful, could inspire a dramatically different future for American schools.

Tessa Arrigo sits at a drafting board, her pink polished nails gently turning a compass to bisect an angle. She swivels on her stool to consult a computer for a self-paced series of 26 exercises in instrument drafting.

The sophomore is part of Design Communication, the "cool" career pathway that enticed her to try this school. She's considering a future in biomedical engineering. The classroom – a sleek studio with state-of-the-art equipment and a creativity-inducing vibe – was designed by teacher and architect Stephen Koziatek. It has a lounge area for brainstorming and critiques, and shelves suspended from the ceiling to display models made with 3-D printers.

"It doesn't feel like school," Tessa says. "I hated coming to school in middle school.... But I actually enjoy coming to this school because it's self-paced. I don't feel stressed out too much because I have time to get things done."

She opens her portfolio to a drawing of her mermaid chair. She has a beach-themed bedroom and recently dreamed up the scallop-backed seat for her industrial design project. First she had to research all the components that go into building a chair. Then she had to draw it from various angles and create an advertisement to sell it.

Melanie Stetson Freeman/Staff

Teacher Daniel Cassidy (c.) helps students in the manufacturing technology lab.

Mr. Koziatek ("Mr. K," to the students) keeps up with what's new in design so they'll be well prepared, whether they go to work as a drafter, head to community college for a CAD (computer-aided design) certificate, or opt for a six-year master's in architecture.

Each career program at MST-HS has an advisory board that includes professionals and partners from local businesses and colleges. They ensure the curriculum keeps up with changes in the field, and they set up internships for students and allow them to shadow professionals. Koziatek hears from students who have gone on to college that "they're the ones that are, in some cases, showing the other kids how to do things."

The high-tech and academically demanding nature of some of the career programs at MST-HS often surprises people in the community, who remember its roots as a vocational school in the 1980s. "They really have that stereotype ... that it's for kids that can't make it academically, so here all they do is work with their hands," Koziatek says.

Education policy makers understand that the world of work has changed, and that for long-term success, some college-level education is going to be required for most people to earn a living wage. Career-tech schools with strong academics show that "there are multiple pathways to it," says Shaun Dougherty, a professor at the University of Connecticut Neag School of Education.

Many students are attracted to MST-HS's motto: "As fast as you want, as slow as you need."

The academic grading system at the school is 1 through 4, with students progressing along the scale from fall to summer, or until they reach Level 3, which means they've demonstrated competency in all the key elements of a course. Reaching Level 4 means they've gone above and beyond.

"At a normal school, you could skate by and get a C," says junior Tyler Burke. "But here ... instead of doing a paper just 'cause I had to do it, I have to be able to know it and give the teacher an example of it. Now I know stuff really well," he says during manufacturing class, above the din of a student grinding metal.

During open houses, teachers tell prospective students they have to be self-motivated. "That's part of the model: There's a lot of freedom," says English and humanities teacher Jillian Corey. But students also have to take ownership of their learning. "With first-year students, we spend a lot of time initiating them, breaking down old ways of thinking," she says. Barely passing "does not exist here.... That blows their mind."

Another challenge: Too many of the students take the mantra "as long as you need" too literally in completing their work. So school principal Karen Hannigan Machado says the staff has been working to build into courses more self-direction, perseverance, and planning – traits often included in lists of "21st-century skills" that employers seek.

Melanie Stetson Freeman/Staff

Justin Michaud (l.) and his twin brother Ryan use geometry to construct a small bicycle in the manufacturing lab at Manchester School of Technology High School, where students learn by doing hands-on projects.

Like many high schools in New Hampshire, this one is working toward having students move on to new classes or alternative learning opportunities as soon as they've mastered the coursework. It's not an easy transformation, but it's already happening in the side-by-side, self-paced math classrooms run by Amanda Egan and Callan Cardin. In the middle of a 100-minute block, a girl walks up to Ms. Cardin and hands in her final test for a geometry unit. The teacher immediately pulls out the materials to get the student started on the next section.

In Ms. Egan's room, freshman Matthew Peterson works on his final unit for Algebra I, erasing mistakes as he talks through a graphing problem with a student teacher. "I'm just about done," Matthew says, wearing a T-shirt plastered with images of cash, of the math course.

He expects to be ready to move to Geometry the following week, with two months still to go in the school year. "I'm already ahead, rather than having to slow down and wait," he says. Matthew has some incentive: Finishing Geometry is a prerequisite for starting the popular Game Design program.

The day before, freshman John Thornton had fulfilled his promise to finish Algebra I before April vacation. "I walked right into the Geometry classroom and asked for a full unit and started doing it as soon as I got home," he says. He finished six out of eight papers for the new unit that very night.

Not everyone is so self-motivated. To help students not fall too far behind, teachers often work with them to set goals, and Egan even offers small prizes for meeting them. The students say they don't need rewards, but, Egan says, "it helps. They're still kids."

Out of 30 students in Egan's Algebra I class, 29 are on track to either complete it this year or take "summer recovery" courses rather than having to come back in the fall. That's a big improvement over last year, when she and Cardin first started the self-paced approach.

She also tracks how her students compare with similar students nationwide. Ninth- and 10th-graders perform in line with the national norm for math, she says, but 11th-graders surpass it. She thinks that's because they are able to apply the skills they built up in the first two years.

The self-paced approach addresses a problem many teachers around the nation face. Advanced students often feel stunted because they have to sit through the basic instruction that many of the others in class need. "But with the self-paced

program, we cater to every type of student," says Cardin. "I just love it."

Teens gravitate to MST-HS for a variety of reasons. Some like the small setting. Some are self-proclaimed geeks or students who have been bullied in other schools and feel more comfortable here, Ms. Machado says.

Of the 325 full-time students, about 25 percent require accommodations because of disabilities or medical issues. The school, which started in 2012, hopes to expand, because it usually has a wait list of at least 50 students after all the seats are filled through a lottery. Another 437 students come part time from "feeder" high schools in Manchester and beyond.

Melanie Stetson Freeman/Staff

Visiting teachers from around the state participate in a question-and-answer session with instructors at Maple Street Magnet School in Rochester, N.H. New Hampshire has become a leader in revamping its schools and education methods, including giving young students, like the ones at the Maple Street school, greater choice and autonomy.

While competency-based education offers the potential for improving educational equity by tailoring learning to students' individual needs, it also comes with risks. One is what happens if slower students never catch up. "If we're not able to give [struggling students] effective support, and the others take off, then we are exacerbating achievement gaps, hurting the kids that this model is designed to help," says Mr. Toch of FutureEd.

But Cardin says she has witnessed students who would be trapped in low-level classes in a traditional high school come here and surpass expectations. She points to one boy who took a year and a half to finish Algebra I, so he came into her Geometry class well into the school year. "Now he's ahead of almost everyone else in the class," she says, because he took advantage of custom-fit resources and instruction.

Not everyone is excelling academically, though. On the SAT exam, 21 percent of MST-HS 11th-graders scored proficient or above in math in 2015-16, compared with 28 percent in Manchester and 40 percent statewide. Scores for reading showed similar gaps, but such disparities often reflect demographic differences – and at this school, in particular, many students struggle with traditional testing. Yet the dropout rate here is very low – less than 3 percent.

Perhaps most unusual about the school is the inventive nature of the instruction. It requires flexibility and adventurousness on the part of both students *and* teachers.

"Ninety-nine percent of the time, when we have a successful lesson, it's because we didn't pull it out of a textbook," says Ms. Robinson of the geometry and physical science class.

The mingling of academics with real-world problems can lead to unexpected moments of discovery. Kevin McDonnell, who teaches Green Technology, recalls when his students were concerned about too much algae in the big blue tubs where

they keep fish for a project that combines hydroponics and aquaculture. In science, they had just learned about freshwater plankton and realized the organisms could eat the algae. Problem solved.

"That was amazing," Mr. McDonnell says. "That's what we're hoping to go for, building-wide – their ability to make that connection...."

Sitting on couches in the Game Design classroom, four teenage boys rank the traits of characters they are creating, such as charisma and stamina, when Jonathan Richard declares: "This class taught me English!"

His friends agree, saying they recently watched an anime film that helped them understand story arc and other concepts their English teacher has offered up in different contexts. "It was deep," Jonathan says.

In Game Design, "if they don't know how to break down a story and write good concepts, then they're in trouble," says teacher Ryan Frasca.

Over in the Algebra I class, Egan sends two students, Nayshalee Rodriguez and Conor Flanagan, on a mission to check three ramps in the school to see if they are in compliance with the ADA (which they'll learn later is the Americans with Disabilities Act). She suggests they borrow a tape measure from the manufacturing teacher, and then they're on their own.

They struggle at first, not sure exactly how to measure the height and length of the ramp and translate that into the "rise over run" formula for slope. It's the kind of exploration that Egan says will motivate real learning. When they come back with their first round of "crazy measurements," she gives them just enough guidance that they feel confident to try again, and eventually they can show that the ramps do indeed comply.

When the four-year high school first opened, both teachers and students found the adjustment to competency-based grading awkward. Machado, as principal, was given a shoestring budget and only three months of planning time to open the school. But some of the early graduates now see the benefits of having to be self-starters, even if they didn't then.

Trevor Harrington says he didn't care about learning until his time at MST-HS. "Now, two semesters into college, I'm almost an entirely A student," says the 2016 graduate who attends Southern New Hampshire University (SNHU). "And it's because the teachers, although they were not always perfect ... taught in a way that made us appreciate the education."

Several of his fellow graduates agree. One of them used college credits earned senior year to jump-start her university education. Another says he can work in great restaurants to help pay for college, because of the culinary program he took – but exploring that in high school also saved him from investing more time and money in a career he decided he didn't want after all.

Teachers, too, have thrived with the experimentation. "I've grown far more as a professional than I honestly feel that I would have in a traditional kind of school setting," says Ms. Corey.

Despite all the innovation going on in schools across the country, most classrooms remain fairly traditional in their approach to learning. Perhaps as a result, only 38 percent of public school students in one national survey said most or all of their classes challenged them to their full potential. To bring deeper learning into classrooms on a large scale would require a "seismic shift" that could take generations, says Jal Mehta, a professor at Harvard's Graduate School of Education, in a report published by Jobs for the Future.

New Hampshire has a head start. High schools here have been shifting into competency-based education since 2005, and some districts have voluntarily transformed all their grade levels to the new approach.

Challenges remain. One is explaining the new way of grading to parents – and college admissions counselors. For those who go straight to a college program aligned with what they studied at MST-HS, that's not usually a problem.

But generally there will be a transition period, Toch says, in which some colleges may be skeptical of competency-based transcripts. The traditional high school credit represents a standardized measure of time spent in the classroom, even though it may not equate to actual learning. It's a currency colleges understand, he says. Mr. Harrington had to explain his grades to an admissions officer at SNHU.

"Thank God they had individualized comments" by teachers on the transcript, he says. But having seen his teachers learn as they go, he's better able to adapt to new situations. "College is a lot like this school," Harrington says. "Every year is different."

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