Bob Pearlman

Bob Pearlman has been a key leader of national educational reform efforts in his unique thirty-year career as a teacher, codirector of computer education, teacher union leader and negotiator, foundation president, and director of education and workforce development. Pearlman's experience and expertise includes whole-district reform, new school development, business-education partnerships and coalitions, school-to-career and workforce development, union–school district negotiations, school restructuring and technology, project-based learning, professional development, educational finance, and school-site assessment and accountability. Pearlman is currently a strategy consultant for 21st century school and district development. He served as the director of strategic planning for the New Technology Foundation from 2002 to 2009. Pearlman consults in the United States and in the United Kingdom on 21st century learning, focusing on new school development and districtwide implementation of 21st century skills.

In this chapter, Pearlman takes a walk through innovative school buildings designed for collaborative learning. He reminds us that the familiar box-based design of most current schools was suited for an outdated factory-model agenda. He shows us that form follows function in these innovative buildings as well, but the functions are now engagement, problem solving, and communication.

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Chapter 6

Designing New Learning Environments to Support 21st Century Skills

Bob Pearlman

Visit any number of new school buildings across the United States, and behind the beautiful, new (and sometimes green) facilities, you will still see the same old 700- to 900-square-foot classrooms, superbly designed for a teacher to stand in front of a class of thirty students set in neat rows, listening, taking notes, and doing worksheets. Yes, you might see wiring for computers and interactive whiteboards at the head of the classroom, but other than that, little has changed.

Go across the pond to England, where they are six years into the eighty-billion-dollar Building Schools of the Future (BSF) program to replace or renovate every secondary school in that country, and you will see some significant innovations beginning to emerge. The aspirations of many local education authorities are high: "BSF is being seen as the catalyst for transformation of education in [England]. BSF is not simply a buildings programme, and must not result in 'old wine in new bottles'" (Hertfordshire Grid for Learning, 2009). What you see, however, in the first wave of new builds and renovations, is still mostly the same "old wine"—traditional education. But because the United Kingdom's process is so much deeper, involving so many

more institutions, companies, local education authorities, and student voices, some significant innovations are emerging.

The United States has always had pockets of innovation in schooling, and the first decade of the 21st century is no exception. But it is happening mostly through the work of not-for-profit school development groups. Little innovation has issued from the federal or state governments. Elliot Washor (2003), cofounder of Big Picture Learning, studied these trends and found little innovation in school facilities:

> Three themes emerge from a review of research and literature on school facilities design. First, facilities designs have been shown to have an impact on learning. Second, these designs have been shown to have an impact on students and others who work in the schools. Third, there have been few innovations in school facilities design. (p. 10)

Hasn't anything changed? Are students today different from their parents? Do they come to school with different capabilities and interests for learning than previous generations? Have new technology tools enabled more learner-centered approaches to education (Watson & Riegeluth, 2008)? Has the new flat world significantly expanded the knowledge and skills that students need to be successful workers and citizens?

If these changes are real, then schools are now enabled to move away from teacher-directed whole-group instruction to create learner-centered workplaces for a collaborative culture of students at work. Many new school designs in the United States and the United Kingdom have done this. A review of best practice illuminates these new 21st century learning environments and school facilities to help school designers and developers and education, civic, and business leaders launch the next generation of innovative schools.

The Digital Natives Are Restless

A torrent of publications are illuminating the new behaviors and capabilities of today's students, from Don Tapscott's *Growing Up Digital: The Rise of the Net Generation* (2001), to Marc Prensky's *Digital Natives, Digital Immigrants* (2001), to the more recent work of Frank S. Kelly, Ted McCain, and Ian Jukes, *Teaching the Digital Generation: No More Cookie-Cutter High Schools* (2008).

A key thesis in all of these publications is that students learn best when they are engaged and that students can now do most of the work. Prensky urges moving from "telling/lecturing" to the "'new' pedagogy of kids teaching themselves with the teacher's guidance" (Prensky, 2008).

Is this any surprise? These students are millenials—digital natives, social networkers, keen to work on their own or in collaboration with others. At home they are likely to be equipped with computers, Internet access, iPods, and smartphones. At school, they typically sit at small desks, push a pencil or pen, and do worksheets.

New Skills and Pedagogy for the 21st Century

There is a growing recognition in the United States and other countries that 21st century knowledge and skills not only build upon core content knowledge, but also include information and communication skills, thinking and problem-solving skills, interpersonal and self-directional skills, and the skills to utilize 21st century tools, such as information and communication technologies. The Partnership for 21st Century Skills (2003) has defined and articulated these 21st century skills. (See Ken Kay's foreword on page xiii of this volume.)

New standards in the United States, United Kingdom, and other countries often stress creativity, critical thinking, problem solving, communication, and so on; however, few curricula bring these standards to life as learning outcomes, and few countries assess them either in national or state tests or in classroom practice. Practitioners have made headway at the classroom level, however, by emphasizing projects, authentic assessment with rubrics that are transparent to students, products, presentations, and exhibitions.

We are now more than a decade into the standards and accountability movement in the United States and the United Kingdom, and already the limitations of a standards-based school accountability system that focuses on basic skills in a fast-changing, globalizing world have been revealed. Calls for change are coming from many places.

In the United Kingdom, the Innovation Unit, supported by the Paul Hamlyn Foundation, published *Learning Futures: Next Practice in Learning and Teaching* (2008), which "sets out the reasons why innovation in pedagogy is needed in order to inspire young people":

> There is a new argument taking centre stage. It is no longer the usual debate over standards and structures but instead a discussion about how young people best learn in the 21st century, and how we can make schools (and those who work in them) catalysts for vibrant engagement, not simply achievement. By looking at how young people choose to learn, what motivation and love of learning mean in the context of school, and how we can give more emphasis to student engagement and voice, there is an almost inevitable sharpening of focus upon what goes on in and out of the classroom. This is a focus on new pedagogy, a domain which has not been prominent in recent secondary school initiatives, but forms the locus of a new programme of work. (Paul Hamlyn Foundation and the Innovation Unit, p.3)

Innovators in the United States and abroad have adopted a new pedagogy—project-based learning (PBL), coupled with performance assessment—as the best way to engage and challenge students and provide them with the learning experiences that lead to 21st century knowledge and skills.

Project- and Problem-Based Learning—Keys to 21st Century Learning

How do schools move, as Marc Prensky urges, from "telling/lecturing" to the "'new' pedagogy of kids teaching themselves with the teacher's guidance" (Prensky, 2008)? According to Paul Curtis, chief academic officer for the New Technology Foundation, what is needed is "a new type of instruction that better reflects the goals we want each student to achieve, demonstrate, and document" (Pearlman, 2006).

Since 2001, the New Technology Foundation (NTF), based in Napa, California, has helped fifty-one communities in ten states launch and implement 21st century high schools based on the model and practices of New Technology High School in Napa, California. The New Tech network's experience is that students best work, produce, and construct knowledge through project-based learning (PBL).

The Buck Institute of Education, which shares the same rigorous PBL methodology as NTF, defines standards-focused PBL as "a systematic teaching method that engages students in learning knowledge

and skills through an extended inquiry process structured around complex, authentic questions and carefully designed products and tasks" (Buck Institute of Education, 2003).

Innovators in the United States and abroad have adopted a new pedagogy—project-based learning (PBL), coupled with performance assessment—as the best way to engage and challenge students and provide them with the learning experiences that lead to 21st century knowledge and skills.

Projects at New Tech schools are typically one to three weeks long. New Tech teachers start each unit by introducing students to a realistic, real-world project that both engages their interest and generates a list of information students need to know. Projects are designed to tackle complex problems, requiring critical thinking. Some examples of projects include presenting a plan to Congress on solving the oil crisis, or inventing, under contract from NASA, new sports that astronauts can play on the moon so they can get exercise.

Through projects, New Tech teachers are able to embed all the learner outcomes (content and 21st century skills) and assess against them. Learner outcomes are the same across all subjects and interdisciplinary courses. Projects have associated rubrics for content, collaboration, written communication, oral communication, critical thinking, and so on, and are all posted online for students so they can decide on their own whether to achieve basic, proficient, or advanced work.

Assessment for Learning

Effective assessment for learning provides students with just-in-time information about their own learning and links it to information on the criteria needed to do better. At New Tech schools, students access an online grade portal. Grades on projects and all learner outcomes are updated whenever new assessment information is available. The usual composite course grades are also available per subject, and across courses for the skills of the learner outcomes. Students and their parents can look at their grades anytime, from anywhere.

Self-assessment is a critical element of assessment for learning. Students look at their grades on a daily basis and check the online rubrics for a project's criteria for basic, proficient, and advanced work. By making the assessment criteria transparent and understandable,

students are then able to make their own decisions about what performance target or level they wish to accomplish. Such just-in-time feedback, coupled with the assessment criteria, provides students with the information needed to foster self-directed behaviors.

Self-assessment is a critical element of assessment for learning.

At the end of a project, student teams present to an external audience of community experts and parents. They are assessed on their product and on their communication skills (oral and written). New Tech students also assess their team members on their collaboration skills and get to see how their peers assessed them on their collaboration skills. They also write reflections on what they learned and how the project can be improved.

From Innovative Pedagogy to Innovative School Facilities

Schools must embrace a new pedagogy today that will engage 21st century students and enable them to acquire and master 21st century skills. Once they embrace the necessary changes in pedagogy, they realize the need for change in the physical learning environment. "Instead of starting from the physical, you need to start with the program you know you need to have," says Betty Despenza-Green, former principal of the Chicago Vocational Career Academy. "Then you can see how your existing structure won't let you do that. And then you do the work of making physical changes" (Davidson, 2001).

Elliot Washor (2003) urges school developers to "translate pedagogical designs into facilities" (p. 22). Kenn Fisher, director of learning environments at Rubida Research, links pedagogy and space for the design of new learning environments (Fisher, 2005). Fisher further divides pedagogy into five distinct aspects: delivering, applying, creating, communicating, and decision making, all of which inform the new environments.

Designing 21st century schools and new learning environments starts with defining the outcomes. We must ask, "What knowledge and skills do students need for the 21st century?" But real design needs to go much further and address the following questions as well:

- What pedagogy, curricula, activities, and experiences foster 21st century learning?

- What assessments for learning, both school-based and national, foster student learning of the outcomes, student engagement, and self-direction?
- How can technology support the pedagogy, curricula, and assessments of a 21st century collaborative learning environment?
- What physical learning environments (classroom, school, and real world) foster 21st century student learning?

After defining these outcomes, the key design issues might be illustrated as depicted in Figure 6.1.

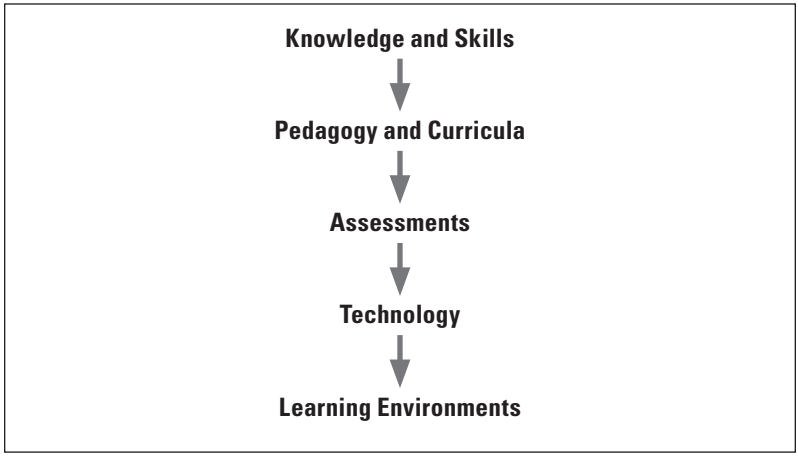

Figure 6.1: Design criteria for 21st century collaborative learning environments.

What Does 21st Century Learning Look Like?

Walk into a classroom in any school in any country today and what you will mainly see is teacher-directed whole-group instruction. Walk into a classroom at a New Technology High School and you will see *students at work* on their own learning—students writing journals online, doing research on the Internet, meeting in groups to plan and make their websites and their digital media presentations, and evaluating their peers for collaboration and presentation skills.

Walk into a classroom in any school in any country today and what you will mainly see is teacher-directed whole-group instruction.

Another teacher's students are also there, in a team-taught interdisciplinary course.

This classroom learning environment looks a lot different. It's double the size with a double group of students, two teachers, and a double-block period for an interdisciplinary course. The classroom is populated by worktables and rolling chairs, not individual student desks. Every student has access to a desktop or a laptop. The tables can be put together as needed for collaborative student project groups, or for teachers-led workshops or seminars constructed around student "need to knows." The classroom, or student workroom, can also serve as a design workshop or even as a space for end-of-project student presentations. The classroom can be set up to accommodate project teams, seminars, or workshops for some of the students while others continue working.

There is also a lot of glass. Glass walls or large glass windows make visible to the students and to visiting adults that this is a school where all students are at work.

Gareth Long (n.d.), a U.K.-based senior consultant on new secondary schools and school learning environments, writes on his work developing new secondary campuses in the Cayman Islands:

> The new learning environments being built are designed to promote total agilty *[sic]* and be capable of continuously reconfiguring themselves. They will allow project based learning rather than discipline based learning and will able teachers to respond to the "blurring" between phases and specific subjects. The ongoing trend towards longer lessons and interdisciplinary coursework reduces the need for student movement and increased effective use of spaces to allow for a variety of teaching and learning styles. They are also being designed for 24/7/360 use.

What Do Students Say?

In the United Kingdom, much work has been done to solicit student input into the design process for new or renovated secondary schools.[1] This student input has been inspired by "The school I'd like" (Birket,

[1] U.K. secondary schools go from year 7 to year 11 and sometimes include years 12 and 13.

2001), a national essay competition by *The Guardian*, for students across the United Kingdom (done in 1967 and 2001), followed by the books of the same name (Blishen, 1969; Burke & Grosvenor, 2003).

In the Knowsley Metropolitan Borough Council near Liverpool in North West England, during April to June 2005, School Works managed a participatory project involving local school communities in the design of eight new learning centers. Student participants identified key ways in which they learn:

- Looking
- Concentrating
- Thinking ahead
- Matching/comparing
- Creativity
- Listening
- Searching
- Negotiating
- Teamwork
- Learning

Knowsley's conclusion from student input and also from teacher and parent input was that pedagogy had to change to enable these learning modes, and that new learning environments and facilities should support these new modes (School Works, 2005).

Kids who have experienced the new pedagogy are even more emphatic in understanding their learning functions and the form that their learning environments need to take. Students from New Technology High School in Napa, California, commented on the design of a classroom of the future as participants with SHW Group architects in the 2009 Open Architecture Challenge (Open Architecture Network, 2008):

> *Colin:* To really be engaged, I need to have an interactive environment where I feel connected to others but can find a place to get away and think, too. I need easy access to all of the tools I might want to use for learning. I need to be able to adjust the space to be more comfortable and to fit the activities we are doing.
>
> *Zaira:* During project-based learning, we move through a variety of activities. We start with forming our teams and analyzing the problem. Then, we determine what we need to know and how to get the information. We have the research

phases, problem-solving phases, and presentation phases. For all of these activities, we need specific tools and need to be able to arrange the space accordingly. In addition, different teams are in different phases at different times, so we need the flexibility to have a variety of options in the same classroom.

"No More Classrooms!": The Language of School Design

"Classrooms are out! No more classrooms! Don't build them," says Roger Schank, founder of the Institute for Learning Sciences at Northwestern University (Fielding, 1999). Schank sees three key student work modes: computer work, talk with others, and making something. These modes, he argues, require three distinct environments for learning: focused work environments, collaborative work environments, and hands-on project work environment.

Innovators no longer speak of classrooms. Instead they have changed the language in order to change the mental model, as urged by Elliot Washor and also Randall Fielding and Prakash Nair of DesignShare and Fielding Nair International. Fielding and Nair are coauthors with Jeffrey Lackney of *The Language of School Design: Design Patterns for 21st Century Schools* (2005), a book that has strongly influenced new design in many countries. Students now work in learning studios, learning plazas, and home bases. They shift as needed into many varied extended learning areas and collaboration zones. These include project-planning rooms, workrooms, and other breakout areas.

Kenn Fisher (2005) translates pedagogy into many learning spaces: the student home base, the collaboration incubator, storage space, specialized and focused labs, project space and wet areas, outdoor learning space, display space, breakout space, the individual pod, group learning space, presentation space, and teacher meeting space. Most innovative schools still feature specialized classrooms for making things, including art, engineering, media, and design labs.

Classrooms, libraries, and labs used to be the only spaces where students spent their school hours. Wireless, laptops, and project learning have changed that. Until a few years ago, laptops were not powerful enough to handle high-level applications. Likewise, wireless was not powerful enough to handle continuous Internet access by even a small

school of four hundred students in a one-to-one environment. Now it is. This has transformed all school spaces into potential extended learning areas, even the corridors and alcoves.

Technology in 21st Century Schools

The signature characteristic of 21st century schools is *students at work*. Pedagogy—a project-based curriculum and companion performance assessment—enables this new shape of schooling. But it is technology and new learning environments that support this new collaborative culture.

The signature characteristic of 21st century schools is *students at work.*

Students utilize new technology tools as investigators and producers of knowledge. The best 21st century schools provide every student with a computer, which increasingly means a laptop in a wireless environment. But personal computing by itself without the new pedagogy and learning environments, even when it is one computer for each student, is no solution at all. It doesn't work. Instead it often reinforces the old teacher-directed whole-group instruction.

Students in 21st century schools first use computers and Internet access to research their projects. They find the information they need through Internet research, but also through email communication and Skype video interviews of experts. Then, working individually or in a collaborative team, they construct products—models, booklets, videos, podcasts, websites, PowerPoints, digital portfolios, and so on. Finally, they utilize technology to present their findings, often to an authentic audience of community experts.

Computers, cameras, and interactive whiteboards all come to life as student tools in a 21st century PBL classroom. Newer Web 2.0 tools—including blogs, wikis, and social networking sites—add greatly to the student toolset for individual and collaborative work. Students utilize all these tools to be investigators and producers of knowledge.

Equipping students with appropriate technology and tools is the beginning, not the end.

However, equipping students with appropriate technology and tools is the beginning, not the end. They also need 24/7 access to their project information, project calendar, assessment rubrics, and their just-in-time assessments. If

they work in collaborative teams, they also need discussion boards, journals, email, and special evaluation tools.

The original New Tech High School in Napa, begun in 1996, built all these special technology tools and implemented them on a Lotus Notes platform. The New Technology Foundation took these tools and professionalized them into the New Tech High Learning System, a learning management system or learning platform specially designed for PBL schools. Since 2008, New Tech has developed that platform into a Web portal called PeBL. PeBL includes the online grade portal. The PeBL learning platform also provides teachers with the tools to design projects, assessments, and calendars and post them online for student access.

The New Learning Environments

New learning environments are needed to support technology-equipped students at work both individually and in collaborative teams, and to provide environments for what Roger Schank calls "focused work, collaborative work, hands-on project work," and for presentation and exhibition (Fielding, 1999).

There has been significant work on these issues by DesignShare and architects Randall Fielding, Prakash Nair, and Bruce Jilk in the United States, and by many parties in the United Kingdom, including the Partnership for Schools (PfS), the British Council on the School Environment (BCSE), the Specialist Trust, the Innovation Unit, and many individual architects and educators.

Five schools in the United States and the United Kingdom exemplify the best of the new learning environments. Each is original in its design and features:

- Columbus Signature Academy, Columbus, Indiana
- New Tech High @ Coppell, Coppell, Texas
- The Metropolitan Regional Career and Technical Center, Providence, Rhode Island
- High Tech High, San Diego, California
- New Line Learning Academy, South Maidstone Federation, Maidstone, Kent, England

Columbus Signature Academy

Columbus, Indiana, a small city forty-six miles south of Indianapolis, boasts the third-greatest assemblage of public and private architecture in the United States, behind New York City and Chicago. Years ago the CEO of Cummins Engine established a fund to support the architecture fees for all buildings built in the city, as long as the commissions went to a list of the ten top architects in the country.

The Bartholomew Consolidated School Corporation (BCSC) has benefited from this funding and the concomitant community spirit. BCSC hired CSO Architects, based in Indianapolis, to work with local educators to develop the new Columbus Signature Academy, launched in 2008 and built in two phases. The academy's program was to be modeled on that of New Tech High School, featuring project-based learning, collaborative teams, authentic assessment, and one-to-one computing. The story of the design process is captured by CSO in three videos available at www.csoinc.net/?q=node/172 (CSO Architects, 2008; for live links and to view graphics from this chapter in full color, visit go.solution-tree.com/21stcenturyskills).

Representatives from CSO visited four sites in California to see the actual implementation of the New Tech curriculum. The original New Tech High School in Napa has two distinct design characteristics that have been emulated in some form by all New Tech schools across the country. The first is the classroom footprint: it is typically double-sized, housing a double group of students in a two-teacher, team-taught interdisciplinary class in a double-block period (see the feature box on page 130 for examples of these interdisciplinary courses). Figure 6.2 (page 130) shows students in a learning studio at Columbus Signature Academy.

The second signature design characteristic is either no walls or glass walls separating classrooms from corridors and breakout spaces. This means that students and adult visitors walking the corridors can see what is going on everywhere. What they see are students at work on their projects. Recent projects have included projects on volcanoes, mitosis videos, electronic games, and motorized toys. This helps establish the collaborative culture of the school. (See figure 6.3, page 131, a 3-D floor plan of Columbus Signature Academy.)

Examples of Team-Taught Interdisiplinary Classes at New Tech High Schools

Global Issues: English and Geography

World Studies: English and World History

American Studies: English and U.S. History

Political Studies: English, U.S. Government, Economics

Scientific Studies: Physics and Algebra 2

BioLit: Biology and Literature

Environmental Studies: Environmental Science and Environmental Issues

Biotechnology Ethics: Biology and Psychology

The CSO team, which included John Rigsbee and Rosemary Rehak, was especially inspired by a dinner meeting with Ted Fujimoto, who as a young business leader in Napa was one of the founders of New Tech High. "We asked Ted what should be done differently," recounted Rigsbee. "His response: 'Fewer barriers. Like a corporate office. Collaborative office space. Teachers as project managers'" (personal communication, June 8, 2009).

Rigsbee continued, "We saw students work as a project team, then break loose and work as individuals. This describes our architect's office, our design studios. That's why we decided not to use the word *classroom* anymore. Instead we now call all these spaces *studios*."

Figure 6.2: A learning studio for an integrated interdisciplinary class at Columbus Signature Academy. Reprinted with permission.

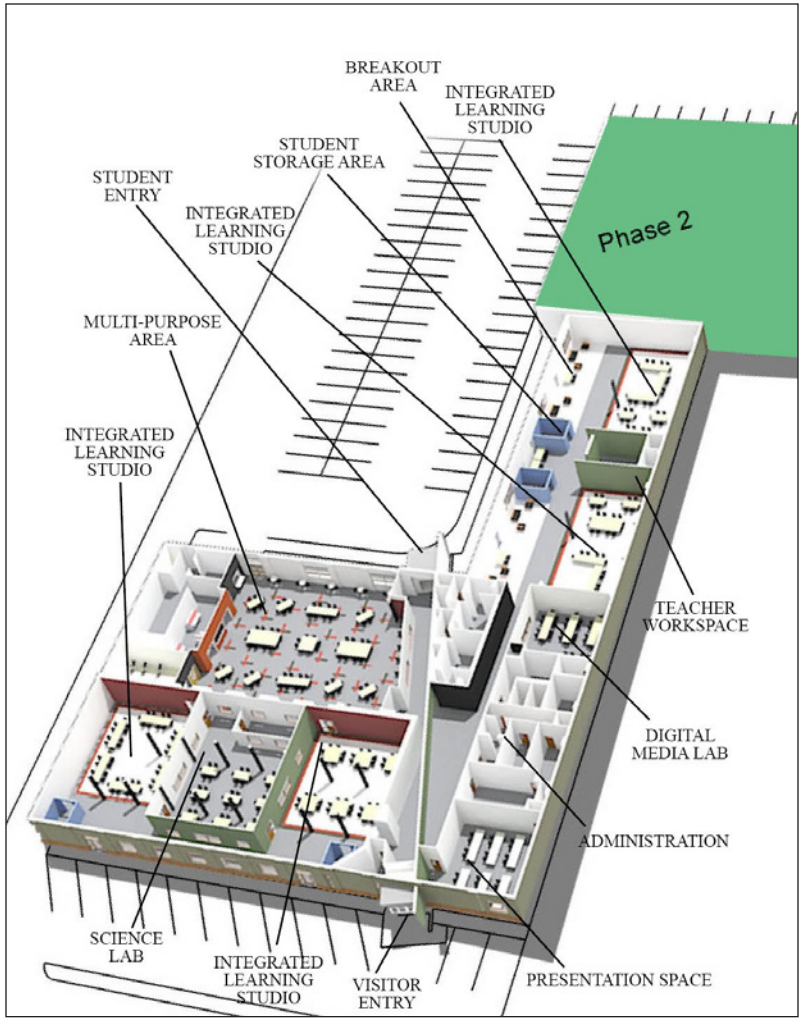

Figure 6.3: A 3-D floor plan of Columbus Signature Academy showing a double-sized integrated learning studio, presentation room, and multipurpose commons area. Drawing by CSO Architects. Reprinted with permission.

On their return, they brainstormed with BCSC personnel to plan the transformation of an auto parts warehouse into a model New Tech High campus. At 44,812 square feet, the academy is designed for four hundred students.

CSO designed these unique learning environments with integrated learning studios, breakout areas, distance learning and presentation

rooms, and project conference rooms for preparing presentations. There are specialty labs for science and graphic media. They also designed a large multipurpose room to serve as a cafeteria and commons area, and to house large-group meetings and presentations, science fairs, and student exhibitions.

CSO wanted as few walls as possible in the new building, so learning studios do not have a fourth wall and instead are open on one end with breakout spaces, which are used for informal individual and small-group work.

Phase two will add more integrated learning studios and more specialty labs, including for engineering. "We know so much more now," says Rigsbee. "Our original plan was that students would go back to regular high schools for art, music, and physical education/fitness. Now students want their own specialty rooms, which we hope to provide in the phase two development."

Furniture is also unique to allow studios to be arranged flexibly for large-group, small-group, or individual work as needed. Studios feature rolling tables and chairs. Tables flip up for post-its and other displays.

New Tech High @ Coppell

At New Tech High @ Coppell, Coppell, Texas, a new small high school launched in 2008, there are no students and no teachers. Instead, *learners* fill the classrooms and project rooms and are supported in their work by *facilitators*. The school has adopted a new language to describe the new roles of both students and teachers. Students are now learners responsible for their own learning; teachers are now facilitators, responsible for designing projects and assessments and guiding and coaching learners and learner teams on their project work.

Learners at New Tech High @ Coppell have a vast array of technology tools and learning spaces in which to do their work. (See figure 6.4, a student project team at work in the open space media library at New Tech High @ Coppell; to view images in full color, visit go.solution-tree.com/21stcenturyskills.) Learners say it is "more professional here" and "we have a big advantage over students at other schools" (personal communication, June 1, 2009). Other learners made the following comments:

Figure 6.4: A student project team at work in the open space media library at New Tech High @ Coppell. Reprinted with permission.

Courtney: We have a big advantage going into the professional world.

Morgan: My brother-in-law does the same stuff at work.

Claire: My Dad really got into giving me ideas on my project on the green revolution and hybrid cars.

Coppell Independent School District worked with SHW Group architects to renovate an old elementary school into the New Tech High @ Coppell. The following text describes these renovations:

> In order to maximize the potential of the learners in the project-based model, the design had to accommodate a radical shift from the classroom layout in the existing elementary school, while recognizing a very modest budget. By strategically removing walls in some locations and opening up others with glass, the spaces transformed from stand-and-deliver classrooms, to energized multi-use spaces for collaboration and teaming that allowed the learners to engage in a variety of activities using wireless internet and moveable furniture.
>
> To build on the educational initiatives of collaboration and transparency in the learning process, certain rooms open out to hallways and, in some cases, glass was inserted into existing walls so that visitors, learners, and facilitators can see the processes at work. Visitors to New Tech High @

> Coppell might feel more like they are in an art gallery or a high-end book store or café than a typical classroom building.[2]

SHW Group developed spaces throughout the building to provide settings for individual, small-group, and large-group interations. SHW called these settings small-group collaboration zones, project rooms, facilitator collaboration zones, single subject-matter learning environments, dual subject-matter learning environments, a digital media library, and large multigroup collaboration zones. (See figure 6.5, distinct activity zones at New Tech High @ Coppell.)

The designers took advantage of the planned robust wireless environment (both inside and outside) and the plan to issue every student a laptop for school and home use and made every space in the building external to the "classrooms" an extended learning area:

- Corridors—Learners and learner teams sit in the corridors to do their work.
- Alcoves—Student work groups use these little corner areas with soft furniture.
- Project planning rooms—Project teams plan their work and presentations in these small conference rooms with whiteboards. Learners call these spaces *workrooms*. New Tech High @ Coppell was the first New Tech High in the country to have small project planning rooms. Phase two of the construction added additional and bigger project planning rooms.
- Media library—Learners and learner teams do their work in this large area of open space with lots of comfortable furniture and some high-end equipment. (See figure 6.6, page 136, a picture of the digital media library at New Tech High @ Coppell.)

The single or dual subject-matter learning environments, which are characteristic of the New Tech model, provide spaces for large group, small group, or individual work, and can be repurposed for any working modality, or "interaction type," using flexible tables and

[2] From SHW Group's project narrative submission to the Council of Educational Facility Planners International for the 2009 James D. MacConnell Award.

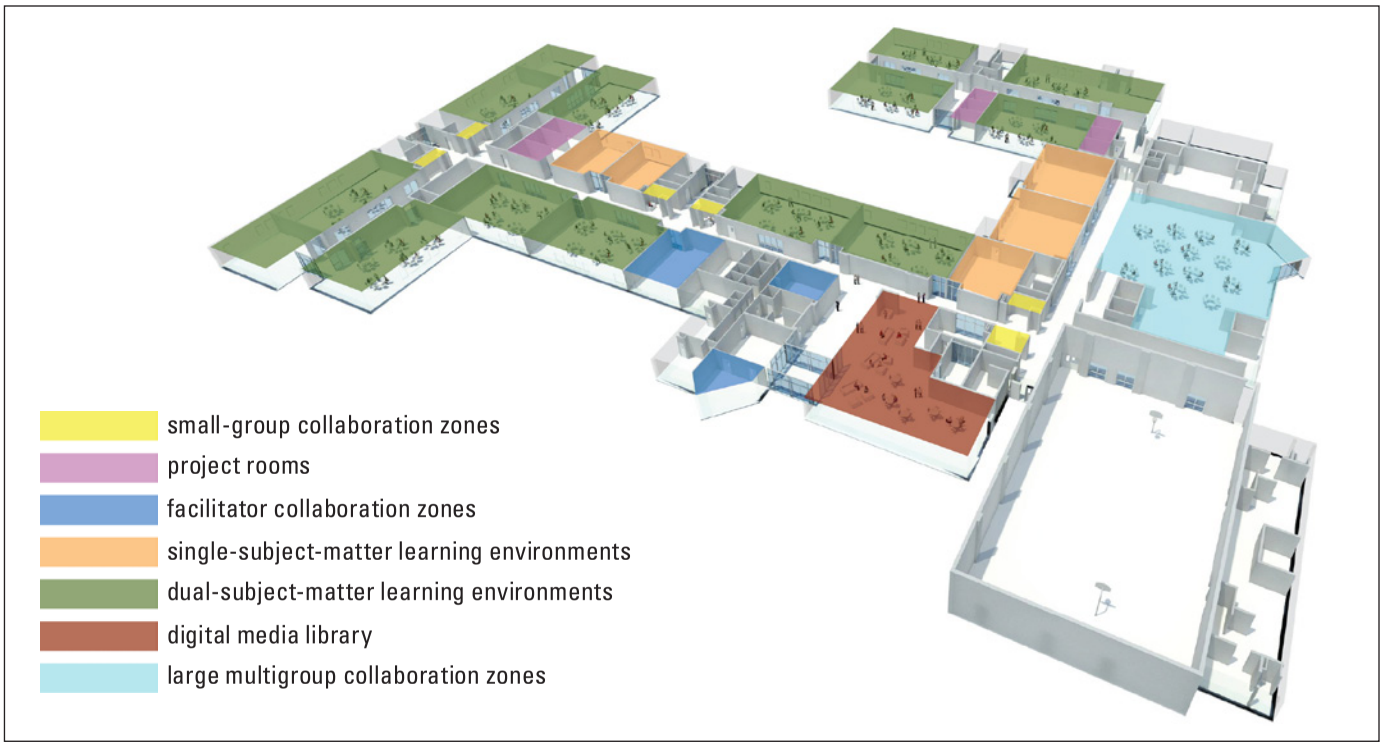

Figure 6.5: Floor plan showing the distinct activity zones in the renovation of New Tech High @ Coppell. Drawing by SHW Group, Plano, Texas. Reprinted with permission.

Figure 6.6: Student collaborative project teams working in the digital media library at New Tech High @ Coppell. Reprinted with permission.

chairs. Because New Tech High @ Coppell is fully wireless, with 100 percent laptop and battery bays in every room, the rooms have few dangling power cords or other obstructions.

The Metropolitan Regional Career and Technical Center

The Metropolitan Regional Career and Technical Center (The Met) was founded in 1996 in Providence, Rhode Island, by Dennis Littky and Elliot Washor. The initial school site for one hundred students was housed in a downtown building. A second small Met of one hundred students opened in 1999 in a remarkable facility that includes classroom workrooms, project rooms, advisory rooms, and a large common room. Four additional small schools opened in 2002 on a common campus using a similar facility design for each small school.

Each one-hundred-student site (small school) at the Met has eight teachers in four learning groups and eight advisory groups. The small size is aimed at personalizing student learning. A key slogan and practice at the Met is "One kid at a time." Students are organized into advisories of fifteen individuals at the same grade level, led by an advisor who stays with them through their four years.

At the Met, the curriculum is Learning Through Interests/Internships (LTIs). Students work with expert mentors in the real world, two days a week, in internships that are based on the students' interests, and come to school the other days to reflect on what they are learning on the job and work on their projects. Students work with their parents, teacher/advisor, and workplace mentor to develop their

own personal learning plan. Popular LTI sites include the Audubon Society, New England Aquarium, hospitals, theater companies, law firms, architecture firms, multimedia companies, and more. To the Met, LTI sites are part of their facilities. The school site is designed to support students working on their LTIs.

Classrooms/workrooms have state-of-the-art computers, peripherals, and presentation technologies for students to do their work and exhibit it. Workrooms also have tools for making scale models, structures, and products for exhibition. Students do projects related to their LTIs. One student worked on a team to develop a 2,400-square-foot museum exhibit, another developed a brochure for new mothers in the neonatal unit at a hospital, and another student did a video project that documented the work of the radiology department at a local hospital.

There are now more than sixty Met schools across the United States and many more internationally. Big Picture cofounder Elliot Washor has been the conceptual architect of the Met design. He identified key elements and functions of the school building: "We needed spaces for individual work, one-on-one, small group, advisory, large space, to make stuff, and to display student work," Washor recalled (personal communication, June 8, 2009). The second Met building was then designed to include a commons, advisory rooms, project rooms shared by two advisories, conference rooms, meeting rooms, and wet lab space for art and science.

At the Public Street Met Campus, four distinct Met schools, each in their own distinct two-story building, share facilities (theater performance center and fitness center) across a campus. In the separate two-story buildings, the commons resides on the first floor and doubles as a cafeteria and an informal workspace. The advisory rooms are larger, now incorporating much of what the separate project rooms served in the past (see figure 6.7, a Met advisory room, on page 138). In addition, the second-story commons serves as an informal and purposeful workspace. (See figure 6.8, a floor plan of the Public Street Met buildings, on page 139.)

Learning environments are characterized by demountable walls, advisory rooms, project rooms, commons, meeting rooms, and more storage space for student projects. These spaces are intended to provide

a variety of options for students: quiet space, meeting space, commons space, and advisory space.

Furniture also supports individual and group work. Soft, cushioned seats are dispersed throughout. Chairs move up and down, conform to the contours of the body, and feature sled bottoms or gliders.

Future Met schools, says Washor, will likely include garage-door openings to workrooms and rooms for artists in residence in blacksmithing, metallurgy, pottery making, and other arts, crafts, and specialized technologies. Currently, Met schools find comfortable settings for these activities in the community.

Figure 6.7: Advisory room at the Met doubles as project room for Met students. Reprinted with permission.

High Tech High

High Tech High, San Diego, California, is a public charter high school launched in 2000 with a diverse student population of four hundred students that mirrors the San Diego Unified School District. High Tech High brings to life its design principles of personalization, intellectual mission, adult world immersion, and performance-based student work and assessment through its size and school organization, facilities, program, and technology.

High Tech High is now nine schools in the San Diego region, six in a family of schools (elementary, middle, and high school) in San

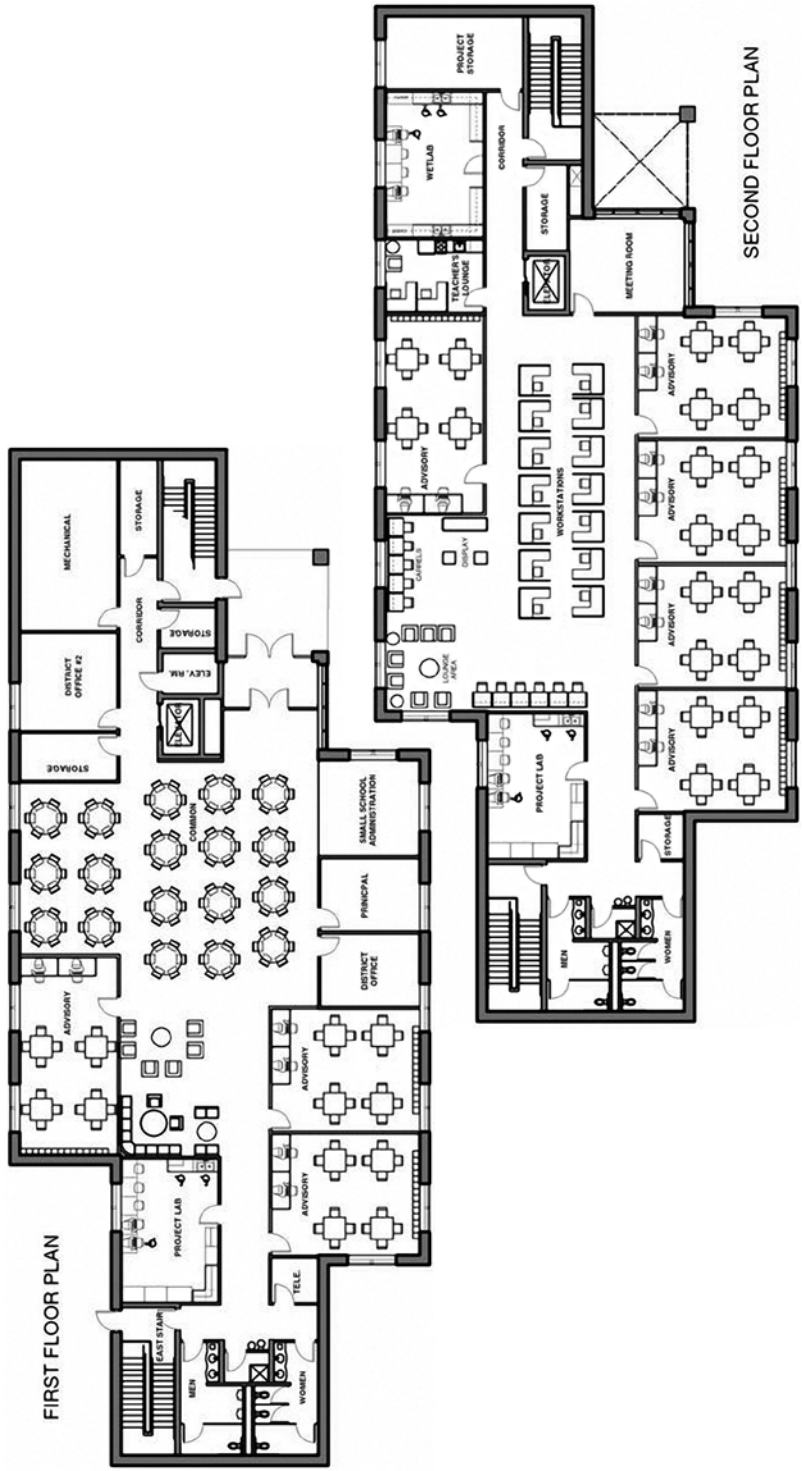

Figure 6.8: Floor plan of each of the Public Street Met buildings showing advisory rooms, project labs, and commons areas. Reprinted with permission.

Diego, a high school and middle school in North County, California, and a new high school in Chula Vista, California.

David Stephen, the conceptual architect for High Tech High, San Diego, working with the Stickler Group and Carrier Johnson, notes that "the original design sought to provide students with personal and small-group workspaces, use of technology, and a high-performance workspace. Key functions were inquiry-based learning, content delivery plus independent investigation, and building and fabricating things" (personal communication, June 8, 2009).

High Tech High originally featured seminar rooms, labs, project studios, small and large conference rooms, a commons area, and a great room. The great room had workstations and collaborative spaces for students. Stephen notes that "we moved away from the great room concept very quickly" because:

> We needed the student workstations and workspaces to be much nearer the classrooms. Now our basic model is a set of four to six classrooms with glass walls clustered around a centralized studio work area for multipurpose activities, including presentations, student project work, fabrications, and so on. (personal communication, June 8, 2009)

In the middle school, says Stephen, classrooms are clustered in a neighborhood concept (see figure 6.9, a cluster area studio surrounded by four flexible classrooms at High Tech Middle).

Figure 6.9: Cluster area studio surrounded by four flexible classrooms at High Tech Middle, San Diego, California. Photo by Bill Robinson. Reprinted with permission.

Wireless technologies and laptops have made a difference. In the new High Tech High in Chula Vista, four classrooms are clustered around a common studio work area (see the video of the new Chula Vista campus at www.hightechhigh.org/dc/index.php). Each classroom is separated by a removable wall to another classroom to enable team teaching by two teachers. (See figure 6.10, a floor plan of High Tech Middle, which is now common in High Tech High buildings as well.) Each classroom has thirteen laptops for student use, and students can bring their own laptops to school.

Room Key

Humanities	H	Office	O
Math/Science	M/S	Reception	R
Teacher's Office	T	Work Room	W
Exploratory	E	Rest Room	RR
Conference	C		

Figure 6.10: Floor plan showing clusters of four integrated classes surrounding a studio area at High Tech Middle. Drawing by David Stephen. Reprinted with permission.

"It's all about ownership," says Stephen. "Kids and teachers need a sense of place . . . where everyone knows one another." The commons provides a place for whole-school gatherings, student presentations, and an informal student work area.

Project studios have also evolved over the years. Originally these were separate from the seminar rooms; now every classroom includes the functionality of a project room. Specialized labs, what High Tech High calls "exploratories," include biotechnology, engineering or "fabrication," art, music, multimedia, and digital arts. "Furniture is really key," says Stephen. "It helps to turn atriums, corridors, and alcoves into work areas for individual students and for project teams."

New Line Learning Academy

One of the most interesting new learning environments comes from school innovator Chris Gerry, executive principal of the South Maidstone Federation in Maidstone, Kent, England. The county of Kent, which lies east of London and runs all the way to the English Channel, is the largest local authority in the country, with over six hundred schools. Gerry was formerly principal at Hugh Christie Technology College, where he first grouped ninety students engaged in project-based learning in a large open space, which he now calls a learning plaza.

Gerry is opening new buildings for New Line Learning (NLL) Academy and Cornwallis Academy in 2010 and refining his ideas in a pilot site developed by architect Philip Gillard of Gensler, a global architecture, design, planning, and consulting firm. The heart of the design is a learning plaza large enough to house ninety or 120 students. (See the animated plaza video at www.newlinelearning.com/new-builds/view/146/New-build-at-NLL-Academy or visit go.solution-tree.com/21stcenturyskills for direct links and full-color graphics.) Modular and mobile lecture-style seating is used to accommodate larger groups and divide plaza space. Each academy will house eight learning plazas. (See figure 6.11, the learning plaza prototype at New Line Learning Academy.) According to Gensler (2009):

> The "Plaza" concept was devised with the Academy to provide a higher degree of collaboration between teachers and pupils through an IT rich, flexible environment that promotes and enables a variety of static and fluid learning settings to occur simultaneously within the physical fabric—from individual personalised learning, to group based activities and a whole plaza scenario of 120 pupils—whilst providing a safe and secure home base. [The concept utilizes] technology such as 360° projection and large display areas, biometric lighting techniques to control and vary the ambience of individual spaces, and flexible and adaptable furniture to allow a variety of work mode settings orientated around sizes of user groups and activities being undertaken.

Figure 6.11: The learning plaza prototype at New Line Learning Academy shows the plaza divided in multiple ways for large-group, small-group, and individual learning. Reprinted with permission.

Gensler adopted a new language, adapted from Nair, Fielding, and Lackney (2005), to describe the different activity modes that take place in each environment and the degree of collaboration involved:

- Multiple intelligence—Allows for different work modes
- Studio—Allows for a mix of different work modes
- Campfire—Allows for class work
- Watering hole—Allows for small-group work
- Cave—Allows for self-study

Due to the pervasive technology and the flexible furniture, the plaza can be set up in many different configurations to aid the learning process. Furniture includes modular tables and mobile lecture-style

amphitheater seating to accommodate larger groups and divide plaza space. The learning plaza incorporates a ground floor, a mezzanine, and an outdoor area. The plaza ground floor provides spaces for project-based learning, group work, lectures, and has breakout areas and a vestibule. The plaza mezzanine provides spaces for independent learning, small-group work, a balcony for spectators of project-based learning, and an outdoor classroom. In addition to the learning plaza, there are specialist plazas that contain specialty equipment for art, technology, and science.

New Learning Environments for Students at Work

What do all have these new learning environments have in common? There is much in common among the physical designs discussed here. All these schools do PBL, though the practice is different in all. Each design seeks to provide spaces for individual work, small-group work, large-group work, lectures, presentations, breakouts, and whole-school or cluster meetings. Table 6.1 summarizes the main features of each school.

Linking Pedagogy and Space

Most new school building construction in the United States and the United Kingdom today is still pouring "old wine into new bottles," replicating the 30-student, 900-square-foot classrooms that both support and often dictate teacher-directed whole-group instruction. These environments will not support student learning of 21st century skills and will be seen in the coming years as outmoded learning spaces requiring a building retrofit.

As school planners look to implement 21st century skills, they will increasingly link pedagogy and space and look to exemplars like Columbus Signature Academy, New Tech High @ Coppell, the Met, High Tech High, and New Line Learning Academy. These designs will be widely emulated and the experience of students, or learners, in these environments will inform the next generation of 21st century learning environment design.

Table 6.1: New Learning Environments in U.S. and U.K. Innovative Schools

	Columbus Signature Academy	New Tech High @ Coppell	The Met	High Tech High	New Line Learning Academy
Primary Student Work Area	Learning studio	Dual subject-matter learning environment	Advisory/project room	Clustered classroom/ common studio	Learning plaza
Presentation Space	Presentation room	Large multigroup collaboration zones	Commons	Commons	Learning plaza
Large-Group Space	Multipurpose room	Large multigroup collaboration zones	Commons	Commons	Learning plaza
Extended Learning Spaces	Breakout area and project conference room	Corridor alcoves, project planning rooms, media library, and outdoor benches	Conference rooms, meeting rooms, and commons	Small and large conference rooms, common studios, and commons	Learning plaza, watering holes, and caves
Specialty Labs	Graphic, media, and science labs	Science	Fabrication	Biotech, engineering, art, music, multimedia, and digital arts	Art, technology, and science
Furniture	Rolling tables and chairs, and flip-up tables	Mix-and-match tables, office chairs, lounge chairs, and sofas in extended learning spaces	Cushioned seats, contour chairs, and flexible tables	Benches in extended learning spaces	Modular tables and mobile lecture-style amphitheater seating

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