

# **P-TECH 9-14 SCHOOL MODEL DEVELOPMENT: SKILLS MAPPING PROCESS GUIDE**

## **INTRODUCTION**

National data indicates that there are 28 million middle skill jobs – those requiring postsecondary degrees – currently available in the U.S., with these jobs paying close to \$40,000 per year on average. Data also shows that over the next 10 years, 14 million new jobs requiring middle skills – a 50% increase – will be created, with those needing STEM skills the highest paid of those jobs. In New York City alone, there were 300,000 vacant jobs in January 2013, most requiring middle skills.

To be hired for these jobs, students must be “career-ready.” Students are considered career-ready when they have the technical and workplace skills necessary to fill high-wage, in-demand, entry-level jobs with real career potential.

While there are many steps that are required to prepare young people to garner these skilled jobs, the design process for the P-TECH model for 9-14 schools begins with a critical and innovative approach to ensure that the curriculum and scope and sequence will meet the promise of “career-ready” for participating students. This approach is called Skills Mapping. Skills Mapping is the mechanism that links in-demand jobs with a highly-skilled workforce. Skills Mapping offers a perspective and foundational requirements to develop an integrated six-year educational program to address academic, technical and workplace skills by mapping backwards from real 21<sup>st</sup> century careers. Because this process is directly informed by actual job requirements, it is the lynchpin for connecting the best employment opportunities to a series of rigorous classroom learning objectives.

Skills Mapping is a process that begins with industry partners but ultimately involves the collaborative efforts of both high school and college leadership and faculty. The process will likely challenge some of the existing offerings, sequences and prerequisites. The result will be a comprehensive program that underscores the best opportunities for students to master the full range of skills they will require, whether it is in a high school or college classroom, or at the workplace.

The process consists of three parts. In part one, the industry partner defines the skills required for jobs in the school’s field of focus. In part two, high school and college leadership and faculty work with the industry partner to determine the postsecondary degrees, and the specific sequence of secondary and postsecondary coursework that will provide students with the necessary skills.

In part III, the process is revisited. Because technology changes so rapidly, so do the jobs and the requisite skills. As a result, to ensure that students graduate with the most up-to-date, in demand skills, industry and education partners should, on an annual basis, review their Skills Mapping work and ensure that it continues to serve industry and education requirements.

This guide is designed to enable industry and education partners to conduct a successful Skills Mapping process.

**PART I: SKILLS DOCUMENTATION**

The first step in the Skills Mapping process is documenting the skills required for high-wage, in-demand entry-level jobs, with real career potential, in the school’s academic focus area – whether that is IT, healthcare, advanced manufacturing or finance.

While the process is a straightforward one, it does requires industry partners to have a thorough understanding of their current and future skill needs and how those skills fit into an overall human resources/career matrix, as well as an organized, comprehensive and clear manner for identifying and describing these skills.

To clearly identify and document skills, companies need to follow four basic steps:

| Skills Documentation Process  |   |   |   |
|---|---|---|---|
| 1. Identify entry level jobs requiring an AAS or equivalent industry approved post-secondary degree | 2. Summarize the tasks that are required to perform selected entry level jobs | 3. Define the broad expertise associated with each task | 4. Identify the specific skills associated with the expertise |

**STEP 1: Identify entry-level jobs that require an associate's degree in applied science or relevant industry approved post-secondary degree that enables graduates to earn a job in the relevant field of study**

Industry partners should identify entry level jobs that require the application of significant, rigorous technical skills in the school’s focus area – whether IT, healthcare, advanced manufacturing, etc. Industry partners should identify appropriate entry-level jobs based on skill level, required years of experience and/or existing career ladders or job hierarchies that exist within their organizations.

This step may not be as easy as initially perceived. In determining entry-level positions, industry partners may need to re-evaluate the education level associated with some positions in their job descriptions. Industry partners should ensure that the education level is reflective of the skills necessary to perform this job. Because of the skills deficiencies that an industry may be experiencing,

specific businesses may be finding that they are hiring overqualified graduates – those with Bachelor of Science degrees or even higher, rather than those with two-year post-secondary degree who could fill positions successfully. Employers also have voiced concern that a given AAS degree does not have the rigor to prepare students with the necessary skills. Remember, industry involvement in this model is designed to ensure that students graduate with in-demand skills necessary to be career-ready. Hiring overqualified graduates means that industry may be compensating these positions at a higher rate than necessary, or that these workers will leave if they find a more appropriate position. It also means that high-potential, two-year degree candidates will be left out of consideration for jobs that they could perform brilliantly.

Once the industry partner has identified all entry-level jobs, it is important to identify jobs that are part of a career ladder within your organization. The goal is to ensure graduates not simply get a “job” upon graduation – but that they earn a position that will lead to an increasingly challenging and rewarding *career*. In the 21<sup>st</sup> century workplace, many employees do not follow a linear career path; they may use transferable skills to move from department to department. No matter the structure at your industry, the purpose of this step is to ensure that the skills students use and grow in this role will be applicable in promotional job roles at your company.

**Example from IBM's Skills Mapping Process: Identification of entry level jobs**

When IBM set out to document the skills needed by graduates of the first grades 9-14 school in Brooklyn, New York – Pathways in Technology Early College High School (P-TECH), the goal was to find those entry level jobs that could be successfully accomplished by an employee who had earned an Associate in Applied Science degree. With a workforce of 450,000+ employees, this opened a host of potential IT jobs at the company. IBM has an organized and comprehensive Human Resources Department and was able to take advantage of an internal US Jobs Library that enabled a search based on education level and degree requirements. To ensure that its skill documentation process was thorough, IBM did not rely solely on education requirements, but examined both AAS and BS positions and identified those that required entry-level knowledge and application of rigorous technical skills.

Below is an example of two such positions, both of which require an AAS degree and have significant career capabilities and opportunities.

| Step 1: Identify entry level jobs requiring an AAS degree   |
|---|
| <p><b>Example 1: Technical Support Representative</b></p> <ul style="list-style-type: none"><li>• <b>Career Capabilities:</b> Technical Support Representatives are Software Development and Support professionals and the recommended career pathway is within Developing and Supporting Products. Software Development and Support professionals design, develop, test and provide technical support on</li></ul> |

a wide range of IBM product software for large, medium, and small businesses including operating systems, networks, middleware, security, and IBM software solutions.

- **Career Pathways and Opportunities:** Based on the development of expertise and skills and demonstrated readiness, Software Development and Support professionals (Technical Support Representatives) can move from entry-level to foundation, experienced, expert and thought leader levels within the Development and Supporting Products pathway, found across various groups within IBM.

**Example 2: Software Specialist**

- **Career Capabilities:** Software Specialists are Product Services professionals and the recommended career pathway is in Supporting IT Solutions. Product Services professionals deliver a comprehensive set of services ranging from remote technical support to on-site management and maintenance of full multiplatform hardware and software environments.
- **Career Pathways and Opportunities:** Based on the development of expertise and skills and demonstrated readiness, Product Services Professionals (software specialists) can move from entry-level to foundation, experienced, expert and thought leader levels within this Supporting IT Solutions pathway, most likely within the Global Technology Services group within IBM.

**STEP 2: Summarize tasks that are required to perform selected entry level jobs**

After determining the appropriate entry-level job roles, the next step is to define the tasks associated with those jobs. “Tasks” are defined as all of the processes that an employee would need to perform in order to be successful at a given job. For example, a task required of a software specialist would be to “use relevant problem management systems to search for known problems and to create new entries/update existing entries.” Within each task are embedded expertise and skills, but it is important to first look at the tasks as a whole to understand the full scope of expertise that will be required to perform successfully. The objective is then to work backwards to determine the skills and expertise an applicant would need to perform the tasks. This enables employers to evaluate the full scope of *what* will need to be done rather than *who* will need to do it. This step in the process allows for a more accurate picture of the functions associated with the job role.

Every company will have organization-specific jargon that only that company will comprehend. For the purposes of eventually

mapping skills and expertise to a non-company-specific college curriculum, it is important to remove all jargon from the task determination. Note that the tasks below do not mention IBM-specific terms (e.g., software like WebSphere) so that it is more feasible to link skills to curriculum.

**Example from IBM's Skills Mapping Process: Task descriptions associated with a Technical Support Representative and a Software Specialist, both entry-level jobs at IBM**

| Step 1: Identify entry-level <u>job roles</u> requiring an AAS degree | Step 2: Summarize <u>tasks</u> that are required to perform entry level jobs   |
|---|--|
| Example 1: Technical Support Representative                           | This role provides remote technical support assistance to clients and technical personnel on multiple products in the high volume through high availability product environments. Technical Support Representatives receive and record incident related information, and using a variety of tools, techniques and procedures, select appropriate actions to resolve problems and communicate the solution or action plan to the client or service representative. They identify/recommend updates to knowledge-based systems and maintenance packages. They may also provide hardware or software technical support assistance to clients and personnel in multi-vendor, multi-protocol networks/systems in the high availability product environment. They use professional knowledge and problem determination/problem source identification skills to resolve problems involving hardware, microcode, operating system, application programs, and network issues. |
| Example 2: Software Specialist  | This role specializes in performing problem determination and problem source identification in software environments. Software specialists complete problem analysis, evaluation, recreation, and resolution of client reported problems. They use relevant problem management systems to search for known problems and to create new entries/update existing entries. They offer advice and guidance to clients regarding the use of software. They use technical resources and tools to answer client questions and respond to clients requirements.   |

**STEP 3: Define the broad expertise associated with those tasks**

Once the tasks are defined, the next step is associating the broad expertise that employees must possess to succeed in the job role. Expertise is defined as the general knowledge set necessary to conduct tasks that make up a specific job. This step is critical because identification of the technical and workplace expertise that a given entry-level job requires is the bridge that links industry to education.

**Example from IBM's Skills Mapping Process: Expertise necessary to perform Technical Support Representative and a Software Specialist tasks**

| Step 1: Identify entry level <u>job roles</u> requiring an AAS degree | Step 2: Summarize <u>tasks</u> that are required to perform entry level jobs  | Step 3: Define the broad <u>expertise</u> associated with those tasks   |
|---|---|---|
| Example 1: Technical Support Representative                           | This role provides remote technical support assistance to clients and technical personnel on multiple products in the high volume through high availability product environments. Technical Support Representatives receive and record incident related information, and using a variety of tools, techniques and procedures, selects appropriate actions to resolve problems, and communicates the solution or action plan to the client or service representative. They identify/recommend updates to knowledge based systems and maintenance packages. They may also provide hardware or software technical support assistance to clients and personnel in multi-vendor, multi-protocol networks/systems in the high availability product environment. They use professional knowledge and problem determination/problem source identification skills to resolve problems involving hardware, microcode, operating system, application programs, and network issues. | <ul style="list-style-type: none"> <li>• Application Implementation Expertise</li> <li>• Business Analytics Expertise</li> <li>• Business Process Modeling Expertise</li> <li>• Business Professional Expertise</li> <li>• Client Relationship Expertise</li> <li>• Data Management Expertise</li> <li>• Data Security Expertise</li> <li>• Integrated Communications Expertise</li> <li>• Mobile Technology Expertise</li> <li>• Office Suite Expertise</li> <li>• Perform Problem Determination Expertise</li> <li>• Performance Management Expertise</li> <li>• Computing Platforms Expertise</li> </ul> |

|                                |  |  |
|--------------------------------|--|--|
| Example 2: Software Specialist | This role specializes in performing problem determination and problem source identification in software environments. Software specialists complete problem analysis, evaluation, recreation, and resolution of client reported problems. They use relevant problem management systems to search for known problems and to create new entries/update existing entries. They offer advice and guidance to clients regarding the use of software. They use technical resources and tools to answer client questions and respond to clients requirements. | <ul style="list-style-type: none"> <li>• Application Design Expertise</li> <li>• Application Development Expertise</li> <li>• Application Implementation Expertise</li> <li>• Business Analytics Expertise</li> <li>• Business Process Modeling Expertise</li> <li>• Business Professional Expertise</li> <li>• Client Relationship Expertise</li> </ul> |
|--------------------------------|--|--|

**STEP 4: Summarize the specific skills associated with the expertise**

While describing the expertise provides a general understanding of the knowledge required to perform job tasks, it is still too broad to enable educators to understand specifically how to prepare students to fill in-demand jobs. Industry partners must narrow the expertise to the set of technical and workplace skills that build upon each other to comprise an expertise. High school and college partners can then determine the academic coursework students need to master these skills and be prepared to contribute to the workforce.

Note that some expertise will require the development of more workplace skills than technical skills and vice versa. No matter what the expertise, it is important to remember that any job role is going to require more than one expertise. It is critical that employers delineate between workplace and technical skills for the purpose of effectively mapping these skills, but it is important to remember that these skills are not mutually exclusive and many skills will recur and overlap.

**Example from IBM's Skills Mapping Process: Technical and workplace skills comprising Mobile Technology expertise (needed for the Technical Support Representative role) and Business Professional (needed for Software Specialist role)**

| Step 3: Define the broad <u>expertise</u> associated with those tasks                | Step 4: Summarize the specific skills associated with the expertise  |
|--|--|
| <p>Mobile Technology Expertise (necessary for Technical Support Representative):</p> | <p><b>Technical Skills:</b></p> <ul style="list-style-type: none"> <li>• Identify problems related to installation, update, configuration, operations or performance, resolve problems, advise on potential resolutions and their implementation and implement suggested resolutions.</li> <li>• Device functional knowledge specific to build, installation, tuning, debugging applications, problem analysis, troubleshooting, technical evaluation.</li> <li>• Apply knowledge of wireless networking and knowledge of features and functions of the product.</li> <li>• Apply knowledge of SmartPhones (android, blackberry, iPhone, Windows), iPad and other tablets, notebook computers</li> <li>• Perform support ( problem determination, trouble-shooting, incident resolution, system prep/deploy, application update, etc) to mobility devices such as PDA's (Personal Digital Assistants), netbooks, mobile phones / smartphones (Blackberry, iPhone, et al), Palm, iPad, etc</li> </ul> <p><b>Workplace Skills:</b></p> <ul style="list-style-type: none"> <li>• Advise, support, and guide customers customer</li> <li>• Use technical resources and tools to answer customer's questions and respond to customer's requirements.</li> </ul> |

Business Professional Expertise(necessary for Software Specialist role):

**Technical Skills:**

- Understand and apply the practices and software of Lean and Agile , including stakeholder feedback, use cases, user stories, iterative development, stable/consumable code, continuous integration, TDD, and value stream maps.

**Workplace Skills:**

- Written communication skills (the ability to prepare and deliver clear, concise business messages and information through all written communication channels (i.e., electronic, business letters etc.) to ensure clarity of purpose.
- Oral communications include the ability to articulate concepts, ideas, recommendations, proposal, etc., through the use of effective presentation skills. Data gathering, presentation planning, and effective use of visual aids. Recognize the need for creating a win/win situation through flexibility and making trade off. Articulate competing points of view, conflicts of interest and competing alternatives.
- Listening communications include the ability to hear and understand what is being communicated. The ability to comprehend input being communicated without interruption, demonstrating an appreciation for another's point of view.
- Non-verbal communications include an understanding of the power of non-verbal techniques (e.g., visual, auditory, tactile, sensory, etc.) used singly or in combination to communicate a message.
- Analyze information developed by others for accuracy, clarity, completeness (level of detail), concreteness, organization, retrievability, style, task orientation, and visual effectiveness.
- Develop guidelines, education, and other resources.
- Analyze a variety of information types, including information centers, books, Web pages, user interface screens, error messages, white papers, technotes, and so on.
- Develop a deep understanding of the products, offering, or solutions you support.
- Advise writers and provide education to the teams you support.

## **PART II: SKILLS MAPPING**

Skills documentation is only the first part of the Skills Mapping process. Once the specific skills for entry level jobs have been identified for appropriate entry-level positions, the collaborative work between high school and college leadership and faculty, with industry assistance, begins. Using the skills as a destination, the team works backwards to determine the postsecondary degrees, along with the specific integrated sequence of secondary and postsecondary coursework, that will ensure that students have mastered these skills upon graduation.

### **STEP 1: Identifying the AAS Programs**

Once the industry partner identifies a manageable but still comprehensive set of technical skills and foundational workplace competencies in key job growth areas for candidates with an AAS degree, college faculty members and college department chairs should identify which of their AAS programs would provide students with these proficiencies. During this collaborative process, the skills map serves as a framework to guide decisions about selecting the appropriate AAS degrees that will equip students with the content expertise and employability skills they will need to successfully perform their jobs and lead to a professional career path.

#### **Example: Pathways in Technology Early College High School, Brooklyn, New York (P-TECH Brooklyn)**

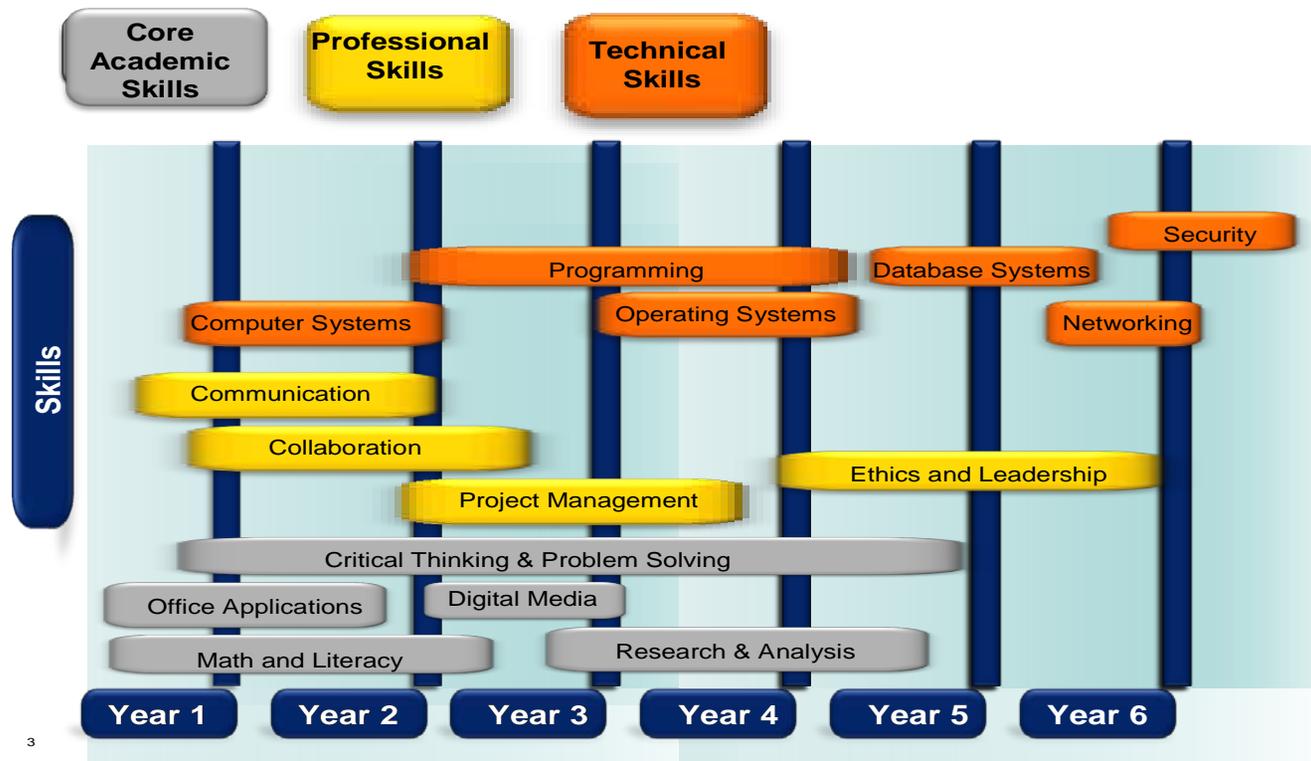
At P-TECH Brooklyn, IBM shared a list of hundreds of skills with Bonne August, Provost from New York City College of Technology (City Tech), the school's college partner. Together with high school faculty and others, the partners reviewed the skills in depth. The Provost then convened the leaders of each department to assess the inventory and determine which degree pathway would best enable students to demonstrate those skills. P-TECH Brooklyn now offers two associate in applied science degrees: Computer Information Systems (CST) and Electromechanical Engineering Technology (EMT). These degrees were chosen based on the relevant skills that they provided that would enable graduate to garner in-demand jobs at IBM, P-TECH Brooklyn's industry partner, and other major IT employers.

### **STEP 2: Ordering skills by complexity**

Once the college partner has identified the appropriate AAS degrees, the partners should work together to separate the technical skills from the professional skills and order each one by its level of complexity. Keep in mind that students will need to master the foundational skills first, and will need repeated exposures over time to higher level technical skills, as well as other complex processes, like critical thinking and collaborative leadership.

**Example: Pathways in Technology Early College High School, Brooklyn, New York (P-TECH Brooklyn)**

Building the foundational skills was top of mind for P-TECH Brooklyn’s Founding Principal Rashid Davis. With a number of students entering at below grade-level, ensuring that students had the reading and writing skills necessary to begin more rigorous coursework was critical. P-TECH Brooklyn students spend an additional 180 minutes everyday in math and English Language Arts during their first years in the program in order to build their math and numeracy skills. In order for candidates to be successful in technical job roles, they need to be proficient in calculus or beyond, as well as reading and writing. These areas are the building blocks for physics, engineering, and information systems. It is also essential for students to be able to collaborate and communicate effectively before they can manage a complex, real-world project. While there may be elements of higher level skills at play in earlier years, the focus should be on building foundational skills that will not become less relevant over time. Ordering each technical and professional skill by level of complexity is the first step in creating a scaffolded progression of learning experiences that enables every student to develop a comprehensive skill set.



In the chart above, each year represents when skills are introduced to students. Teachers and professors should determine which skills need to be revisited in subsequent years. Many of the professional competencies will likely need to be re-visited in greater depth/complexity as students progress through the program. For example, students at P-TECH Brooklyn have multiple opportunities to practice public speaking, business writing, and project management. With every opportunity they have to practice work-based tasks or projects, students are adding depth to their knowledge base and will be able to handle even more complex skills.

### **STEP 3: Mapping to college courses**

Once the skills have been ordered, partners can now work together to determine which technical skills naturally align to existing college course offerings within the defined AAS degrees, and which ones need additional curricular resources. It is critical to assess any gaps between the industry qualifications and the college course offerings. If there are skills or experiences that are not adequately covered in the curriculum, all partners should work together to develop additional high school and college academic support and/or real-world experiences to bridge those gaps. Some industries may require specific certifications or a portfolio to consider prospective employees, and it is critical to build those requirements into the 9-14 model if the college degree does not explicitly cover it.

### **Example: Pathways in Technology Early College High School, Brooklyn, New York (P-TECH Brooklyn)**

P-TECH Brooklyn will build a series of rigorous, technical internships into every student's schedule because many employers, including IBM, require candidates with an AAS degree to have relevant work experience. Since this is not a degree requirement, IBM in collaboration with its partners, developed work-based learning experiences, such as work site visits, work-based projects, a mentor program, and internships, in conjunction with the academic scope and sequence. The work-based learning pillar of P-TECH enriches the core academic program by providing students with essential professional skills, a network of support from industry mentors, and meaningful work experience in the IT field.

| Skill   | Corresponding Courses   | Additional Resources to Support Learning                   |
|---|---|--|
| <p><b>Platforms-</b> A computing platform is some sort of hardware architecture and software framework (including application frameworks) that allows software to run. A platform is a crucial element in software development.</p> <ul style="list-style-type: none"> <li>- Apply knowledge of Unix/Linux</li> <li>- Apply knowledge of Mac OSX</li> <li>- Apply knowledge of storage products</li> <li>- Apply knowledge of virtualization</li> <li>- Apply knowledge of Windows Operating Systems</li> <li>- Maintain desktops and workstations</li> </ul> | <p>CST 1204- Database Systems Fundamentals<br/> CST 1205- Operating Systems and Job Control Language<br/> CST 1215- Operating Systems Fundamentals<br/> CST 2400- Computer Systems Management and Support<br/> CST 2415- System Administration (UNIX/Linux)<br/> CST 2404- System Administration (Windows)<br/> EMT 2390L- Operating Systems Laboratory</p> |  |
| <p><b>Project Management-</b> Project management is the discipline of planning, organizing, securing and managing resources to bring about the successful completion of specific project goals and objectives</p> <ul style="list-style-type: none"> <li>- Perform Project Tracking/Reporting/Delivery Process</li> <li>- Plan Projects</li> <li>- Manage Project Change</li> <li>- Manage Cost/Revenue</li> </ul>  | <p>Daily work-based learning course at P-TECH</p>   | <p>Monthly work-based learning team projects at P-TECH</p> |
| <p><b>Business Process Modeling-</b> Apply existing business processes to support business mission, ensure consistency, and measure effectiveness. Understand the importance</p>  | <p>Virtual Enterprise course at P-TECH</p>  | <p>Internships</p>   |

|   |  |  |
|---|--|--|
| <p>and relationship of business processes within Procurement. Seek out opportunities to introduce process improvements, optimize attainment of key metrics and eliminate redundancy. Drive to achieve client objectives. Apply and execute new process models, for example, e-procurement. Understand the client's vision, goals, objectives, strategy, tactics and how they relate to company's objectives. Ensure business processes are in place to support achievement of objectives.</p> |  |  |
|---|--|--|

**STEP 4: Developing an integrated sequence of high school and college classes**

Once the appropriate college classes are identified, the partners work together to develop a scope and sequence that outlines the high school and college courses and learning objectives for each year that align to the skills. They should also create a work-based learning scope and sequence alongside it to provide a series of opportunities for students to demonstrate their technical/professional skills and address any pertinent skills gaps in the academic courses. This document should give an overview of the core standards for the professional and technical skills for each year.

Remember that every year should build on the previous year in terms of depth and complexity. Thus, the sequence of courses should front-load the professional competencies and basic technical skills in earlier grades. As students attain higher level skills in math and science, they will be ready to take more college-level technical classes that are aligned to the skills map. It is important that the partnership articulates how students will demonstrate mastery and how to integrate supporting experiences outside of the classroom to reinforce each skill.

Finally, the college and high school faculty should outline each standard in more detail (by year), and which skills will need to be revisited in greater depth or complexity as students progress through the program.

**Example: Pathways in Technology Early College High School, Brooklyn, New York (P-TECH Brooklyn)**

The high-level Workplace Learning cope and sequence below outlines each year with guiding themes, objectives, and career-readiness indicators, which ultimately culminates in a capstone work experience. This framework allows the school partner to find or design the appropriate curricular resources to help deliver the instructional content for each year. P-TECH Brooklyn uses interdisciplinary projects and a virtual business model curriculum to target the yearly standards for students, and has used resources

from the Ford Partnership for Advanced Studies, the Buck Institute, Teachers Try Science, and Virtual Enterprise. The outcomes and objectives for each year also inform the professional development that the teaching staff needs in order to implement the curriculum effectively and convey the overall vision of work-based learning.

### Sample Work-Based Learning Scope and Sequence Overview

| Theme                      | Year 1   | Year 2   | Year 3  | Year 4  | Years 5/6  |
|----------------------------|--|--|---|---|--|
|                            | Intro to Information Technology  | Problem-Solving in the Workplace   | Work Readiness for IT Fields  | Leadership in the Workplace   | Capstone Experience  |
| <b>Core Standards</b>      | Build awareness about how to use critical thinking and teamwork to solve problems and improve lives; Build awareness about what information technology really means. | Explore how information technology can solve a problem in the community; Explore careers in information technology | Prepare to be successful in an information technology work environment. | Prepare to be successful in an information technology work environment; Develop an education and/or career pathway. | Students will be able to pursue their academic and professional interests in more depth according to their goals and skills. |
| <b>Professional Skills</b> | Communication, Accountability, Critical Thinking   | Project Management, Adaptation, Research & Analysis  | Technical Writing, Innovation and Creative Problem-Solving              | Work-Readiness, Ethics, Leadership  | Leadership   |
| <b>Technical Skills</b>    | Office Applications, Digital Media, Programming Fundamentals   | Computer Systems, Programming, Circuits  | Mobile Technology, Digital Control, Data Management                     | Database Systems, Operating Systems, Electronics  | Computer Hardware Systems, Networking, Security  |

|                           |  |   |   |   |   |
|---------------------------|--|---|---|---|---|
| <b>Outcomes</b>           | Quarterly group projects and presentations<br>Portfolio of projects, graded rubrics, and written reflections | Quarterly group projects and presentations (or team competitions)<br>Portfolio of projects, graded rubrics, and written reflections<br>Gateway Presentation | Group project<br>Product/web design concept<br><br>Individual research project/presentation               | Co-Op or Internship   | Capstone Project  |
| <b>Assessments</b>        | Project Rubrics<br>Portfolio   | Project Rubrics<br>Gateway Presentation   | Project Rubrics<br>Portfolio  | Mastery Exams of Technical Skills<br>Gateway Presentation   | Mastery Exams of Technical Skills<br>Course exams   |
| <b>Ongoing Activities</b> | Mentoring, Job Shadowing; Worksite Tours; Guest Speakers; Team project; Externship                           | Mentoring, Job shadowing; Worksite Tour; Guest Speakers; Externships.   | Mentoring, Worksite Tour; Career Fair with Industry Coalition; College visit with mentors; Guest Speakers | Mentoring, Internship or Independent Research; Develop Resumes; Mock Interviews; Guest Speakers as needed | Mentoring, Internship or Independent Research; Develop Resumes; Mock Interviews; Guest Speakers |

**PART III: ANNUAL REVIEW AND AN ONGOING FOCUS ON WORKPLACE SKILLS, INCLUDING “HABITS OF MIND”**

Importantly, the process does not end once the skills have been mapped. Because the pace of technology changes so rapidly, jobs and their requirements also will change over the course of a student’s time at school. To that end, it’s important that industry and education partners work together to review the skills and the mapping process on annual basis to ensure that students are learning necessary skills. Today’s cutting-edge technologies could be considered basic knowledge in a few short years.

In this regard, it is important not to disregard the great value that employers place on workplace skills. These skills, such as critical thinking and problem solving, teach young people *how to learn*, preparing them to approach problems in creative ways. If one thing is true, change will be the norm, and students will need to be comfortable with ambiguity. Because no one knows exactly what information and knowledge they will need, young people will need to know how to *apply* what they learn.

It is also important to remember that workplace skills encompass “habits of mind” such as "grit," "persistence" and "work ethic" that

play heavily into young people's success. While these habits may not be taught explicitly, they are characteristics that students acquire when teachers and mentors model them and emphasize them as students tackle academic and life challenges.

## **CONCLUSION**

Students graduating from P-TECH 9-14 model schools are first-in-line for jobs at their industry partner. This commitment is hollow if partners do not engage in a thorough Skills Mapping process that ensures that students have the skills that industries need. This process gives educators an opportunity to review offerings in response to industry trends, and provides the partnership as a whole with the foundation to build a scope and sequence that most effectively integrates high school, college and workplace learning. While led by business, this process, like all aspects of the school, requires the thoughtful investment of time and thinking from all partners, and when done well, sets the right tone and the correct course for the hard, but rewarding, work ahead.

*This guide was written by Charlotte Johnson, IBM Industry Liaison for the Sarah E. Goode STEM Academy, and Temeca Simpson, IBM Industry Liaison for Pathways in Technology Early College High School (P-TECH Brooklyn), with significant input and expertise from Brian Piper, Senior Client Services Representative & Researcher, IBM Human Resources.*

*This guide is based on the Skills Mapping Process developed at P-TECH Brooklyn in collaboration with the New York City Department of Education, The City University of New York, New York City College of Technology and IBM Corporation.*