Strengthening STEM and Computer Science Outcomes for Tennessee High School Students:

A Work-Based Course Blueprint for the Tennessee SySTEM Grant

AT A GLANCE

The Work-Based Courses Blueprint is a foundational guide for all Tennessee SySTEM school sites engaged in designing and developing work-based courses for 11th and 12th grade students. Specifically, this blueprint covers pertinent work-based courses topics such as building a work-based course team, course design, and course delivery. The blueprint will evolve over time to capture best practices and lessons learned as school sites test this proven model to see if strong outcomes persist for students, with particular emphasis on supporting Black, Latinx, female, and/or students from low-income backgrounds in dual enrollment work-based courses.

AUTHORS

Lee Domeika
Senior Program Manager, **JFF**

Lauren Miller
Program Manager, **JFF**

Anna O'Connor
Director, **JFF**

JANUARY 2022

Acknowledgments

This opportunity is funded under a grant from the U.S. Department of Education, Education Innovation and Research (EIR) Program.

About JFF

Jobs for the Future (JFF) drives the transformation of the American workforce and education systems to achieve equitable economic advancement for all. www.jff.org

About JFF's Language Choices

JFF is committed to using language that promotes equity and human dignity, rooted in the strengths of the people and communities we serve. We develop our content with the awareness that language can perpetuate privilege but also can educate, empower, and drive positive change to create a more equitable society. We will continually reevaluate our efforts as language usage continues to evolve.

About TDOE

Tennessee enrolls approximately 998,000 students and is divided into 147 districts with both significant urban and rural populations. Academically, Tennessee students still perform below the national average, and this is compounded by significant gaps by income and race. The Tennessee Department of Education is dedicated to the goal of dramatically improving student achievement and committed to the belief that children from all backgrounds can succeed when given the opportunities they deserve.

Table of Contents

About Work-Based Courses and the Blueprint

As part of an Education Innovation and Research (EIR) TNSySTEM grant, Jobs for the Future (JFF) and the Tennessee Department of Education (TDOE) are working to develop, implement, and test the feasibility of Science Technology Engineering Mathematics (STEM) and computer science-focused work-based courses for juniors and seniors within the Tennessee public high school system. Tennessee sites committed to designing work-based courses will be advised to prioritize student enrollment for students interested in STEM and computer science who are Black, Latinx, or female, as well as students considered "economically disadvantaged" by the state. These student populations remain disproportionately underrepresented in those fields both in Tennessee and nationwide.

A concept rooted in work-based learning principles originally developed by JFF, work-based courses integrate the classroom and the workplace by formalizing instruction that happens on the job and using the workplace as a learning lab for students. Students fulfill program requirements for postsecondary courses, while also experiencing a practical understanding of the unique needs, challenges, and opportunities of the industry[i]. For purposes of this grant, high school and postsecondary partners will work in tandem with local employer partners to reconstruct current dual enrollment courses focused on STEM and computer science to incorporate an employer co-instructor with the workplace as part of the classroom setting.

This blueprint serves as a foundational guide for school sites to use at the beginning of their course design and development in order to best support their faculty team, partners, and students. The blueprint covers in detail what work-based courses are and how they operate, the benefits of work-based courses to key stakeholders, key elements for designing and delivering, and how to support students to and through program completion. Most importantly, this blueprint will evolve over time to capture best practices and lessons learned as JFF, TDOE, and school sites test this proven model to see if strong outcomes persist in dual enrollment work-based courses.

Getting Started: Tennessee STEM and Computer Science Work-Based Courses

For purposes of the Education Innovation and Research (EIR) Tennessee SySTEM grant, work-based courses (WBC) are defined as STEM or computer science dual enrollment courses that integrate classroom and work-based learning (WBL) strategies and are co-taught by academic

faculty and employer instructors, creating a model that contextualizes learning by combining industry-specific content with on-the-job experience. Successful work-based courses are dependent on strong partnerships between local school districts, postsecondary institutions, and employer partners.

Traditional Course Instruction	Work-Based Course Instruction
Course modules and objectives remain the same as written in the existing course syllabus	Course modules and objectives **remain the same** as written in the existing course syllabus
100% instruction taught in the classroom or lab at the school	**80%** instruction taught in the classroom, **20%** hands on instruction taught at the workplace
All course objectives taught in the classroom	**Mix of course objectives** taught in the classroom and at the workplace

Work-based courses encourage strong, strategic, and innovative partnerships to reimagine how to prepare students for success after high school. From the use of time and space, entrance requirements, instructional practices and modes of learning, scheduling, mentorship, and training opportunities available to students, this work-based learning model can become a strategy to rethink and re-envision high school education and career preparation.

Work-based courses offer Tennessee public schools the opportunity to leverage local employer instructors who can help address the existing shortage of STEM/computer science-based teachers. Course content will be taught both remotely and in-person through applied learning that uses the workplace as a "learning lab," enabling students to simultaneously experience postsecondary-level courses, gain credit, and practice workplace skills that prepare them for STEM/computer science careers. As core components of the work-based course model, strong academic support and career advising should be embedded into course curricula.

Evidence has shown that work-based learning can improve academic outcomes at the secondary and postsecondary levels,[ii] supports positive youth development and fosters employability skills,[iii] and leads to improved job quality later in life.[iv] Access to work-based courses is especially crucial for students with lower postsecondary enrollment rates, which is an issue across the state: in 2016, only 63 percent of high school graduates enrolled in a postsecondary institution in the summer or fall following their graduation, and the numbers were significantly lower for students who were Black, Latinx, or economically disadvantaged.[v] Despite the positive

outcomes, the participation of Black, Latinx, and economically disadvantaged students in work-based learning is also disproportionately low.

Additionally, incorporating a STEM or computer science focus with work-based courses will prepare students for in-demand, high-wage jobs in the field. The median salary of STEM industry workers in Tennessee is $70,849, which is more than twice the median salary of all employed Tennesseans. Despite significant growth in this field, there are disparities in which workers have access to these careers.[vi] A 2018 study found that Black and Latinx workers are underrepresented in the STEM workforce: Black workers make up 11 percent of the U.S. workforce, but only 9 percent of STEM workers, while Latinx workers are 16 percent of the total workforce, but only 7 percent of STEM workers.[vii] Although women make up about half of U.S. STEM workers, they are concentrated in low-wage clusters, making the gender wage gap in STEM wider than in non-STEM career paths.[viii] STEM and computer science work-based courses represent an opportunity to address these equity gaps in education access and STEM representation. As such, this project will emphasize and scale research-based strategies to design and implement work-based courses that will measurably improve the educational and career outcomes of Black, Latinx, female, and economically disadvantaged students.

Benefits to Employers, Students, and Schools

Students

Through work-based course models, high school students gain dual opportunities for career and educational advancement. These courses help them gain a deeper understanding of STEM and computer science content, while also obtaining relevant credit and skills that can be transferred to other educational opportunities or within the workforce. Additionally, high school students can develop relationships with local employers in ways they may not experience otherwise. The opportunity to take work-based courses in traditional school settings and on-site at employer locations help deepen relationship building and STEM/computer science workplace awareness. Finally, in work-based courses students are actively exploring the intellectual and physical attributes of specific careers which provides unique opportunities for career advice and exploration.

Employers

Employers faced with training and retaining a skilled workforce can provide students rigorous, academic, and industry-aligned training in a format that is tailored to their production processes and skill needs. Work-based courses also offer employers the opportunity to develop meaningful

partnerships in their community, which can be an attractive trait as a business. In addition, work-based courses build long-term career pathways without requiring a long-term training commitment upfront.

Secondary and Postsecondary

Secondary schools can use work-based courses to best prepare their students for future education or work opportunities. Work-based courses also offer secondary schools the opportunity to address the shortage of STEM and computer science teachers their school system may be facing by working in tandem with local employers who can offer an important and unique perspective on course learning goals. For postsecondary schools, work-based courses are an opportunity to bridge partnerships with high schools and employers while maximizing the value to students. For instance, developing a work-based course provides an opportunity to initiate or deepen engagement with industry partners and partnerships with high schools encourage students to pursue future degree programs in STEM and computer science who might not otherwise.

Building Blocks

Tennessee public schools developing work-based courses should ensure they have the following:

- A team composed of at least one high school, one postsecondary partner, and one local employer ready to engage in work-based course development and implementation
- A designated lead in the high school who is responsible for leading the planning and collaboration with high school, postsecondary, and employer partners
- A designated instructor in the high school or postsecondary institution who has the capacity to collaborate with the employer partner
- A designated supervisor in the employer partner who has the capacity to oversee the work-based classroom activities
- A clear vision as to how work-based courses would best prepare students for future opportunities in STEM/computer science
- A plan for how to actively recruit students in the target populations
- An existing STEM/computer science dual enrollment course to enhance using the work-based courses model, or be in the position to add additional dual enrollment courses to its course catalog

- Structures in place to ensure at least 20 percent of the work-based course is taught at the workplace with the employer, ideally in-person

Course Design	Course Delivery	Course Instructors
WBC adapts existing postsecondary courses that are offered as dual enrollment. These courses should build into a high school career pathway. The courses should be STEM courses, with preference for computer science. Teachers and employers should map the skills and competencies of the course objectives and then determine which are better suited for learning in the classroom and learning at the workplace. The courses withstand the same academic standards and rigor as before adaptation. The course content remains the same, the approach to instructional delivery changes.	At least **20%** of the course should be instructed **at the workplace** by an employer instructor. Students should be able to **see the connections** between the learning that is happening in the classroom and at the workplace (e.g., applied workplace learning activities). There is **clear, consistent, and open communication** between the teachers and employers before and during course delivery. To ensure equitable delivery, instructors should be prepared to **offer reliable digital access and strong representative content to students.**	Teachers and employers should be **co-designing, co-delivering, and co-assessing** course content and learning. Teachers and employers should **share assessments**, collaborate on assignments and projects, and work to **inform the practice of one another.** Teachers will receive **upfront professional development** on the WBC model, incorporating Diversity Equity and Inclusion (DEI) practices, developing communication strategies with employers, and documenting students' mastery of skills. With professional development, **teachers will train employers** to teach in a work-based learning format.

Partnership Development

Building a Work-Based Course Team

A crucial component of work-based courses involves building out a team of key workforce and education stakeholders. Employers and supervisors, postsecondary institutions, and secondary schools all play a unique and pivotal role in developing quality work-based courses that meet the needs of students, employers, school faculty, and the broader workforce field.

While secondary and postsecondary instructor partners will have a good grasp on student needs and learner-centered course design, employers will be able to sharpen course curricula by identifying key workplace skills and competencies that students will need. In general, work-based courses will require all key players to expand their current roles, including taking part in capacity-building and professional development activities as work-based course development unfolds.

Below are some examples of the roles and responsibilities associated with each stakeholder engaged in developed work-based courses. This chart may be useful to think through key elements of building out the right work-based course.

HIGH SCHOOL
→ Build off current STEM/Computer Science pathways catered to target 11th and 12th graders → Organize a work-based course planning team to meet regularly to plan course design and delivery → Coordinate with employer partner(s) to ensure that 20% of course is taught off-site and in the workplace → Provide students with appropriate support, advising, course-completion materials, and credentials → Work with employer to provide students with relevant course assessments

COLLEGE
→ Build off current relationship with high school and associated STEM/Computer Science pathway → Leverage any existing and relevant employer partners → Support the planning and design of work-based courses by serving on the work-base course planning team → Engage relevant faculty and staff on their input on course delivery and supporting dual enrollment students → Connect students with relevant support systems to facilitate enrollment and a pathway to college degree

EMPLOYER
➔ Represent STEM/Computer Science fields in Tennessee, prioritizing women and employees of color ➔ Support the planning and design of work-based courses by serving on the work-base course planning team ➔ Co-develop work-based course curriculum to ensure that content is industry-relevant and aligned ➔ Host students at the workplace at least 20% of the entire course ➔ Provide opportunities for students to connect with employees and grow their social capital ➔ Provide students with opportunities to receive an employer-signed letter of participation

STUDENT
➔ Provide feedback on work-based course content, delivery, student support, employer interactions, etc. ➔ If interested, support the planning and design of work-based courses

Educator and Employer Relationship Building

An important factor in successful work-based courses models is having a strong relationship between educators and the local employer as they co-design and teach the course as well as support students along the way. For students who may be struggling with course content or nonacademic barriers, having instructors and employer partners aware and connected will help create a well-rounded system for providing targeted support to the student. Additionally, educators and employers should have the option to observe each other to gain mutual understanding of respective classroom content. Wherever possible, educators and employers can consider co-teaching courses to strengthen relationships and build shared content knowledge.

Throughout course delivery, relevant educators, administrators, and employer partners should schedule touchpoints to address relevant updates, progress, and challenges that are surfacing. Educators should be prepared to offer light training to employers on engaging and working with students. Employers should also provide educators with insight on industry-relevant content and topics that they feel are vital for students to prepare for STEM and computer science fields.

Teacher externships are another great way to bridge the gap that often exists between educators and employers. Through externships, educators are offered a unique professional development opportunity to immerse themselves in a company to learn about the skills and competencies needed to succeed in that industry or career path.[ix] Teachers are paired with local employers and receive hands-on experience in industries related to the subjects they teach in class. While time consuming, this experience may help strengthen educators' abilities to bring relevant, real-world context into the classroom and better prepare students for career pathways in postsecondary and into the workforce.

Designing the Course

Designing curricula for work-based courses requires adapting the content, delivery, and scope of existing course offerings, and requires high school and postsecondary faculty to work collaboratively with industry partners to create learning activities that reach beyond the existing confines of the classroom and into the workplace. Conversations focus first on connecting high school and postsecondary faculty with industry representatives who have a full grasp of the skills, training needs, and gaps the work-based courses will address.

High school and postsecondary partners should use their existing dual enrollment courses to determine what could be augmented to fit a work-based courses approach. Concept mapping of tasks to course content will require detailed conversations about what is necessary for foundational knowledge, skill mastery, and performance of job tasks while adhering to academic principles and standards.

Key considerations for designing quality work-based courses include:

- Adapting existing dual enrollment courses
- Mapping tasks to competencies and academic standards
- Designing instruction for multiple settings and a variety of learners
- Documenting learning

Adapting Existing Courses

The first step in the course design process is selecting which dual enrollment courses to adapt from their existing, traditional format to a work-based delivery. The decision will be based on a variety of factors unique to the high school and postsecondary institution. Employers are a major driver of work-based courses: the students are their workers, the on-the-job learning happens in their workplace, and their supervisors provide hands-on instruction.

These courses cannot happen without fully engaged employers, and so the course selection process should gather their input from the beginning. Work-based courses are distinct from other forms of employer-driven education because they are drawn from credit-bearing courses that are requirements within a postsecondary degree or certificate program. They are not intended to provide generic credit but rather to provide an alternative format for technical courses required for program completion that also advance student careers.

Mapping Competencies to Skills and Tasks

Identifying work-based course competencies and then mapping them to associated skills and tasks is an essential activity for work-based course design. This "mapping" gives both instructors and employer partners the opportunity to collaborate on what information and activities are critical for students to engage in, both in the workplace and in the classroom. For purposes of this work, we are defining "competency," "skill," and "task" as the following:

Competency	The capability to apply or use a set of related knowledge and skills required to successfully perform tasks in a defined work or education setting. These are the main ideas students will work on mastering within the course.
Skill	Specific learned abilities that a student would need to be able to perform a given job well. Obtaining skills can help in mastering competencies.
Task	Time-bound job or assignment activities that help a student gain proficiency within a skill. For purposes of work-based courses, tasks can be both job and assignment*. **Job tasks refer to any activity that can be completed while at the workplace. Assignment tasks refer to activity that can be completed through classroom assignment or homework.*

Once the competencies are identified, work-based course planning teams are encouraged to work together to identify the skills and tasks that are most relevant and applicable to each course competency. To provide an example, the charts below outline possible course competencies with associated skills and tasks that could be prioritized in the classroom, in the workplace and within both for an introductory coding work-based course.

TAUGHT IN THE CLASSROOM
Competencies ✓ Implement current and commonly used data structures ✓ Write functional algorithms ✓ Use UX/UI and frontend programming to design websites/apps
Skills ✓ Arrays, Stacks, Queues ✓ HTML, CSS, JavaScript (JS)
Tasks ✓ Read about array literals ✓ Practice adding and changing values to arrays via their indices ✓ Use Chrome DevTools to debug CSS ✓ Practice problem solving through HelpDesk simulations ✓ Sort and identify coding issues through example problem sets ✓ Wireframe a complex layout utilizing semantic HTML tags ✓ Use the box model to position specific web-based elements on a web-page or app ✓ Articulate the difference between statements and expressions in JavaScript

TAUGHT IN THE WORKPLACE
Competencies ✓ Demonstrate workplace teamwork standards ✓ Articulate tech-related issues and possible solutions ✓ Organize and update key project information
Skills ✓ Computer security incident handling and response ✓ Collaboration and conflict resolution ✓ Customer service and problem solving ✓ Project management
Tasks ✓ Evaluate cybersecurity risks, threats, and vulnerabilities of a hypothetical network/organization ✓ Demonstrate conflict resolution and customer service techniques through HelpDesk simulations ✓ Practice balancing multiple deadlines and tech-based issues through e-Ticketing ✓ Develop GANTT or RACI organization charts to facilitate strong team management and organization

TAUGHT IN BOTH THE CLASSROOM & WORKPLACE
Competencies ✓ Design and implement basic computer applications ✓ Identify social, legal, and ethical issues as they pertain to computer usage ✓ Communicate basic computer architecture terminology ✓ Demonstrate workplace teamwork standards ✓ Articulate tech-related issues and possible solutions
Skills ✓ HTML, CSS, JavaScript (JS), GitHub ✓ Content Management Systems (CMS) ✓ Computer security incident handling and response ✓ Communication, problem solving, and conflict resolution
Tasks ✓ Practice effectively talking about and explaining code without writing code ✓ Demonstrate conflict resolution and customer service techniques through HelpDesk simulations ✓ Practice adding and changing values to arrays via their indices ✓ Use Chrome DevTools to debug CSS ✓ Sort and identify coding issues through example problem sets ✓ Wireframe a complex layout utilizing semantic HTML tags ✓ Articulate the difference between statements and expressions in JavaScript

Designing Instruction for Multiple Settings

The most significant and motivating aspect of the work-based course model is the varied approach to instructional delivery. The critical underpinning of work-based courses is the idea that for learning in general, and for technical education in particular, practice and application of knowledge should include real-world context.

High schools, postsecondary institutions, and employers should collaborate to map out instructional scenarios, and then determine which is best suited for the traditional classroom vs. workplace. There may be more than one way to deliver instruction, and it may be a matter of determining what is taught in one place and reinforced in another (traditional classroom vs. workplace).

Assessing Learning

Work-based courses are uniquely designed to promote deeper engagement with content, as the student is learning and applying knowledge and skills simultaneously, and assessments should reflect this. Simple instruments like written tests or quizzes, or "can-do" checklists, are helpful, but should not be used as the full measure of knowledge and ability. For work-based courses, experiential learning, or learning through doing and reflection, drives the assessment process. Program developers of work-based courses should integrate practices of both formative and summative assessments for learning. As much as possible, assessments should be linked to job performance processes and benchmarks to help students understand how skills and knowledge are evaluated and rewarded on the job.

Designing assessment practices requires strong communication, agreement on mutual goals, and commitment from both the high school, postsecondary, and industry partner. Wherever possible, employers and faculty should share assessment documents, collaborate on assignments or projects, and generally work to inform the practice of one another. Sound assessment design can enable both employers and faculty to identify specific goals and communicate degrees of student progress. Employers can provide valuable information for faculty on how a student performs a particular skill on the job, and faculty can inform employers on when a student has demonstrated sufficient understanding of a new concept or skill and is ready to carry out a work task. This symbiosis is critical to gathering the full range of information on a student, and it forms the cornerstone of any successful work-based course.

Additionally, work-based courses assessments can promote mastery, rather than simple competence, on the job. For students to demonstrate comprehension or mastery of course content, instructors and supervisors should communicate consistently to better assess each student and support their progress. Mastery can be assessed through applied, hands-on learning activities that draw on course content and actual workplace scenarios. This establishes a strong foundation and shows the student's ability to use, transfer, and apply knowledge from one context to another—skills that employers continually cite as integral to work performance. Also, it provides a launchpad to help students and workers continue to advance once they are employed and as part of a career development plan.

Strategies for Equitable Course Design

High-quality work-based courses may serve as a tool for advancing economic opportunities for students who are often shut out, in particular Black, Latinx, female, and economically disadvantaged students. It is for this reason that equity must be thoughtfully woven into the

design of work-based courses, from course syllabi to connections with employers to instructional materials.

Culturally Responsive Teaching & Representative Content

It is important that work-based courses and curricular materials are culturally responsive and represent the racial, economic, gender, and ethnic diversity of their students. Culturally Responsive Teaching is a research-based approach to teaching that connects students' culture, languages, and life experiences with what they learn in class. Research shows that there are important educational and personal benefits to learning in culturally responsive classrooms. Additionally, several studies show that Culturally Responsive Teaching increases student achievement and interest in STEM, especially in students from underrepresented groups[x]. Key components of this approach include:

- Drawing on students' culture and identity to shape curriculum and instruction
- Bringing real-world issues into the classroom
- Model high expectations for all students
- Collaborate with families and the local community
- Communicate in linguistically and culturally responsive ways

High school and postsecondary partners should also prioritize working with employers who best represent their students. Employers who are women and/or individuals of color will likely resonate with students who may not have enough consistent exposure to STEM and computer science professionals who represent their communities and identities. When students see their identities reflected in course lectures, materials, and instructors, they are more likely to feel a sense of belonging and engagement.[xi]

Other strategies for incorporating representative content include utilizing open educational resources, such as Common Open Education Resources (OER). In general, open education resources allow for co-creation and continuous iteration of content by students on specific coursework that can then be shared publicly. Common OER includes a database of resources specifically on STEM CTE that may be useful for future work-based courses models.

Universal Design for Learning

A relatively new movement in the education field, Universal Design for Learning (UDL) is a framework for the design of materials and instructions that are usable by and applicable to a wide range of students.[xii] This framework, developed by the Center for Applied Special Technology (CAST), recognizes that individual learning patterns differ and that learning systems

should take a holistic approach to learning where curriculum, learning management systems, and education policy work in tandem to support the needs of learners. Guidelines for UDL include providing multiple means for engagement, representation, action, and expression[xiii].

The framework of UDL offers educators an opportunity to build a more student-centered curriculum, allowing equity to be consistently part of the conversation. In application form, UDL strategies include but are not limited to posting lesson goals weekly, offering a variety of assignment options for students to choose from, establishing flexible work and learning spaces, and providing regular, consistent feedback on student performance.

Increasing Social Capital

While work-based courses often emphasize applied skill development and credential obtainment, pathways to postsecondary and employment are stronger with access to social capital, or the "who you know." Employer partners, supervisors, mentors, case managers, instructors, and other relevant work-based courses stakeholders play an integral role in not only advancing students through the course itself but connecting them with valuable resources and exposure that can broaden their networks. Research concludes that social capital networks attribute to educational advancement, including but not limited to lower dropout rates, improved career pathways, and higher grade point averages.[xiv]

Employer partners should demonstrate a commitment to equity and inclusion and be prepared to best support and connect students along their journey. Specifically, employers can support equitable course design by ensuring that students leave with tangible and relevant workplace connections they can lean on in their future education and professional pursuits. Employers can work with current employees interested in offering some level of mentorship to work-based courses students or connect with local college students enrolled in STEM and computer science based programs who can provide guidance and support to work-based course students.

Flexible Accommodations

To ensure equitable access to work-based courses, educators and employers should evaluate what program requirements might add unnecessary barriers to participation. If work-based courses involve prerequisites, they should be as flexible as possible. Requiring prior coursework, test scores, or experience may deter students from enrolling and reaching those who could benefit most from experiencing a work-based course.

For any portion of the course that will take place off school campus (i.e., class at the employer site or courses taught at the postsecondary institutions), travel accommodations should be made

available routinely. Accommodations may include public transportation passes, rideshare app codes/coupons, or use of school buses. Travel accommodations are especially important to ensure students can get to and from the worksite or school campus efficiently without disrupting their other classes. It is recommended that conversations with employers happen early on to solidify the schedule and that travel time is considered.

Digital Access

Currently, an estimated 14 percent of Tennesseans do not have access to broadband internet, with technology gaps even greater for economically disadvantaged families, families of color, and rural residents.[xv] For both rural and urban areas, lack of connection is concentrated among economically disadvantaged, Black, and Latinx households, amplifying the need for additional support and digital access.

While some schools may maintain an online component due to the ongoing impact of COVID-19, students may still struggle to access consistent WiFi, computer hardware/software, and bandwidth to attend class and complete mandatory assignments. Employers and educators should ensure students have access to the technology necessary for the course and have a plan for accommodations. Strategies for expanding tech access to students can include but is not limited to the following:

- Create or expand school-based spaces for tech and broadband access (WiFi enabled buses or extended WiFi from school buildings)
- Utilize Learning Management Systems that can be accessed from both a computer and mobile device so students have options for viewing and reviewing course content and assignments
- Prioritize professional development for educators with a focus on technology and virtual, asynchronous learning

Conclusion

From developing key partners to creating inclusive learning spaces, work-based courses represent a new and innovative model for preparing students for their possible futures in STEM and computer science fields. This blueprint will continue to expand and evolve as TN SySTEM school sites continue to develop their courses in conjunction with employers, postsecondary partners, and students. Future topics this blueprint will explore include student recruitment, student support and academic advising, and student voice and evaluation.

[i]JFF. "Benefits of Work-Based Learning". JFF Center for Apprenticeship. https://www.jff.org/what-we-do/impact-stories/center-for-apprenticeship-and-work-based-learning/benefits-work-based-learning/

ii Rogers-Chapman M.F. and Darling-Hammond L. 2013. Preparing 21st Century Citizens: The Role of Work-Based Learning in Linked Learning. Stanford Center for Opportunity Policy in Education. https://edpolicy.stanford.edu/sites/default/files/publications/preparing-21st-centurycitizens-role-work-based- learning-linked-learning.pdf

iii Lippman L. H., Ryberg R., Carney R., Moore K. A. 2015. Key "Soft Skills" That Foster Youth Workforce Success: Workforce Connections: Toward a Consensus Across Fields. Child Trends. https://www.childtrends.org/wp-content/uploads/2015/06/2015-24WFCSoftSkills1.pdf

iv Ross M., Anderson Moore K., Murphy K., Bateman N., DeMand A., Sacks V. 2018. Pathways to High-Quality Jobs for Young Adults. Child Trends. https://www.brookings.edu/wpcontent/uploads/2018/10/Brookings_Child-Trends_Executive-Summary-FINAL.pdf

v TN Department of Education. Drive to 55: Pathways to Postsecondary Report. https://www.tn.gov/content/dam/tn/education/ccte/ccte_drive_to_55_report_state.pdf

vi Tennessee Department of Labor and Workforce Development. 2019. The Demand for STEM Occupations in Tennessee. https://www.jobs4tn.gov/admin/gsipub/htmlarea/uploads/LMI/Publications/STEMReport2019Up dated.pdf

vii Funk C., Parker K. 2018. Women and Men in STEM Often at Odds Over Workplace Equity. Pew Research Center. https://www.pewsocialtrends.org/2018/01/09/diversity-in-the-stemworkforce-varies-widely-across-jobs/

viii Ibid

[ix] University of California at Berkley, Graduate School of Education. Career Academy Support Network. "Teacher Externship Guide". 2010. https://casn.berkeley.edu/wp-content/uploads/resource_files/teacher_externship_guide.pdf

[x]https://www.newamerica.org/education-policy/policy-papers/culturally-responsive-teaching-competencies/

[xi] NC State Unviersity. Bowen, Janine. October 2021. College of Education News. "Why Is It Important for Students to Feel a Sense of Beloning at School?". https://ced.ncsu.edu/news/2021/10/21/why-is-it-important-for-students-to-feel-a-sense-of-belonging-at-school-students-choose-to-be-in-environments-that-make-them-feel-a-sense-of-fit-says-associate-professor-deleon-gra/

[xii] Understood. Morin, Amanda. 2020. "What is Universal Design for Learning?". https://www.understood.org/articles/en/universal-design-for-learning-what-it-is-and-how-it-works

[xiii] Center for Applied Special Technology (CAST). "UDL: The UDL Guidelines". 2021. https://udlguidelines.cast.org/.

[xiv] Getting Smart. "Ten Ways Schools Can Build Student's Social Capital. 2021. https://www.gettingsmart.com/2021/04/27/ten-ways-schools-can-build-students-social-capital/"

xv State Collaborative on Reforming Education. "COVID-19 Impact Memo 4: The Digital Divide" SCORE. Summer 2020. https://tnscore.org/wp-content/uploads/2020/05/COVID-19-Impact-Memo-4_Digital-Divide.pdf