



# DESIGNING STEM PATHWAYS THROUGH EARLY COLLEGE

OHIO'S METRO EARLY COLLEGE HIGH SCHOOL

AUGUST 2011

By Charlotte North

**EARLY COLLEGE  
DESIGN SERVICES**



**JOBS FOR THE FUTURE**

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## ABOUT JOBS FOR THE FUTURE

JOBS FOR THE FUTURE develops, implements, and promotes new education and workforce strategies that help communities, states, and the nation compete in a global economy. In more than 200 communities across 43 states, JFF improves the pathways leading from high school to college to family-sustaining careers. JFF manages the *Early College High School Initiative*.

## ABOUT THE EARLY COLLEGE HIGH SCHOOL INITIATIVE

EARLY COLLEGE HIGH SCHOOL is a bold approach to education reform, based on the principle that academic rigor, combined with the opportunity to save time and money, is a powerful motivator for students to work hard and meet serious intellectual challenges. Early college high schools blend high school and college in a rigorous yet supportive program, compressing the time it takes to complete a high school diploma and up to the first two years of college.

Since 2002, the partner organizations of the *Early College High School Initiative* have started or redesigned 230 schools in 28 states and the District of Columbia. The schools are designed so that low-income youth, first-generation college goers, English language learners, students of color, and other young people underrepresented in higher education can simultaneously earn a high school diploma and an Associate's degree or up to two years of credit toward a Bachelor's degree—tuition free. All the schools include the high school grades (grades 9-12); some incorporate middle grades as well (grades 6-12 or 7-12).

## EARLY COLLEGE DESIGN SERVICES FOR SCHOOL DISTRICTS

JOBS FOR THE FUTURE helps districts significantly increase the number of students who graduate from high school and are prepared to succeed in postsecondary education. We provide districts with training, tools, and advice that transform schools serving young people underrepresented in higher education. *For more information, Associate Vice President LaVonne Sheffield, lsheffield@jff.org, 617.728.4446*

## ABOUT THE AUTHOR

Charlotte North works as a consultant to support improvement at the classroom, school, and district levels. She has supported STEM instruction for Massachusetts' school planning teams through the *Early College High School Initiative* at Jobs for the Future. She also has been an instructional coach for the Boston Teacher Residency. In that capacity, she has worked with secondary English and science teachers individually and on department teams to support student learning through instructional inquiry and classroom practice.

Ms. North has contributed research, analysis, writing, and technical assistance to projects at the Education Development Center for, among others, the Regional Educational Laboratory (An Examination of State-Led Formative Assessment Initiatives, forthcoming) and the Wallace Foundation (Districts Developing Leaders: Lessons on Consumer Actions and Program Approaches from Eight Urban Districts, 2010). She also has contributed to projects for the Rhode Island Department of Education, including turnaround support for Providence middle and high schools; the Advanced Leadership Development Seminar for superintendents; a commissioner's visit to Central Falls High School; and, in collaboration with the Annenberg Institute for School Reform, a Teaching and Learning Review for middle grades mathematics in Pawtucket. Ms. North holds Master's degrees from Brown University in biology teaching and urban education policy, as well as a Bachelor's degree from Swarthmore College in English literature. She taught high school English and humanities for six years.

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*For more information on Metro Early College High School, visit <http://www.themetroschool.org>.*

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# PREFACE

**J**obs for the Future prepared this profile of Metro Early College High School in Columbus, Ohio, as part of our ongoing work to support the development of six STEM early college high schools in Massachusetts. School developers in Massachusetts were particularly interested in how one community has integrated a STEM focus with an Early College Design to give students a supported transition from high school to college work and prepare them for postsecondary success in STEM fields.

In providing school design and professional development services to early colleges nationwide, JFF has worked with a wide variety of STEM schools within the *Early College High School Initiative*. JFF's Early College Design Services help such schools adopt a college-ready instructional framework that supports strong teaching in math, science, writing, and the other disciplines. One model that JFF is documenting is the Pharr-San Juan-Alamo T-STEM Early College High School in Pharr, Texas. The PSJA T-STEM Early College, which offers a variety of career pathways leading to an Associate of Science degree from South Texas College, will become a demonstration site for instructional and college readiness practices.

Two other examples of STEM-focused early colleges are the Academy for Math, Engineering & Science (AMES) in Salt Lake City; and the Collaborative College for Technology & Leadership ECHS in Statesville, North Carolina. Like PSJA, they demonstrate diverse ways for approaching STEM. Partnered with the University of Utah School of Engineering and with an emphasis on fieldwork, AMES is designed to provide high school students with opportunities to advance in specialized fields of study. The Collaborative College for Technology and Leadership is a partnership between the Iredell-Statesville Schools, the Mooresville Graded School District, and Mitchell Community College. MCC offers a wide range of degree programs, including programs leading to transfer to the state's university system and to career opportunities in more than 20 fields, as well as additional non-degree programs in almost 30 fields.

All these schools share a common goal and achievement: They make "college for all" a reality for young people, even in the most challenging circumstances.

*—LaVonne Sheffield, JFF Associate Vice President, Early College Design Services*

# INTRODUCTION

Columbus, Ohio. On this February morning, the 336 students of Metro Early College High School gather in the center of the school building, situated in a research park adjacent to Ohio State University. The entire student body is present, as they are every Tuesday and Thursday morning a little before 7:50. This includes the third- and fourth-year students who spend most of their time away from the school taking college classes, participating in internships, or conducting research or other projects. Recent off-campus experiences for older students have included taking OSU classes in computer science, Spanish, and comparative literature; interning with a vice president at Battelle, a multinational research and development organization; acting as a congressional page for U.S. Representative John Boehner; and interning at Shadowbox Live, a local performance troupe where each member contributes to performances and helps the organization run. Opportunities are diverse, especially for fourth-year students.

Some students have traveled a long way to get here, using multiple public transportation connections. Some students are chatting; some have their laptops out; some are reading or writing. Most are sitting on the floor in informal clusters or on curved benches that encircle tables.

Classrooms radiate from this central space; some open into the space, while others are enclosed but visible through windows. Exhibits of student projects and artwork line the hallways. All the furniture is on wheels to allow for different configurations. The space will accommodate a dance-a-thon after school on Friday. Planned by Metro students in conjunction with college volunteers, the fundraiser will benefit Nationwide Children's Hospital in Columbus. The hospital also plays host to student interns, most commonly students who choose a life sciences focus in their third year at Metro.

This morning, faculty members and students who plan to speak to the group are standing around the perimeter. At 7:50, the room quiets and everyone listens carefully to announcements about the dance-a-thon and about college planning, student clubs, and volunteer opportunities. When the planned announcements are done, students can address the school community with any other news. Today, one young woman announces an upcoming blood drive.

A mix of discipline and freedom is evident, reflecting the values of the Metro school community, characterized by decency, trust, and an openness to learn from and with one another. If asked, students and faculty alike confirm that, over time, each student learns that it is a privilege to attend a school so rich in opportunities, especially a school that prepares them for—and enables them to take—challenging math, science, and other college courses while still in high school. At the same time, they are recognizably adolescents, waking up slowly in the morning, multitasking with their electronics, and catching up with friends.

# THE STEM CHALLENGE

Calls for improved outcomes in U.S. science, technology, engineering, and mathematics education are frequent and insistent.<sup>1</sup> In 2009, the Commission on Mathematics and Science Education, convened by the Institute for Advanced Study and Carnegie Corporation of New York, concluded that:

**KNOWLEDGE AND SKILLS FROM SCIENCE, TECHNOLOGY, ENGINEERING AND MATHEMATICS—THE SO-CALLED STEM FIELDS—ARE CRUCIAL TO VIRTUALLY EVERY ENDEAVOR OF INDIVIDUAL AND COMMUNITY LIFE. ALL YOUNG AMERICANS SHOULD BE EDUCATED TO BE “STEM-CAPABLE,” NO MATTER WHERE THEY LIVE, WHAT EDUCATIONAL PATH THEY PURSUE, OR IN WHICH FIELD THEY CHOOSE TO WORK.**

Implicit in this conclusion is the pressing need to dramatically reduce and eventually eliminate the enormous achievement gaps in high school completion, college preparedness, and completion of STEM degrees between, on the one hand, white and Asian students and children from relatively prosperous families and, on the other hand, black, Hispanic, and Native-American students and children from poorer families.

Just as important, as the commission noted, “excellent mathematics and science learning for all American students will be possible only if we ‘do school differently’ in ways that place math and science more squarely at the center of the educational enterprise.”

Among the models illuminating the way forward are STEM-themed schools built on Early College Designs. These early colleges are a compelling illustration of how school can be done differently—and how high levels of math and science achievement can be realized by a broad spectrum of students.

Now in its ninth year, the *Early College High School Initiative* has grown into a network of 230 schools committed to providing access to advanced learning in high school. The initiative especially advocates for young people likely to experience constricted opportunities and educational underachievement at the secondary and postsecondary levels, based on family income and background, prior educational experiences and achievements, or racial/ethnic identity. Early colleges provide students with opportunities to earn college credit at a partner college at the same time as they meet local and state requirements for high school graduation.

Early colleges are demonstrating encouraging results for students, and they are serving their target populations:<sup>2</sup>

- > Almost all graduates earn some college credits.
- > In 2009, 24 percent of graduates who were enrolled in their early college high school for four years earned an Associate’s degree or two years of college credit; 44 percent earned at least a year of college credit.

- > During the 2009 school year, 70 percent of the students were young women and men of color, and 59 percent were classified as eligible for free or reduced-price lunch. Nearly half will be the first in their family to attend college.

Almost one-third of all early colleges feature a STEM focus, and their record parallels that of early colleges in general.<sup>3</sup> In the 2009 and 2010 school years, 1,474 young people graduated from 33 STEM-themed early colleges:

- > 25 percent earned Associate's degrees.
- > 66 percent of graduates went on to attend four-year colleges.
- > 20 percent went on to attend two-year colleges.
- > 3 percent went on to attend technical colleges or programs.

From 10 STEM-focused early college high schools that reported such data, more than half of the students earned at least two years of college credit.

Each of these schools makes unique choices about curricula, structure, partnerships, and many other design factors, depending on local conditions and opportunities. *Designing STEM Pathways through Early College* is a profile looking at one such school: Metro Early College High School in Columbus, Ohio.



# DOING SCHOOL DIFFERENTLY

**M**etro Early College High School opened in the fall of 2006 with a ninth-grade class, adding a class each year until it served students in grades 9 through 12. Designed as a small school, it has the capacity to enroll 400 students, about 60 more than currently attend.

Metro shares a number of elements with the network of early college high schools across the country:

- > As students demonstrate key skills, knowledge, and dispositions, they can enroll in college-level courses and earn multiple years of college credit for free. Early college high schools compress the years to a postsecondary degree.
- > Students learn in small communities that demand rigorous, high-quality work.
- > Academic and social supports help students succeed in a challenging course of study.
- > The school eliminates the stark transition between high school and college: students begin college work without formally applying to college. They are supported by high school faculty and accompanied by other students from their high school cohort.

Within that Early College Design framework, each school develops a unique learning environment that reflects local context, interests, and needs. For Metro, these design features focus on science and technology. Metro is distinct in its research-and-design-inflected approach. As a result:

- > Interdisciplinary projects called “design challenges” drive the high school-level curriculum. Partnerships with local government and the business, academic, and service communities are highly visible in curriculum choices (content, context, and audiences for student work) and in student opportunities for internships and research.
- > Teachers “backward plan” assessments for their students to reflect the skills, dispositions, and knowledge necessary to meet college general education requirements and succeed in general education courses.
- > Students must demonstrate mastery—defined by the school as equivalent to earning an “A”—in core high school academic content before reaching their “gateway,” or formal transition to college courses. This mastery requirement applies to every core academic class.
- > The time it takes for students to reach mastery in each course is flexible. A student might repeat parts or entire courses. Conversely, students ready for calculus before their gateway can enroll in a college calculus course taught at the high school by a faculty member from The Ohio State University. Most students achieve their gateway at the end of their second year, but some require four years to reach that point. A handful graduate without taking college coursework.

- > Metro encourages agility among faculty and students alike. Teachers and students remain open to modifying schedules and other logistics to allow real-world projects to evolve and to take advantage of learning opportunities that community partners or events might introduce.

Metro students have opportunities to engage in applied science and technology fields through coursework, internships, and research. But the school's STEM focus—science, technology, engineering, and mathematics—extends beyond content knowledge. Metro strives to teach its students to think scientifically, pragmatically, and humanely about a wide variety of real-world problems.<sup>4</sup>

From the early planning stages, Metro leaders were committed to project-based learning. Seeking a way to increase the rigor of that work, they settled on the notion of the “design challenge.” Today, students, faculty, and administrators commonly speak of the design challenges they encounter in their work.<sup>5</sup>

For the students, design challenges are often formalized within courses of study and supported by faculty. For Metro adults, design challenges might involve addressing the budget, travel, schedule, or other logistical issues they must sort out in order for students to gain access to the learning opportunities and supports that the school envisions. Both adults and students in the Metro community share the core value of honing the skills to identify, explore, and prepare and present analyses and recommendations for the design challenges they encounter in life and work, large and small.



# PARTNER RELATIONSHIPS

**M**etro Early College High School is structured as a program administered by the Educational Council, a confederation of the 16 school districts in Franklin County, Ohio. It is also a research and development center for STEM-focused early college teaching and learning, supported by The Ohio State University and by Battelle, a multinational corporation headquartered in Columbus, Ohio.<sup>6</sup>

Those three main partners came together to plan Metro, a process that began a year before the school opened. Another early partner was the PAST (Partnering Anthropology with Science and Technology) Foundation, which uses anthropology as a lens through which to support the development of project-based, interdisciplinary curricula.<sup>7</sup> Community members also participated in planning.

Metro principal Marcy Raymond<sup>8</sup> initiated the planning year while she was a senior program officer at KnowledgeWorks Foundation, where she designed and coordinated technical assistance to large urban high schools converting to small schools in the Ohio High School Transformation Initiative.<sup>9</sup> Raymond was committed to project-based, mastery learning for Metro, as was Dan Hoffman, a superintendent from one of the Educational Council districts and who also directed the Ohio Coalition of Essential Schools. When the rest of the planning team learned about that approach to instruction, they, too, recognized its value. The team also took inspiration from the 10 common principles of the Coalition of Essential Schools, the college access program of the International Baccalaureate, and the Breaking Ranks II strategies for high school effectiveness.<sup>10</sup>

Raymond facilitated the planning process. For curriculum planning, 150 people worked in 27 flexible groups. They defined nine pathways, planning backward from college and industry priorities for student understandings, skills, and dispositions. College needs were also aligned with the ACT test, particularly in the case of planning the English curriculum, which focused largely on college reading and writing and nonfiction texts.

The partners planned—and continue to see—Metro as a research and development institution. Thus, the school simultaneously serves its students and provides a model and direct assistance for local educators who are considering or adopting similar instructional strategies. As a regional learning laboratory, it builds relationships with other schools to spread access to Early College Designs and community-based learning. The partners who support Metro want a small school with a “big footprint.”

## THE OHIO STATE UNIVERSITY

The Ohio State University provides infrastructure support and college access for Metro. Ohio’s flagship public research university, OSU is one of the largest universities in the nation and has a competitive admissions process for undergraduates.

The primary relationship between the university and the high school is through Metro students who take college courses. Students who have met Metro’s requirements for mastery can enroll in OSU courses without any other placement exam. Metro has made

the case, justified by student performance in OSU courses, that mastery of its core high school curriculum meets the prerequisite for success in college-level general education. OSU only confers credit for courses taught by college faculty; Metro faculty teach courses exclusively for high school credit.

OSU deans and faculty in education, math, and the physical sciences participated in the planning process. The relationship between Metro and OSU has continued since then and constantly evolves. For example, feedback from college instructors informs high school program improvement. English and math courses at Metro have been revised to better meet students' needs for college success. Metro English courses reflect the standards and content for the OSU's first-year honors seminar in composition. Revisions of Metro's math program, in particular, were based on meeting the needs of a subset of students who were not doing well in OSU math courses.

Learning centers provide a natural opportunity for collaboration between Metro and OSU faculty. Each learning center is housed by a community partner that hosts Metro students in cohort groups for a bridge year that blends preparation for college and enrollment in college courses. The high school teacher assigned to a learning center coordinates a coherent, yearlong program that includes both high school and college courses and culminates in individual capstone research with an OSU faculty member. Teachers leading the learning centers accompany their students to all their college courses at the learning center. Metro teachers confer with college faculty primarily through email.

There are cases of deeper instructional collaboration. Some learning center courses include co-teaching by college and high school faculty. In a more specific example, an OSU English professor helped evaluate Metro students' digital media projects, completed as part of a high school course, to help create shared criteria and expectations with high school faculty. In addition, some OSU graduate students have been directly involved with Metro since its beginning as resident counselors in the student support center, student mentors, and facilitators of student projects.

## THE EDUCATIONAL COUNCIL

The Educational Council, made up of 16 school districts in Franklin County, Ohio, is the primary funder for Metro, pooling district funds for the program. The Metro program costs about \$11,000 per student, which is close to the state's average per pupil cost (see box on page 9, "Paying for Early College"). Among other budgetary items, the school covers students' college costs (tuition and books), except in the case of repeated college courses, which students must pay for themselves. If students take but do not receive credit for a college course, they must repeat it and earn credit for it before enrolling in other college courses.

Officially, Metro is a program, not a school, and students remain enrolled in home district high schools. As an Educational Council program, Metro employs its staff year-to-year.

## BATTELLE

Battelle provided an initial investment and supplies about one-fifth of Metro's funding. Diana Wolterman, a Battelle staff member, is at the school full time. In addition to supporting some of the school's programs, she is the main contact person for teams of educators and policymakers visiting the school.

Battelle, a multinational company with 22,000 employees in 130 countries and headquarters near the OSU campus, devotes about 80 percent of its charitable funding to STEM-education initiatives. The Ohio STEM Learning Network is among its grantees.<sup>11</sup>

Metro's partnership with Battelle has engendered a focus on systems design (called "design challenges" at Metro), among other research and development principles, as an organizing principle for learning. This approach is consistent with but emerged separately from an emphasis on research and development in the context of education reform. Battelle also facilitates Metro's partnerships with others from the company's vast professional network in the Columbus area. For example, Battelle not only provided philanthropic support to the Mid-Ohio Food Bank but also encouraged the bank to host one of the Metro learning centers.

## PAYING FOR EARLY COLLEGE

No matter how well any high school model functions to prepare all students for continued success, key questions remain about costs, how those costs are paid, and whether the program is sustainable in the absence of continued grant funding. The day-to-day funding for most early colleges comes from a school district, which partners with a local college to offer postsecondary experiences for the students.

For Metro Early College High School, the total cost is about \$11,000 per student. This is close to Ohio's average per-pupil cost. The primary funder, the Educational Council, pools resources from 16 member districts and contributes about \$6,700 per student. Other major fiscal support comes from Battelle and The Ohio State University.

In addition, Metro benefits from contributions to the operating budget: \$1 million in 2009 and 2010, mainly from Battelle. OSU contributes about \$600,000 each year through in-kind services for rent and utilities. The largest such contribution from OSU is use of the nearly 30,000-square-foot school building, which would cost about \$520,000 to rent. The position of college liaison—to advise, schedule, and track achievement for Metro students taking undergraduate courses at OSU—is funded half by OSU and half by Metro.

The planning process received grant support from the Coalition of Essential Schools and the Bill & Melinda Gates Foundation. KnowledgeWorks supported Metro in its second year, when the school officially became an early college high school; it has become less involved as state funding has diminished. Because Metro is classified as a program or educational option rather than a school, it is not eligible for direct funding from the state of Ohio.

Metro pays OSU for each course and student, with the amount depending on the delivery model. Tuition per credit hour is discounted from the amount paid by full-time undergraduates.<sup>12</sup> The base fee Metro pays is \$100 per credit hour per student. Fully enrolled course sections cost less per student—whether they meet at Metro, at a learning center (primarily cohorts of Metro students), or on the OSU campus (primarily OSU students, with individual or small clusters of Metro students)—because there is no instructor fee above base tuition. OSU tuition is part of the \$11,000 per student that it costs to operate Metro.

College textbooks are discounted at the OSU bookstore and funded via a grant. Students take vouchers to the university bookstore and receive new books for use in their college classes. At the end of each term, students return the books to the bookstore, and Metro is charged for the difference between the new book cost and the used book value. Sometimes instructors require an e-book or printed package of materials. In this case, Metro purchases the extra books, and is not reimbursed.

Metro bears the annual cost of about \$90,000 to provide free or reduced-price lunches for students who are eligible, and it is considering ways to do so more economically. Metro does not receive external lunch funding because of its official status as a program, not a school, and home districts do not contribute to a separate lunch system.

# THE STUDENTS

**M**etro draws incoming ninth graders from throughout Franklin County. Thirteen of the districts in the Educational Council have sent students to Metro, with about half coming from Columbus City Schools. Students remain enrolled in their home districts and can still participate in extracurricular activities there. For example, Metro students have chosen to play basketball or continue cheerleading at their home school.

Students enter a lottery to gain admission to Metro. Although the school focuses on STEM disciplines, it welcomes applications from anyone in the county who is looking for a challenge and a close-knit learning community. To enter the lottery, students submit an application that includes an essay, but Metro does not select students based on their academic records or STEM experience. Metro encourages students with average or underperforming records to apply, and the school most actively recruits students from high-poverty communities. The school is also approved to serve autistic students and provides a safe environment for them; up to 10 students with autism attend, most of whom have Asperger Syndrome.

Thus far, two classes have graduated from Metro Early College High School. The 75 young women and men of the Class of 2010 were the first to graduate:

- > They earned a total of more than 3,000 college credit hours (an average of 40 per student).
- > All were accepted to college.
- > Seven out of ten graduates went to OSU, which gained a new pipeline for attracting and enrolling high school graduates prepared to succeed in college.



- > Over one-third of the graduates were the first in their families to attend college.
- > The graduates were offered more than \$4 million in scholarships (an average of \$53,000 per student).
- > Two-thirds of the graduates enrolled in STEM degree programs; all graduated “STEM-ready.”

Ninety-three students graduated in 2011:

- > The graduates earned a total of 3,300 college credit hours (an average of 35 per student), with an overall grade point average of 3.1.
- > All were accepted to college.
- > Half of the graduates chose to attend OSU.
- > The graduates were offered more than \$4.1 million in scholarships (an average of \$44,000 per student).

METRO STUDENT DEMOGRAPHICS
<p>336 students were enrolled in Metro Early College High School for the 2010-11 school year: *</p> <ul style="list-style-type: none"> <li>&gt; 55% White</li> <li>&gt; 26% African American</li> <li>&gt; 9% Multiracial</li> <li>&gt; 5% Asian</li> <li>&gt; 4% Latino</li> <li>&gt; &lt;1% Native American</li> </ul>
<ul style="list-style-type: none"> <li>&gt; 15% have identified special needs</li> <li>&gt; About 30% are eligible for free or reduced-price lunch</li> <li>&gt; About 67% come from urban areas</li> </ul>

*\* For comparison, the county is 69 percent white, 21 percent African-American, 5 percent Latino, and 4 percent Asian-American. Also, 18 percent of the county population is classified as living below the federal poverty level.*

# CORE HIGH SCHOOL ACADEMIC PROGRAM: PREPARING STUDENTS FOR COLLEGE SUCCESS

**T**he Core High School Academic Program, a Bridge Year, and a Final Year are the three major stages of the academic and social program that most Metro students experience in their four years at the school.

Metro students enter as ninth graders and quickly become part of an intimate community of learners, with specific and consistently reinforced expectations about what excellent learning looks like, how schoolwork relates to real-world questions and concerns, and how effective learners engage in school and life.

The first two years at Metro incorporate all of the core high school academics presented at an accelerated pace with deliberate, cross-disciplinary attention to three areas:

- > **Mastery learning:** Students must demonstrate mastery in core high school academic content before their “gateway,” or formal transition to college courses.
- > **Authentic tasks:** The curriculum emphasizes connections to real-world work and concerns.
- > **Habits of mind:** The development of these key habits is central to the Metro approach for challenging students and supporting their work. Students must demonstrate these habits in addition to academic achievement in order to pass through their formal gateway into college courses.

The construction and sequence of core high school academics at Metro provide a foundation for success in college general education courses. Coursework integrates real-world connections through curricular choices and plentiful outside opportunities in the form of service learning, travel, and interdisciplinary projects.

## MASTERY LEARNING

Metro's core high school academic curriculum comprises 18 courses. Each unit within a course includes a series of *foundation assignments* that provides opportunities to build the skills and knowledge necessary for that unit and to receive ongoing feedback from instructors and peers. All foundation assignments (e.g., day-to-day class work, homework) for a unit must be complete and meet expectations before a student can work on the unit's culminating *mastery assessment*.

The *mastery assessment*—a project or an exam—provides an opportunity for each student to synthesize and apply the knowledge and skills gained throughout an entire unit. Mastery assessments are summative unit assessments and therefore demand greater attention from students than foundation assignments. Students receive formal grades for mastery assessments—through rubrics in the case of projects—while their foundation

assignments are marked as complete (perhaps with a check/check-plus quality distinction) or incomplete (and needing to be completed). Course grades result solely from mastery assessments, one for each unit.

## A SAMPLE COURSE SYLLABUS

Available online are a course syllabus and overviews for two units, all from Cory Neugebauer's 2010-11 Integrated World Studies course for second-year students. These documents provide concrete examples of the assessment structure for high school courses, how questions are framed, and how Metro sees STEM as a disposition toward learning, not confined to certain disciplines.

The course syllabus includes: essential questions/understandings; social science goals through the lens of Metro Habits; a description of foundation and mastery assignments; and the protocol for revising work and recovering credit if mastery is not achieved.

The overview sheet for each unit includes unit goals—by content, skill, and essential question or theme—as well as a list of the foundation assignments and that unit's mastery assessment. Posted online are the assignment sheets for "Unit 3: A People's HiSTORY: Social Movements of the 20th Century" and "Unit 4: Our World: The Globalizing 21st Century."

*These resources are available at: <http://www.earlycolleges.org/publications.html#creatingearlycollegehighschools>.*

In every core high school academic course, each student expects to work on each mastery assessment until earning the equivalent of an A. The expectations for academic performance are consistently high for everyone. However, the time necessary to achieve an "A" level of work is flexible. There is an understanding that individual students might need more time and support in some courses. If possible, students revise work and demonstrate mastery within two or three weeks after a course ends. Sometimes they need to complete summer work or retake an entire course.

Students who have demonstrated the knowledge and skills for all 18 core courses reach the gateway to taking college courses and beginning internships. Once course requirements have been fulfilled, each student must defend his or her readiness by presenting evidence to a panel. The gateway presentations involve not only academic growth but also personal growth through the framework of the Metro habits of mind. Students do not need to meet other entry requirements for OSU. The rigor of the Metro gateway is considered equivalent to OSU admissions criteria, including an ACT score of 27. Most students reach this point by the end of their second year at Metro, but some require a third or even fourth year to master the core high school coursework.

Most students graduate from Metro having demonstrated mastery in the core high school academic courses, ready for college-level study toward a Bachelor's degree. Most students also earn one year of college credit by the time they finish Metro—what the school calls "quality credit" toward a four-year degree. Some have earned up to *three* years of college credit.<sup>13</sup> A couple of graduates have even become published authors while at Metro.<sup>14</sup> Students who matriculate at OSU or other public institutions in Ohio enter with advanced standing and their college credits are accepted; this is the case for more than half of Metro's graduates. The transfer of credits must be negotiated with other colleges on a case-by-case basis.

Attention to deep learning and building a foundation for future learning continues throughout a student's years at Metro. Consistent with its emphasis on quality, the school's goal is not to have every student earn the greatest number of college credits but for all students to develop the flexibility, persistence, and depth as learners that will serve them in college and in life.

For a few students, such an approach means mastering high school but not beginning college work in their Metro years. One student who took four years to complete his high school coursework nevertheless spoke highly of his learning and his perceived preparation for college. He was accepted at a four-year university and feels like he better understands both himself as a learner and the resources that can support his learning. If he could return to his first two years at Metro, he says that he would make different choices in order to learn more efficiently.<sup>15</sup>

The mastery requirement becomes more flexible for fourth-year students who are still taking core high school courses. A handful of students in the first class graduated with Bs and Cs in some courses and discreetly earned non-mastery diplomas. The purpose of a mastery-based system is not to cut off college access or endanger graduation for any student but to ensure that all students gain the depth of learning that will prepare them well for college and work.<sup>16</sup>

## AUTHENTIC TASKS, AUTHENTIC AUDIENCES

Peter DeWitt, who teaches biology and coordinates the Bodies learning center, described Metro as “career education for the 21st century,” and the curriculum is rooted in strong connections to real-world jobs and experiences. In their first two years, students regularly present to or write for “authentic” audiences—for example, emailing white papers about pending legislation to state representatives or presenting grant applications to program officers from a local foundation. Students and faculty expect feedback on their efforts from business, government, and research professionals in the Columbus area.

Reflecting the emphasis on design challenges, Metro encourages teachers to create learning tasks that integrate the United Nations Millennium Development Goals.<sup>17</sup> For example, in a second-year world history class, the mastery assessment for the unit called “designing a sustainable world” required students to choose a millennium goal and prepare a formal proposal, write and deliver a three-minute lecture, create a five-minute iMovie, and assemble documentation, including an annotated bibliography.

The impact of this curricular approach is evident in students’ work. Students demonstrate leadership, comfort with the complexity of interdisciplinary projects, and awareness of how business considerations influence effective real-world project design. They are remarkably composed while explaining their work and comfortable both initiating conversations and fielding questions about their thought processes and decision making. All Metro students, not just a select few, have frequent opportunities to be leaders through independent or collaborative projects, service learning, and clubs. As one senior explained, the challenge of Metro is not only in its academics but also in balancing involvement in so many activities. That senior also explained that all students work with peers and external partners—there is no place to hide. Metro students and faculty are accustomed to organizing their work around pressing human questions and needs and local work. They also speak explicitly of the various resources, tools, and perspectives that are necessary components of such interdisciplinary projects.

Another result of completing authentic tasks and project-based learning is that students gain an appreciation for the business or administrative side of work. Students speak of their business strategies whether they are coordinating a local farmers’ market to support school programs or improving the Web interface of a dance-a-thon fundraiser in order to maximize donations for a local hospital. They note how project-based experiences increase their sophistication when approaching new tasks that involve real-world complexities.

While each student can name specific highlights of his or her Metro learning, consistent across all students is how reflectively they describe their cumulative learning from a series of project-based tasks. All students can draw upon a personal portfolio of Metro experiences when discussing their independent learning strategies (several students cited time management as an ongoing goal. They can also draw upon their

approaches to work that rely on collaboration or contributions from others (e.g., coordinating volunteers and vendors at a farmers' market; designing an Internet interface to make charity donations appealing, simple, and secure).

## HABITS OF MIND

Especially during their first two years at Metro, students reflect on and set plans for developing six Metro habits of mind: inquiry; critical thinking; communication; active and responsible decision making; engagement in learning; and collaboration. Within Metro coursework, students must demonstrate discipline-specific evidence for each of the habits. For example, students in second-year world history demonstrate inquiry through attention to "perspective consciousness, warranting conclusions, and relatedness/interdependence." By the time students reach their gateway to taking college courses, they can point to evidence of the habits they have developed and justify their readiness for early college. After the gateway, formal scaffolding to reflect on those habits becomes unnecessary because students have internalized them.

### SUPPORT FOR MASTERY LEARNING AND HABITS OF MIND

An important element of any Early College Design is deliberate attention to academic and social supports for students. Entering ninth graders are not ready for full immersion in college. Therefore, Early College Designs support student acceleration and gradually transfer responsibility to the students for managing their own learning, an important disposition for college and employment. For example, each Metro ninth grader enters knowing that math through pre-calculus is a graduation requirement, and teachers work to support each student's success. At Metro, classroom teachers work together with colleagues to reach each student.

Metro employs two full-time intervention specialists, one full-time tutor, and several part-time tutors to offer targeted assistance to students who need it. Collaborating with these staff members, classroom teachers bear primary responsibility for modifying their instruction to meet the needs of diverse learners. Teachers know their students well and pay attention to what and how they learn. For example, an English teacher might shape the curriculum to tap into students' interests and allow flexibility in how students communicate their understanding of the subject matter.

Each full high school course at Metro spans a 12-week term, but no stigma is associated with taking more time to complete it. The school culture emphasizes the need for quality work and acknowledges that this sometimes requires extra time. Any given course might even include some students who are repeating it, along with the majority who are taking it for the first time.

In regular sessions with a faculty advisor, students use the lens of the Metro habits to reflect on their progress across classes. For 90 minutes each week, students in all grade levels, including the third-year and fourth-year students who spend much of their time outside the school walls, return to Metro to meet in mixed-grade-level advisory groups. Each teacher advises a group of about 20 students. The advisory provides academic and personal support, such as helping each student identify, track, and revise personal goals. The advisory also offers a structure in which students can engage in volunteer work both at the school and outside it.

Older students act as informal mentors to their younger classmates in the advisories. They acknowledge the challenges of the core high school curriculum, but they reinforce by example how the Metro habits, including persistence, allow not only for high school success but for participation in college and real work.

Often, younger students choose to attend the gateway presentations of older classmates and in that way learn firsthand about the process and expectations.

Within advisory groups, students tackle formal design challenges twice each academic year. The challenges are interdisciplinary and assigned by year (first, second, and combined third/fourth). For example, a recent design challenge for third- and fourth-year students centered on Haiti's need for potable water. Student work included collages made from found objects, research on water transport systems (e.g., Roman aqueducts), and poetry. Other recent design challenges have focused on malaria and rollercoaster designs.

## COURSE SEQUENCE FOR CORE HIGH SCHOOL ACADEMICS

The course sequence and scheduling in the first two years provide students with knowledge and experiences they need to succeed in college-level general education courses required for a Bachelor's degree, such as introductory science classes for prospective majors. Mathematics, English, and science dominate the first year at Metro, with social studies and modern languages added in the second year. The skills and dispositions learned in the English courses prepare students for college-level reading and writing across the curriculum and can be applied to any text-heavy course. Similarly, math courses provide foundational knowledge for many college science courses. In the third and fourth years, students complete the fine arts and wellness/physical education requirements for high school in conjunction with taking college courses.

### CHANGING THE ACADEMIC CALENDAR: A DESIGN CHALLENGE FOR METRO

Both Metro and OSU divide the year into trimesters, but their academic calendars never align perfectly, even though students take classes at both places. For example, students might be completing final requirements for a high school course while beginning an OSU course.

After much thought, Metro assistant principal Aimee Kennedy proposed different ways to address the calendar's challenges. The school's governing body, composed of parents and faculty, unanimously chose to introduce two longer terms and one shortened term beginning in 2011-12. The Metro community believes that the new schedule will represent a better use of time, acknowledging that basic differences between the length of academic years in high school and college make perfect alignment between the two schedules essentially impossible.

During the first two years, students take three high school-level academic courses each trimester (see box, "A Typical Course Sequence for the First Two Years at Metro" on page 17). Metro teachers, in partnership with college faculty, carefully "backward planned" the core academic sequence in the first two years from the skills, knowledge, and dispositions needed for success in first-year classes at OSU. Even in its brief history, Metro has revised some courses and course sequences—particularly in math—in response to feedback from OSU instructors.

## A TYPICAL COURSE SEQUENCE FOR THE FIRST TWO YEARS AT METRO

YEAR 1, TERM 1	YEAR 1, TERM 2	YEAR 1, TERM 3
Algebra 2	Trigonometry	Geometry*
College Reading (English 9)	College Writing (English 10)	Literary Analysis* (English 11)
Environmental Science	Introduction to Engineering	Physics*

\* Recovery classes might be necessary instead for students who require more time to master one or more courses. The 18 courses might be finished in as few as two years or as much as four years.

YEAR 2, TERM 1	YEAR 2, TERM 2	YEAR 2, TERM 3
American History	World Studies	Government
Foreign Language	Foreign Language	Foreign Language
Student Choice**	Student Choice**	Student Choice**

\*\* Students choose among such classes as biology, chemistry, English 12, engineering, trigonometry, pre-calculus, and OSU Calculus 151, taught by an OSU instructor at Metro.

## LEARNING OUTSIDE THE SCHOOL WALLS

Metro students have abundant opportunities to learn outside the walls of their school. Most common are local experiences through OSU or government, nonprofit, or business partners. Metro also creates or supports learning opportunities that entail national or international travel. The school cultivates flexibility—a word heard frequently at Metro—to seize teachable moments and be sensitive to the potential of real-world work to supplement and extend student learning.

In their first two years, students engage in service learning through their advisory groups and have opportunities to participate in summer projects and travel for immersion in project-based learning. For example, a summer trip to China has become a school tradition. After taking three terms of Chinese in their second year at Metro, eight students, with a faculty member, took part in a summer immersion program in China. On their return to Ohio, students took a chemistry course in Chinese, earning credit for both chemistry and a fourth term of Chinese. One student who participated in the summer immersion program returned to China after taking chemistry/Chinese 4 at Metro for an additional four-month immersion program. In her fourth year, she conducted senior research for college credit in a dental laboratory and took OSU courses.

Every student has a story about how a personal interest or strength, noticed by a Metro faculty member, led to a project or a new direction for study. For example, one student interested in the arts contributed through an internship to the design of a Dale Chihuly exhibit at Franklin Park Conservatory, a botanical landmark in Columbus that features Chihuly's glass art. Also common are stories of students discovering

new interests through required parts of the Metro curriculum. One student did not think she was interested in agriculture until participating in the third-year Growth strand, which focuses on agriculture and water distribution. She subsequently managed Metro's farmers' market—the proceeds of which support a robotics team—and in spring 2011 she was selected for a summer internship in Mexico City through the World Food Prize.<sup>18</sup> She now hopes to become an agricultural engineer.

These experiences build on students' interests and talents—or help them discover new ones. The relationship between students and Metro faculty is characterized by respect, project-based learning, and an emphasis on mastery.

## KEIMA SMITH, METRO CLASS OF 2011

Despite misgivings about giving up a traditional high school experience, Keima Smith entered Metro at her mother's urging. Indeed, Metro had a very different atmosphere from Keima's middle school. Its small student body mixed students like her from Columbus with others from the suburbs, and a little over half the students were white. Still, Keima, a strong student in all of her subjects, including math and science, liked the idea of needing to really think and work in school.

In Keima's first Metro class, the teacher told the students, "You think you know how to read, but I'm going to teach you." The focus on critical thinking presented Keima with her first real challenge in school, but the feeling of accomplishment of interacting with challenging texts and ideas was immense. She remains proud of a number of her projects for Metro classes, such as a white paper she wrote about financial literacy to inform pending state legislation.

Not every step was smooth. One of Keima's most difficult experiences was in trigonometry. It was the first time she did not earn an A, yet no one else appeared to be struggling. She felt like she didn't belong, like they all understood some secret she couldn't get. She required extra time for the course and completed an independent study in the summer to demonstrate mastery. In retrospect, her greatest lesson that year was that even strong learners like her would sometimes need to ask for help.

After her gateway, Keima was talked into trying the Design learning center—and was glad she did. She didn't know what to expect, but she did know engineering was more interesting to her than medicine (Bodies) or agriculture (Growth). Before taking any engineering course, she found herself leading about 20 classmates preparing for a robotics competition. She helped draw out the strengths of the group members and helped the team win third place in the state!

Keima interned with a senior vice president at the Center of Science and Industry, where her research project involved surveying visitors, by targeted ages, about what they wanted to see and what excited them about science.

After her "amazing opportunities" at a STEM-focused school, Keima is interested in studying psychology at the University of Michigan beginning this fall. She says she hopes to become a high school counselor and launch a foundation for urban youth in her own community.

# THE BRIDGE YEAR: SCAFFOLDING THE TRANSITION TO COLLEGE

Central to Early College Designs is the blending of high school and college. Once Metro students demonstrate mastery in all of their high school core academic courses, they are ready to defend their gateway (formal transition) to college coursework. At Metro, that transition occurs through a full bridge year that blends college, high school, and placements in local businesses, nonprofit organizations, and research laboratories.

## LEARNING CENTERS: THEMATIC STRANDS WITH COMMUNITY PARTNERS

Each Metro student selects one of several thematic strands and joins a cohort and a high school faculty member with whom they will experience their bridge year—for most students, their third year. High school and OSU classes for each cohort meet in a community-based learning center that relates to the thematic strand. Through meeting regularly at a learning center, students gain first-hand knowledge of their host organization’s work. They also gain experience in real-world design challenges through an internship and a capstone research project (see box, “A Typical Course Sequence for the Bridge Year”).

Metro offers a choice of thematic strands for sustained and integrated study during the learning center year, each in coordination with a community partner:

- > **Growth:** Agriculture/water distribution, hosted by Mid-Ohio Food Bank;
- > **Bodies:** Life sciences, hosted by OSU researchers at the Labs in Life at Columbus’s Center of Science and Industry; and
- > **Design:** Materials science/engineering, hosted by Edison Welding Institute and OSU.

A TYPICAL COURSE SEQUENCE FOR THE BRIDGE YEAR, HOUSED AT A LEARNING CENTER		
TERM 1	TERM 2	TERM 3
High school class (LC cohort)	High school class (LC cohort)	
OSU class (LC cohort)	OSU class (LC cohort)	OSU class (LC cohort)
Art (at Metro)	Wellness (at Metro)	P.E. (at OSU facilities)
Internship (individual)		Capstone research (individual)

One exception to the STEM focus of the thematic strands is Mosaic, a regional program administered by the Educational Council. Metro students choose this strand if they wish to focus on the humanities. Mosaic serves high school juniors and seniors from public schools across Franklin County. Students pursue in-depth research, examine international connections in Central Ohio, engage with the local arts community, and make presentations in a variety of forums.

Many students serve as volunteers for their learning center host organizations. For example, a student at the Growth learning center volunteers at the food bank. She says she is learning how the food bank works and what it does for families. She is assigned to the community gardens, but each Metro volunteer at the food bank has a different role.

Faculty from Metro, OSU, and Columbus State Community College, also located in Franklin County, are developing additional bridge-year strands. To identify possible new learning centers, they must consider possible partners, areas for future employment in the region, and how the experience would meet students' needs. Two additional learning centers are slated to launch in 2011-12:

- > **Energy:** Physical sciences/economic theory, to analyze and evaluate the world's energy sources, uses, and policies, hosted by Franklin Park Conservatory; and
- > **Environment:** Environmental Science, Safety, and Health; the first bridge-year strand in partnership with Columbus State Community College. It will integrate with an Associate's degree program that prepares technicians and confers certificates in environmental and occupational health fields.<sup>19</sup>

## STRENGTHENING THE TRANSITION TO COLLEGE WORK: A DESIGN CHALLENGE FOR METRO

Students in Metro's first two graduating classes (2010 and 2011) experienced a much shorter time at a learning center than subsequent classes. For them, the learning center spanned a single 12-week trimester. It included one high school course, one OSU course, and capstone research, all connected by a central theme. After that blended trimester, students enrolled individually in college courses.

Metro faculty noticed that some students in the first two graduating classes struggled in the transition to full college coursework. The reasons included ordinary college challenges, such as the reading load and material the students found boring. Also, many students found it difficult to tap into the resources that a large university offers; at Metro, they had easy access to many opportunities.

School leaders envisioned providing better scaffolding for students in their transition to college work through a yearlong bridge, introduced in the 2010-11 school year. A full year gives more time for exploring a learning center theme in depth, more time for students to be known by the Metro teacher responsible for their learning center, and more time for explicit stages of development as students take on greater responsibility for managing their own work.

Students, eager to dive into full college coursework, were skeptical about a yearlong bridge. And some faculty members had reservations about sustaining one focus area for an entire year. Less than one year into the new approach, however, students spoke of discovering interests and their deeper understanding; faculty spoke highly of the greater personalization and depth that students experienced.

A Metro teacher coordinates each strand and serves as the primary advisor for the students in that year's cohort. That faculty member, along with Metro administrators, is responsible for finding OSU faculty whose courses fit the strand well. Metro faculty have identified a number of OSU courses and faculty for each strand—more than can contribute to a single year's program. They plan to keep the broad learning center

themes but to vary the specific content focus for each strand each year in order to include more OSU faculty and keep the Metro curriculum fresh and open to experimentation.

In addition to teaching high school courses that explore the learning center's theme, the Metro coordinator accompanies the cohort to its college courses at the learning center. In the first trimester, the high school teacher conducts 30-minute discussions after each OSU class to structure study strategies, elicit student questions, and help students take effective advantage of college supports. For example, students might receive guidance about when and how to contact professors by email. To increase student independence gradually, the high school teacher stays with the cohort during each OSU class in the second and third trimesters but does not facilitate formal study sessions.

Because the learning center topics are interdisciplinary, Metro teachers support students in OSU coursework that is both within and outside each teacher's academic expertise. When teachers accompany students to a course outside the discipline they teach, they are learning as well and can authentically model good college dispositions and behavior for students. For example, Neal Blueel, the Metro teacher for the Growth strand, accompanied students taking a course in digital media. He then applied his own new knowledge to his classroom practice in a highly visible way: he introduced student films as a form of assessment in his class.

Students earn grades for learning center courses—both high school and college. In contrast to the requirements for their core high school classes, they can pass these courses with less than an A. The mastery system in Metro students' first two years provides a strong foundation for succeeding in college-level work. One OSU instructor, at Metro to teach a calculus section, pointed out that a noticeable difference between the Metro students and the undergraduates he teaches is that Metro students commonly expect to work hard in order to master material.

Although Metro students take their OSU courses at the learning center during the bridge year, the faculty and course content are the same as for traditional OSU students taking those courses. In fact, non-Metro OSU students sometimes join a learning center section because it fits their schedule better.

## INTERNSHIPS

Every student takes part in an internship, coordinated by Metro faculty member Cory Neugebauer, during one trimester of the learning center year. By meaningfully engaging in one stage of work at their internships (i.e., playing a role in a single department or project of a larger work group), students gain an understanding of the larger systems to which each function contributes.

Each Metro internship must involve real work that represents a real contribution. Students spend six hours per week on their internships, focusing their learning on professionalism, research, and design. This experience provides a foundation for capstone research in the third trimester of the learning center year.<sup>20</sup>

At first, Metro offered 30 internship options based on contacts provided by Metro staff members. When the internship coordinator encouraged students to find their own internship settings, the list quickly grew and now stands at more than 100. Some students find immediate excitement in their internship placement, while others discover that their engagement grows as they learn more.

School faculty challenge potential internship mentors to identify substantive work for students. Conversely, with so many potential placements, Metro can assign a student to a site at a time when the work will represent the best value for the host. Students present their internship work at a science fair-style exhibition.<sup>21</sup>

The internships are diverse. A veterinary office asked interns to define a customer base. One student worked on a prototype of three-dimensional wireless headphones. Student interns worked with a company performing an energy audit at Franklin Park Conservatory. The educational outreach programs at the conservatory asked interns to improve their communication department's email databases. Several students have contributed to research at OSU, including human-twin studies, students' perceptions of themselves as leaders, and seed dispersion in cow pastures.

All Metro students complete internships, including-fourth year students who are still working on core high school courses and have not proceeded to a learning center and college courses. Such students also participate in Metro's health and wellness class, which meets in an OSU facility.

## CAPSTONE RESEARCH

The faculty members who coordinate thematic learning center strands also match students with culminating independent projects, known at Metro as capstone research. A wide variety of opportunities, all of which relate to the learning center theme, allows differentiation by both interests and skills. Metro faculty have identified a sizeable pool of OSU professors willing to engage individual students in independent research. The process is also stimulating for Metro teachers as an opportunity to keep abreast of research in their content areas. Across the learning centers, faculty work together to revise rubrics and models in order to capture the flexibility and ongoing nature of research.

Some students choose their capstone research projects, while others are assigned projects by their faculty advisor. Students join university research teams for capstone research but are supervised by their high school teacher and earn high school credit. In spring 2011, student capstone research in the Growth strand included these projects:

- > Working with a horticulture and crop science researcher and graduate students to extract and perform PCR (polymerase chain reaction, a molecular biology technique to produce many copies of a DNA sequence) on genes from a common fungus known to infect rice plants;
- > Working with food science researchers on the addition of soy to bread products, testing properties of bread that affect its consumption; and
- > Working with horticulture and crop science researchers to characterize how earthworms affect where and how ragweed seed disperses.

## SPREADING GOOD PRACTICE: THE BODIES LEARNING CENTER

Metro is working to spread its innovations and build the capacity of local school districts and educators through learning center partnerships. For two years, Metro has operated the Bodies learning center in collaboration with the Westerville City School District. In both years, Metro faculty member Peter DeWitt partnered with a Westerville teacher to coordinate the program. In 2010-11, another Westerville teacher joined as a third coordinator and teacher in the program, and 24 Metro students and the same number from Westerville City Schools participated.

Through this partnership, Westerville students took college courses and participated in the same transition to college opportunities afforded to Metro students. To be eligible, Westerville students first had to fulfill certain requirements for OSU (specified grades in core high school courses and an ACT score of 27, including writing). Most of the Westerville participants were honors students in their senior year.

The collaboration provided benefits to both partners:

- > **Lower costs per student.** OSU courses with full sections cost less per student.
- > **Deepening shared teaching practices over a yearlong, daily partnership.** Practices include daily instruction and assessment, collaboration with OSU faculty and support for students in university courses, facilitation of capstone research, and modifications to Project Lead the Way courses. Project Lead the Way is a national provider of STEM curricular programs used in middle and high schools.<sup>22</sup>
- > **Spreading complex practices.** After two years of co-teaching, the Westerville teacher has become a Metro employee and the lead Bodies teacher in a partnership with Reynoldsburg High School in another district for 2011-12. The second Westerville teacher will remain with her school and independently administer a Bodies learning center. Peter DeWitt, the original Metro teacher for Bodies, will develop a different program at Metro for the coming year. Growing expertise is a goal of Metro's partnerships with other schools.
- > **Advancing Metro's role in research and development.** The learning center concept can inspire other programmatic innovations in new district settings, even as it evolves. The concept is not a finished product; instead it embodies a disposition toward revision and experimentation in response to learners and community resources.
- > **Providing a model for high schools that want to integrate opportunities for early college and applied learning.** The partnership with Westerville provided a model of what it takes to integrate a program like a Metro learning center into a more traditional high school. Metro is publishing materials for other educators to learn from the collaboration.

For Metro, scaling up is not solely about the number of schools and students reached but about financial feasibility and the depth and quality of the instruction.

Metro plans to forge a different type of partnership through a new learning center strand, Energy. West High School in Columbus is converting into a STEM-focused school, and students there will be encouraged to participate in that learning center. In addition, an existing learning center, Growth, is piloting yet another kind of partnership: within a Columbus neighborhood. Linden, a neighborhood on the east side of Columbus, has adopted growth as its theme across grade levels and content areas. Metro has played a consulting role in Linden's work but without collaboration around a learning center.

# THE FINAL YEAR

**M**etro students have highly personalized experiences after completing the bridge year. They continue to meet twice a week for Advisory, which remains the only constant in the formal program. With the advice and support of a college liaison and their advisors, most students enroll in courses at OSU or Columbus State Community College.

Metro students enroll primarily in general education courses at OSU. Such courses are required for most majors and most readily transfer to other institutions. Commonly chosen courses include calculus, biology for prospective majors, freshman writing, American history, introductory Spanish, study skills, general psychology, introductory sociology, introduction to cultural anthropology, and introductory political science. Smaller numbers of students have chosen chemistry for prospective science majors, introductory physics, and introductory computer science and engineering.

Although individual programs depend on student interests and priorities, Metro emphasizes earning what it considers “key” or “quality” credits toward the completion of a four-year college degree. The belief is that earning initial college credits in challenging courses will help students succeed in the kind of environment that must be navigated to become an engineer, physicist, or professional in other STEM fields.

Fewer than ten Metro seniors each year have chosen to participate in senior research, an opportunity to earn college credit by engaging in independent research with the support of an OSU professor. The most independent and rigorous of the school’s STEM offerings, it would represent a challenge even for advanced college undergraduates. But because the bridge year now provides more time and scaffolding leading up to the capstone research project, faculty believe that more students will choose to include the independent college research option as part of their final Metro year.

Metro students prepare for and present a second gateway (the graduation gateway) toward the close of the final year. Their audience includes the external partners who have welcomed students to become part of their work and otherwise have supported Metro. For the graduation gateway, each student describes the opportunities, supports, and other resources that have defined his or her time at Metro and then presents evidence for the returns of those investments. Evidence might include accomplishments in research, business, government, and academics and their plans for future learning and work.

## SCHOOL LEADERSHIP PRIORITIES

Planning, careful attention to students, and ongoing revisions make Metro the school it is. Its leadership priorities cast light on how the school community works together to tackle design challenges and build toward shared goals and norms:

- > **Teachers** with strong content knowledge and instructional agility and a willingness to try new things pedagogically. School leaders can help teachers stretch, but they cannot teach all content or content-specific pedagogy from the ground up.
- > **Assessments**, varied and appropriate, to drive the curriculum, and the deliberate use of appropriate data for continuous improvement.
- > **A professional culture** (described by both teachers and administrators with a laugh as “grinding” at times) that pushes practice. In 2010-11, the focus for professional development was “design challenges.” The goal of collective learning was not to add work for teachers but to reshape classroom work. This effort was led by principal Marcy Raymond, assistant principal Aimee Kennedy, and Andrea McAllister, a staff developer assigned to Metro through the Educational Service Center of Central Ohio.
- > **Student responsibility** to take advantage of the privileges they have in early college. Metro offers many supports for student success, but a strong and consistent expectation remains for students to persist and put forward their best effort.
- > **Scaling up successful practices** through sustainable funding (for example, looking for ways to make college courses more affordable to Metro) and spread to other sites with attention to quality and depth (through direct and ongoing collaboration with local schools).
- > **Leadership** as an outcome for all teachers. Metro expects teachers to embody roles that are often reserved for administrators, such as facilitating program strands. In addition, faculty learn to embody a mastery- and project-based, personalized high school program. They are prepared to spread Metro practices to new settings, particularly if they work as administrators or teacher leaders.



# SCALING UP SUCCESS

**W**ith its research and development focus, the Metro design is a valuable example as school districts and planning teams make decisions about partnerships, high school curricula and supports, and bridges to STEM degrees and professions. Metro is grounded in the distinctive educational opportunities and circumstances of the Ohio communities it serves and reflects what its community considers to be appropriate goals for its students. Nevertheless, the lessons emerging from Metro might extend to other early colleges as well as to other secondary schools. The principal STEM-specific design challenges the school has addressed include:

- > Meeting diverse students where they are academically when they enter high school, enabling all to master high school work and engage in pressing and complex real-world questions through a STEM lens;
- > Providing most students with access to and successful completion of general education courses taught by university faculty, in STEM and other disciplines;
- > Fostering an adult learning community through professional development and distributed leadership, enabling teachers to respond to the challenges of preparing the underprepared and advancing the well-prepared through mastery and project-based learning;
- > Providing a range of supports for success in all courses, with an emphasis on STEM fields and on skills, dispositions, and understandings that college, business, and community partners have highlighted as vital for future work and success;
- > Implementing effective partnerships with postsecondary institutions and a variety of other supportive institutions; and
- > Designing fieldwork experiences intended to extend classroom learning and strengthen student familiarity with and plans for educational and career options.

Ciera Fluker, a 2011 Metro graduate, Columbus resident, and Gates Millennium Scholar, plans to attend OSU and major in business. In her valedictory speech, she mentioned her month-long trip to China and her internship at Battelle. She also described how the six Metro habits have become true life skills for her, even if she and her classmates sometimes railed against reflecting about them and found them “annoying.” Her parting words reminded those assembled that:

**WHEREVER WE GO IN LIFE, WE WILL STAND OUT AND THRIVE. METRO HAS GIVEN US THE LIFE TOOLS TO BE AS INNOVATIVE AND AS CREATIVE AS WE WANT. WE KNOW HOW TO CREATE PROJECTS OUT OF THIN AIR. WE KNOW HOW TO COLLABORATE WITH OTHERS TO COME UP WITH SOLUTIONS. WE KNOW HOW TO THINK CRITICALLY ABOUT THE WORLD IN A NEW LIGHT AND INQUIRE ABOUT THE WORLD AROUND US. AND THE MOST IMPORTANT THING THAT HAS BEEN INSTILLED IN US IS THAT WE ARE IN CONTROL OF OUR SUCCESS. BY TAKING RESPONSIBILITY OF OUR ACTIONS, WE CAN DO GREAT THINGS.**

Many Metro graduates pursue further study in STEM disciplines. All Metro graduates have gained STEM dispositions and understandings that provide a strong foundation for engaged learning, citizenship, and work.

# ENDNOTES

<sup>1</sup> A list of reports appears in **The Opportunity Equation: Transforming Mathematics and Science Education for Citizenship and the Global Economy**, published by Carnegie Corporation of New York/Institute for Advanced Study.

<sup>2</sup> These data come from Jobs for the Future's 2011 report, **Unconventional Wisdom: A Profile of the Graduates of Early College High School**, by Michael Webb and Lia Mayka. The report examines characteristics of the 2007, 2008, and 2009 early college graduating classes. It focuses on early college schools and programs that have been open for four or more years.

<sup>3</sup> These data come from the **Early College High School Initiative** Student Information System and other data collected by the initiative.

<sup>4</sup> To hear Meagan Jones, a 2010 graduate, speak about how her current study as an OSU history major fits into her STEM-focused experience at Metro Early College High School, go to: <http://www.tedxcolumnbus.com/speakersperformers/meagan-jones>.

<sup>5</sup> Other examples of the impact of research and development in the context of education reform are supports for networks of practice and short cycles of research and design. See research and essays on this topic from the Carnegie Foundation for the Advancement of Teaching at: <http://www.carnegiefoundation.org/improvement-research/approach>. In their words, "Carnegie is developing and promoting a Research and Development (R&D) infrastructure that we call Improvement Research that allows us to cull and synthesize the best of what we know from scholarship and practice, rapidly develop and test prospective improvements, deploy what we learn about what works in schools and classrooms, and add to our knowledge to continuously improve the performance of the system."

<sup>6</sup> For more information about each of the three main partners, see: Educational Council: <https://www.edcouncil.org/programs/metro.php>; The Ohio State University: <http://www.osu.edu/>; and Battelle: <http://www.battelle.org/community/Education/index.aspx>.

<sup>7</sup> For more information about the PAST Foundation, see: <http://www.pastfoundation.org>.

<sup>8</sup> In summer 2011, Raymond moved to the Reynoldsburg, Ohio, schools where she oversees the district's STEM programs and initiatives, including the high school academy and the creation of a STEM middle school for the 2012-13 school year. She is also principal-in-residence with the Ohio STEM Learning Network. Aimee Kennedy became the principal of Metro.

<sup>9</sup> For more information about KnowledgeWorks, see: <http://knowledgeworks.org>.

<sup>10</sup> For more information about the Coalition of Essential Schools, see: <http://www.essentialschools.org>. For more information on the International Baccalaureate, see: <http://www.ibo.org>. For more information on Breaking Ranks II, a project of the National Association of Secondary School Principals, see: <http://www.nassp.org/school-improvement/breaking-ranks-ii-and-high-school-reform>.

<sup>11</sup> For more information on the Ohio STEM Learning Network, see: <http://www.osln.org>.

<sup>12</sup> Ohio residents pay \$9,420 to enroll full time at OSU's Columbus campus. If full-time students enroll in 45 credit hours, the cost is over \$200 per credit hour. Thus, Metro pays less than half that amount if a course section is fully enrolled. See: <http://undergrad.osu.edu/money-matters/tuition-and-fees.html>.

<sup>13</sup> At Metro, high school and college courses and credits are separate from each other, in contrast to the model of dual enrollment programs and the basic Early College Design. OSU does not grant credit for college-level courses taught by high school faculty.

<sup>14</sup> Two students who studied plant pathology with Neal Bluel helped create OSU fact sheets that are in the process of being published. Produced by Ohio State University Extension and other state universities with extension roles, fact sheets are used to inform the public about research and recommended practices. For examples, see: <http://ohioline.osu.edu/hyg-fact/3000>.

<sup>15</sup> Metro has no formal policy barring a fifth year for students to experience the bridge to entering college courses, which usually takes place in the third year. However, students have been eager to graduate with their peers.

<sup>16</sup> For the 2010-11 academic year, two rising fourth-year students chose to leave Metro because graduation in that year would be difficult; instead, they chose to complete credits for their home high schools through Internet courses.

<sup>17</sup> The 2010 United Nations Summit on Millennium Development Goals produced a global action plan to achieve the following eight goals by 2015: an end to poverty and hunger; universal education; gender equality; child health; maternal health; an end to HIV/AIDS and other diseases; environmental sustainability; global partnership.

<sup>18</sup> Each year, more than 100 high school students from across the United States and other countries are selected to participate in the three-day Global Youth Institute hosted by the World Food Prize Foundation. Students and their teacher mentors interact with Nobel and World Food Prize Laureates and discuss pressing food security and agricultural issues with international experts. For more information, see: [http://www.worldfoodprize.org/en/youth\\_programs/global\\_youth\\_institute](http://www.worldfoodprize.org/en/youth_programs/global_youth_institute).

<sup>19</sup> For more information on Columbus State Community College's program in Environmental Science, Safety and Health, see: <http://www2.csc.edu/academics/programs/envr>.

<sup>20</sup> Typically, the internships do not connect to the learning center theme, but this is a possibility in the future.

<sup>21</sup> Early in Metro's history, students presented their internship work at conferences with their mentors, parents, and intern teachers present. That model grew to be impossible, with only one teacher supporting the internship program.

<sup>22</sup> For more information on Project Lead the Way, see: <http://www.pltw.org>.



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