



A New Architecture for High School Learning

Purdue University is home to renowned STEM programs that attract applicants from around the globe. Yet when state leaders and school officials looked at enrollment data in 2015, they noticed the stunningly low enrollment of students from Indianapolis Public Schools (IPS), just an hour from the university campus. Of roughly 1,100 IPS graduates in 2015, 26 qualified for admission to Purdue. Just 12 enrolled. As a result, hundreds of high-tech, high-paying jobs—essential to the state’s and nation’s long-term economic health—were going unfilled.

The problem was not the absence of IPS student potential. Rather, the students had not had access to the learning opportunities they needed to meet the bar. How did we get to the point where so many smart, curious, capable students are unprepared to participate in the workforce? The short answer is that the U.S. educational system operates on a model designed to prepare workers for an industrial economy that no longer exists.

The Ubiquitous Carnegie Unit

In 1906, the Carnegie unit, or credit hour, was introduced to standardize U.S. public education. It defined the precise number of minutes students needed to learn a particular subject and the number of credit hours required to earn a high school or college degree. At the dawn of the 20th century, the Carnegie unit served the important purpose of bringing order to an entirely unstandardized system.

Today, the Carnegie unit has infiltrated almost every aspect of American schooling. It defines precisely how many minutes one must sit at a desk in a classroom or in front of a digital platform to learn. It shapes how schools and teaching are organized. It determines what is and is not assessed. It defines graduation

requirements and dictates how schools are accredited. And it prescribes what goes on a high school transcript and influences who receives financial aid for postsecondary education. In essence, the Carnegie unit is not just hard-wired into the system; it is the system.

For students, this model of schooling exacts a heavy toll. Young people consistently report feeling they are in an intellectual straightjacket: Their schools give them schedules, tell them what classes to take, stick them in rows of desks, and make them read textbooks that lack relevance and study subjects that are disconnected from the skills they need to succeed.¹ For most students, school is neither engaging nor inspiring; it is something to endure.

From Alaska to Florida, the overwhelming majority of American high schools are organized in lock step around the Carnegie unit. Yet less than half of U.S. high school graduates are ready for college or a career.² Consequently, most young people start their adult lives behind, and they will have to spend some, if not all, of their time trying to catch up.

The consequences are unambiguous. According to Harvard University Professor Raj Chetty, the United States has seen a precipitous, generational decline in economic mobility. Specifically, the percentage of children earning more than their parents dropped from over 90 percent for the 1940 birth cohort to around 50 percent for the 1980 birth cohort.³ Commenting on Chetty’s work, Richard Reeves and Eleanor Krause noted that the American Dream is more of a reality for those in Canada, Denmark, and the United Kingdom than for those in the United States.⁴

Compounding these challenges is the unprecedented, painful disruption of

State leaders should retire the Carnegie unit and open the door for high school designs that ensure learning is engaging, relevant, experiential, and competency based.

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COVID-19. The most recent report from the National Assessment of Educational Progress, the first since 2019, revealed how much students fell behind: Reading scores dropped below pre-pandemic levels, and math scores plummeted to where they were three decades ago.⁵

Starting with High School

Members of state boards of education who wonder how this reality can be turned around for high school students have some examples to learn from. In 2015, Purdue University president Mitch Daniels challenged the community to solve the problem of the unacceptably low number of underrepresented minority students from Indiana who were qualified to gain admittance to Purdue. That challenge required an initiative to reimagine education in Indianapolis and elsewhere in the state and strengthen the pipeline to college and a career, particularly for students in the most underresourced communities. The result was Purdue Polytechnic High School, which opened its doors in 2017. Its intent was to engineer and serve students in radically better ways that do not conflate time and learning.

The curriculum at Purdue Polytech prioritizes projects rather than classes, hands-on learning instead of memorization, and real-world demonstrations of competency in addition to traditional modes of assessment. Student outcomes testify to the efficacy of this model (box 1). The school's co-founder and head of school, Scott Bess, now also sits on the Indiana State Board of Education, where he advocates for moving tested, effective learning models from the margins to the mainstream.

Transforming a century-old, deeply ingrained system is a complex, difficult challenge. Among other things, it can be hard to settle on where to start. But we are convinced that high school is the fulcrum for change. When high schools improve learning, K-8 is pressed to raise standards to prepare students for more engaging, relevant, rigorous curricula. And when high school learning improves, postsecondary completion improves. Over time, we believe these benefits will compound, leading to better learning outcomes for students throughout K-16, stronger communities, increased economic productivity, and greater civic engagement.

For this reason, the Carnegie Foundation for the Advancement of Teaching and the XQ Institute, which we lead, have partnered to catalyze a better model. We want high schools to help students develop the rich tapestry of skills they need to succeed in school and life and to recognize that learning can happen anywhere. Put differently, we are intent on building a new educational architecture that shifts the sector to truly competency-based systems—and away from time-bound conceptions of what knowledge is and how it is acquired.

We are not alone in this work. A growing number of states and communities are establishing competency-based education models, offering flexibility for what counts as student learning and reimagining how credit for that learning is awarded. New Hampshire's Learn Everywhere law, for example, empowers students to earn credit wherever learning occurs. Texas, Missouri, and several other states allow schools and systems to request waivers from seat-time mandates. Across Rhode Island and in Phoenix, Washington, DC, and Tulsa, school leaders are designing more rigorous, engaging, relevant models for high school learning.

A 2022 graduate of Grand Rapids Public Museum School (box 2) described his school's approach: "[S]tudents are pushed to not only achieve mastery but to find something they love and can connect with on a personal level every time we study something," he said.

Building Blocks in a New Architecture

What will it take to create thousands more high schools where learning is more like what occurs at Purdue Polytechnic and the Grand Rapids Public Museum School? We believe it requires a new set of building blocks that together form the foundation of a new architecture for education:

- learner outcomes that clearly articulate an expanded vision for student success;
- well-defined, specific competencies to guide teaching and learning;
- powerful learning experiences inside and outside of the classroom that align with those desired outcomes and competencies;
- richer models of assessment rooted in a competency-based framework, which

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Box 1. Outcomes for the Purdue Polytech Class of 2022

Despite the challenges posed by the pandemic, Purdue Polytechnic High School's Class of 2022 sent 34 graduates to Purdue University and had an overall college-going rate of 65 percent, which significantly exceeds the most recent statewide average of 53 percent.^a Proficiency rates on state assessments are four times higher than proficiency rates for IPS as a whole.^b Black students, Latino students, students from low-income families, and students who qualify for special education services among the school's 2022 graduates had higher proficiency rates on state assessments compared with similar groups districtwide and statewide. For example, 30 percent of Purdue Polytech students who qualify for special education services passed a statewide test when they were 11th graders versus 1 percent districtwide and 8 percent statewide.

The class as a whole outperformed the district and the state on the biology end-of-course exam: a passing rate of 52 percent compared with 39 percent statewide and 9 percent for the district. Its students passed the math and English sections of the state test at a rate four times higher than those in the district as a whole, 34 versus 8 percent.

^aIndiana Commission for Higher Education, *Indiana College Readiness Report 2022, June 2022*, https://www.in.gov/che/files/2022_College_Readiness_Report_06_09_2022.pdf. The state figure is for 2020, the most recent year available.

^bIndiana Department of Education, "Data Center and Reports," <https://www.in.gov/doe/it/data-center-and-reports/>. Figures are from state's ISTEP 10+ assessment, which was administered in 11th grade in spring 2021 to make up for testing gaps caused by the pandemic the previous year.

students, parents, and educators can use to accelerate learning;

- new kinds of transcripts that codify and clarify for postsecondary schools and employers what young people know and can do;
- support for aspiring and incumbent teachers to help them fill new roles; and
- designs for schools that are not tethered to minutes in chairs or preparation for an economy that no longer exists, but on developing the knowledge and skills young people need for success in this century.

This list is a tall order, yet examples of what such models look like in practice abound. A movement to reimagine high school is gaining momentum nationwide, and many school leaders are participating in this work.

Roles for State Leaders

State leaders have essential roles in catalyzing a new model for high school. They can create incentives for communities to redesign their high schools and for schools and teachers to remake learning experiences. And they themselves can reimagine how student learning is assessed and credentialed.

Engaging community stakeholders. In Memphis, parent Ginger Spickler saw an XQ billboard inviting communities to enter a high school redesign competition. She called a meeting with dozens of parents, educators, business owners, and civic leaders. Together, with hundreds of students, they created a blueprint for the school that their community needed.

The result was Crosstown High, which opened in 2017 and takes a project-based learning approach in all classes. A 2023 graduate of Crosstown reflected on the effort to design her high school: "If I had to rethink high school in one sentence, I would say that it should be a space that raises problem solvers and solution makers and promotes constant growth," she said.

More than 95 percent of its inaugural cohort graduated on time, compared with 80 percent in the surrounding school system. The Class of 2022 outperformed their peers across Tennessee and the nation in meeting college readiness benchmarks on the ACT in English, reading, math, and science.

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at a time from the ground up. XQ worked with Rhode Island to take a more systemic approach: With input from communities across the state, Rhode Island redesigned its 64 schools at once (see related article, page 18). XQ is also working with Washington, DC, Public Schools to expand its high school transformation work system-wide. Similarly, Carnegie launched its Learning Leadership Network to engage school systems across the nation in high school transformation at scale. Every state can undertake such efforts.

Incentivizing schools to make the learning experience more engaging, rigorous, relevant, and experiential. Young people need learning experiences that are multidimensional, project-based, high-interest, and relevant to their lives and aspirations.⁶ Learning experiences need to be authentic, not made-up school tasks. They should build students' academic content knowledge *and* essential skills and competencies such as critical thinking and collaboration. And they need to be rigorous, challenging every student to go further and discover more,

both inside and outside the classroom and the traditional school day.

To catalyze such shifts in learning, states can create innovation grants for teachers, schools, and community organizations to plan together and deliver transformative learning experiences that build explicit competencies necessary for success in postsecondary school and the workforce. To provide guidance, XQ and Carnegie are creating a toolkit for educators and curriculum makers that articulates what these new learning experiences should look like. Our goal is to spur both the supply of new curriculum products and demand from students, teachers, and families for high school learning that is different and better.

The talent and capacity exist in every community—urban, rural, suburban—to do this groundbreaking work. States can help unleash it.

Changing the assessment and credentialing of student learning. Traditional math classes such as Algebra I and Geometry are often taught in a uniform way. Students who fail a course typically have to repeat it entirely, even if they

Box 2. Centering Project-Based Learning

Colocated in a museum with 250,000 cultural and historical artifacts, Grand Rapids Public Museum School in Michigan leverages its location for rich project-based learning. Some days, students collaborate to research artifacts such as a spacesuit from an Apollo mission. Other days, students pursue independent passion projects aligned to rigorous academic standards.

Eighty-six percent of the 2022 graduating class finished in four years, compared with 79 percent for the district overall. The class had higher rates of proficiency on state assessments than students in the surrounding district and statewide in English language arts, social studies, and science. For example, 67 percent met the college-ready benchmark for reading and writing compared with 30 percent districtwide and 57 percent statewide.^a And there were higher proficiency rates for students from low-income families than similar students districtwide and statewide (52 percent met the college-ready benchmark for reading and writing compared with 30 percent districtwide and 39 percent statewide).

Michigan uses the national SAT exam as its statewide assessment for testing 11th graders in English and math and a home-grown assessment for testing social studies and science. More than two-thirds of museum school students met the SAT's college-ready benchmark for evidence-based reading and writing in 2021 and also outperformed the district and state in state social studies and science assessments.^b

^aMichigan Department of Education, "College Readiness," on MI School Data website, <https://www.mischooldata.org/college-readiness/>

^bMichigan Department of Education, "High School State Testing Performance," on MI School Data website, [high-school-state-testing-performance/](https://www.mischooldata.org/high-school-state-testing-performance/).

struggled in only a few areas. This practice burdens teachers and discourages students.

In contrast, badging breaks courses down into smaller components aligned with each student's learning journey and lets students attain badges as they master the components. Badging also gives students more agency over how their learning is organized and the path they take through a subject toward mastery. It makes math more manageable for students, builds their confidence, and leads to greater achievement in the long run.

XQ is building a math badging system with Student Achievement Partners and a network of math pedagogy, assessment, policy, and instruction experts. Idaho, Illinois, and Kentucky are piloting this effort, and each is doing it differently. In Kentucky, badges will align with a traditional Algebra I curriculum, allowing students to demonstrate mastery of concepts at an individualized pace. In Idaho, badging will provide an alternative to Algebra II, giving high school seniors the option to take badged courses associated with the math skills most important for their college or career choice.

Redesign also calls for better, more useful forms of educational assessment. In April, Carnegie announced a partnership with the Educational Testing Service to design, pilot, and introduce new tools that reliably measure the essential affective, behavioral, and cognitive skills necessary for success in school and the 21st century economy. In essence, the initiative aims to create a much better set of tools that can help students, parents, and educators accelerate learning and help state leaders track students' progress toward attaining skills we know are necessary for success in school and a career.

Questions State Leaders Can Ask

State and local leaders often ask us how they might jump-start this work. We usually urge them to begin by asking three questions.

Has our state defined a vision for high school student success, or are we doing so now? This is critical. By establishing a public, shared vision and creating a space to engage key stakeholders, particularly students and families, education leaders can build an understanding that student success hinges on more than narrowly defined disciplinary knowledge. States such as Utah, Virginia, and Rhode Island have

crafted "portraits of a graduate" and detailed the robust competencies that students in those states must demonstrate to graduate.⁷ XQ Learner Outcomes, and the competencies that undergird them, can also serve as a useful starting place for states undertaking this work, as they seek to describe the skills, knowledge, and dispositions every high school graduate should possess.

Are we making it easier for educators to design and implement transformative learning experiences, and have we removed policies that may create obstacles to high school redesign? As we hope we have made clear, required seat time is one common, overarching policy obstacle. Some states already offer flexibility around seat time by giving schools and districts the chance to apply for waivers. If your state already offers flexibility, it is important to make sure schools and systems are taking advantage of the flexibility that exists. States like Utah and Idaho offer financial incentives, innovation zones, and pilot programs with funding to help schools offset the transition and startup costs that high school learning redesign demands.

Are we engaging with higher education, employers, and other stakeholders to rethink how learning is credentialed? K-12 systems cannot transform their schools alone. It takes a community working and planning together and ultimately executing a vision together. In the most elegant high school models, classrooms and schools are porous. That is, there are consistent opportunities for students to learn independently in school or elsewhere, take postsecondary courses, and earn "credits" by working and learning in cultural institutions, community organizations, apprenticeships, and internships.

This vision for high school requires building robust, learner-centered ecosystems that leverage learning opportunities for students far beyond the four walls of the classroom. Building such ecosystems demands deep engagement with a broad range of stakeholders and the establishment of new civic compacts. Doing so will ensure that rich learning opportunities are reserved not for just a few students but are available for everyone.

Let's Get to Work

Transforming high schools is monumentally important work: essential to our economy,

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adamant that if you do everything right, you will go to college, but that's just about all school can do for you.

I'd shift to more holistic preparedness. I'd shift it to something that incorporates not only life skills but mental health strategies, that incorporates spiritual health and finding a purpose and fulfillment in life so you don't leave high school feeling aimless. That's what happens with a lot of people. They go to high school, and even college sometimes, and say, "So what? What do I have to do now?" High school should be about showing people that it's not all about the rat race; it's about educating you, and some part of that is, why do I want to do this? What is there after? ■

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our democracy, and our social fabric. We have seen pockets of progress. But it is time for the entire nation to embark on this work. It will require bold plans, new policies, courage, and commitment.

State boards hold a unique position that afford them an opportunity to lead the way. As the citizen's voice, state board members are on the frontlines, both in and above the political fray, working with communities and convening stakeholders to craft policies that deliver for young people. If every state addresses the three questions above, the entire nation will be stronger for it. The Carnegie Foundation and XQ stand ready to partner on this journey.

¹Gallup, "2016 Gallup® Student Poll: A Snapshot of Results and Findings," web page, 2017, <http://www.gallupstudentpoll.com/home.aspx>; Ulrich Boser, "Revisited: Do Schools Challenge Our Students?" (Washington, DC: Center for American Progress, March 7, 2017).

²College Board, "SAT Suite of Assessments 2022 - Reports," <https://reports.collegeboard.org/sat-suite-program-results>.

³Raj Chetty et al., "Social Capital and Economic Mobility," Opportunity Insights (Cambridge, MA: Harvard University, August 2022), https://opportunityinsights.org/wp-content/uploads/2022/07/socialcapital_nontech.pdf.

⁴Richard V. Reeves and Eleanor Krause, "Raj Chetty in 14 Charts: Big Findings on Opportunity and Mobility We Should All Know," Brookings Institution blog, chart 1 (January 11, 2018), <https://www.brookings.edu/blog/social-mobility-memos/2018/01/11/raj-chetty-in-14-charts-big-findings-on-opportunity-and-mobility-we-should-know/>.

⁵The Nation's Report Card, "NAEP Report Card: 2022 NAEP Reading Assessment," <https://www.nationsreportcard.gov/highlights/reading/2022/>; "NAEP Report Card: 2022 NAEP Mathematics Assessment," <https://www.nationsreportcard.gov/highlights/mathematics/2022/>.

⁶See, e.g., Jenny Nagaoka et al., "Foundations for Young Adult Success: A Developmental Framework," Concept Paper for Research and Practice (Chicago: University of Chicago Consortium on Chicago School Research, 2015).

⁷Valerie Norville, "States Sketch Portraits of a Graduate," *State Innovations* 27, no. 1 (Alexandria, VA: NASBE, October 2022).

cont'd from page 17...Telltale Signs of Rigor and Career Readiness in High School

It is time to help schools engage all students in assignments that connect to their interests and give them ownership in their own learning. No one strategy will be sufficient. The combination of strategies outlined in this article—when implemented effectively—will engage students in rigorous, relevant assignments with teachers who let them take greater responsibility for their learning, who see their potential, and let them know they care about their progress.

¹Stephen W. Raudenbush, Brian Rowan, and Yuk Fai Cheong, "Higher Order Instructional Goals in Secondary Schools: Class, Teacher, and School Influences," *American Educational Research Journal* 30, no. 3 (Fall 1993): 523–53; Jeannie Oakes, *Keeping Track: How Schools Structure Inequality* (Yale University Press, 1985).

²Gene Bottoms, Alice Presson, and Lingling Han, "High School Reform Works—When Implemented: A Comparative Study of High- and Low-Implementation Schools" (Southern Regional Education Board, 2004); Jeannie Oakes, *Keeping Track: How Schools Structure Inequality* (Yale University Press, 1985).

³Marisa Castellano, Sam Stringfield, and James R. Stone III, "Secondary Career and Technical Education and Comprehensive School Reform: Implications for Research and Practices," *Review of Educational Research* 73, no. 2 (2003): 231–72; Southern Regional Education Board, "Bridging the Computer Science Education Gap: Five Actions States Can Take," Report of the SREB Commission on Computer Science and Information Technology (November 2016).

⁴Jeannie Oakes and Marisa Saunders, *Beyond Tracking: Multiple Pathways to College, Career, and Civic Participation* (Harvard Education Press, 2008), p. 256.

⁵Gene Bottoms, *Tomorrow's High School: Creating Student Pathways for Both College and Career* (Alexandria, VA: ASCD, 2021), figure 4.2.

⁶National Research Council and Institute of Medicine, *Engaging Schools: Fostering High School Students' Motivation to Learn* (Washington, DC: National Academies Press, 2004), pp. 80–81.

⁷Bottoms, *Tomorrow's High School*, sidebar on pp. 87–88.

⁸Karen C. Fuson, Mindy Kalchman, and John D. Bransford, "Mathematical Understanding: An Introduction," in M. Suzanne Donovan and John D. Bransford, eds., *How Students Learn: History, Mathematics, and Science in the Classroom*, Committee on How People Learn: A Targeted Report for Teachers (National Research Council of the National Academies Press, 2005); Asha K. Jitendra, et al., "Teaching Mathematical Word Problem Solving: The Quality of Evidence