IT SKILL STANDARDS 2020 AND BEYOND

IMPACTS

2018-2024

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A MESSAGE FROM ANN BEHELER

Ann Beheler, PhD
Principal Investigator
IT Skill Standards 2020 and Beyond

Dear Colleagues:

The "ITSS Skill Standards 2020 and Beyond" grant awarded in 2018 sought to provide comprehensive, employer-led skill standard content to help educators better align curriculum with IT workforce needs. The last time the National Science Foundation funded this kind of deep dive into the in-demand skills of the IT industry was 2003. To say the IT landscape has changed since then would be an understatement. Many of the skills and tools students are learning in today's classroom had not yet been developed in 2003.

As you'll see in the pages that follow, from 2018 to 2024 the ITSS project convened IT industry leaders, both executives and technicians alike, from across the country for multiple in-person and virtual meetings. We used their expertise to create concrete, actionable data on what students need to know going forward. The robust output of this material – which includes knowledge, skills, abilities, and tasks; employability skills; key performance indicators; and student learning outcomes – has been posted on the ITSS website and disseminated at educator workshops and conferences nationwide. We're most proud of the fact that the ITSS material was adopted and approved by the Texas Skill Standards Board (TSSB) for use across the state. These materials, posted on the TSSB web page, are available to educators inside and outside Texas.

Aside from the skill standards material, we soon realized that the process we'd developed for creating this content and working with employers is just as valuable to educators. The ITSS skill standard process is powered by the "BILT Model." The Business and Industry Leadership Team (BILT) concept was first developed at the National Convergence Technology Center (CTC), which was also funded by a National Science Foundation grant from 2012 to 2023. The BILT Model provides a framework for educators to better engage employers by making them co-leaders of a technical program through frequent meetings and an annual prioritization vote and discussion of entry-level job skills. When employers feel valued and can see that their feedback is helping improve a program, they become extremely invested in a school's faculty and students. The ITSS project adapted and adopted the BILT Model first to identify key job clusters and then later to create skill standard materials that go beyond knowledge, skills, and abilities. This process was shared at six "ITSS Summit" workshops for educators across several technical disciplines.

The ITSS project has had a number of invaluable partners along the way. We've worked with executives and educators from partner institutions at the Allison Group (Washington), Lake Washington Institute of Technology (Washington), Lone Star College (Texas), and Suffolk County Community College (New York). I want to offer special thanks for the ongoing generosity and support of our host institution, Collin College.

As you might imagine, our work has been driven by the expert perspectives and recommendations of the many employers who donated their time to attend our meetings, answer our questions, and shape the skill standard output. We cannot thank them enough for all that they have done.

I believe this work will make a difference to hundreds of thousands of students and improve many IT and other technical programs at schools across the country. It's been a pleasure to lead this effort.

Ann Beheler

Ann Beheler, PhD
Principal Investigator
IT Skill Standards 2020 and Beyond

PARTNERS

From 2018-2024, five colleges and organizations served as partners of the "IT Skill Standards 2020 and Beyond" NSF project grant. Partners and senior staff convened every other week to steer grant activities, which included not only managing the daunting task of capturing and analyzing employer SME feedback on hundreds of skill standard elements, but also developing and implementing successful dissemination of the work online, in-person at conferences and events, and through publications. "IT Skill Standards 2020 and Beyond" outreach shared both the skill standards output (what the SMEs provided) and the skill standards process (how the SMEs provided it).

Collin College 2018-2024
Dr. H. Neil Matkin, District President
www.collin.edu

Lone Star College 2018-2023
Mario K. Castillo, Chancellor
www.lonestar.edu

Lake Washington Institute of Technology 2018-2022
Dr. Amy Morrison, President
www.lwtech.edu

Suffolk County Community College 2018-2024
Dr. Edward T. Bonahue, President
www.sunysuffolk.edu

The Allison Group 2018-2024
Terryll Bailey, President

Clockwise from top left: Ann Beheler leads a 2019 job cluster meeting in Sunnyvale, CA; Pete Maritato and Terryll Bailey work a booth at the 2023 ATE Principal Investigators conference in Washington, DC; Gordon Snyder and Ann Beheler network with educators at the 2019 ATE Principal Investigators conference in Washington, DC; Terryll Bailey discusses employability skills at a 2019 job cluster meeting in Frisco, TX; Terryll Bailey advises "ITSS Summit" attendees in 2023; Ann Beheler leads a workshop at the 2022 HITEC conference in Salt Lake City, UT; Terryll Bailey co-presents at the 2019 HITEC conference in St. Louis, MO; Pete Maritato (l) shares best practices with "ITSS Summit" attendees in 2023.

66 There's no better way to align curriculum to workforce needs than to collaborate directly with employers and learn from them first-hand what emerging skills and tools and tasks are most needed in the industry. Educators across the country can benefit from the work the ITSS project conducted."

- Deb Roberts, Lone Star College (Houston, TX)

66 Given the ever-changing IT landscape and the ongoing integration of AI, it's crucial for industry and education to collaborate in order to shape a successful future for students and future employees. The ITSS project illustrated how this can be accomplished, and through BILT Model, it cemented the educational-industry partnership in such transformative ways as to design IT programs that meet current and future needs."

- Pete Maritato, Suffolk County Community College – SUNY (Long Island, NY)

66 This is a much-needed update of the 2003 skill standards. It added a completely new job cluster that did not exist then and used a streamlined methodology for obtaining input from industry that took advantage of current digital capacities. This produced a more robust set of knowledge and skills. A major new feature of this new version is student learning outcomes, which will facilitate use of the skill standards by educators to update and create new curriculum in the years to come."

- Terryll Bailey, The Allison Group (Seattle, WA)

66 Collin College is proud of its role in helping incubate the BILT Model that has so successfully powered the ITSS project grant work. The BILT Model, first developed through the NSF's National Convergence Technology Center, puts business and industry in a co-leadership role with technical programs. This leads to relationships between educators and employers that are stronger, more productive, and lasting."

- Dr. Jay Corwin, Collin College (Frisco, TX)

66 The collaborative, structured approach of the ITSS project was able to illicit in-depth feedback from industry professionals, ranging from technical to soft skills needed in a wide array of IT fields. The output offered a tangible, actionable wealth of knowledge IT faculty can apply in the classroom."

- Dr. Suzy Ames, Peninsula College (Port Angeles, WA) formerly at Lake Washington Institute of Technology (Kirkland, WA)

IDENTIFICATION

- "Thought Leaders" (mostly CTOs and CIOs) meet and identify the top critically-needed IT job clusters and skill sets.

SKILL VERIFICATION

- Employer and educator SMEs convene to tackle each area identified by the Thought Leaders.
- Using a modified DACUM process across multiple meetings, employer SMEs produce Skill Standards (tasks, knowledge, skills, abilities, and employability skills) using a structured, repeatable process.
- The project team synthesizes results and works with employers to verify synthesis and create key performance indicators for tasks.
- Educator SMEs develop student learning outcomes from the verified KSAs.

DISSEMINATION

- Components of the Skill Standards and Skill Sets are widely disseminated to educators and employers.
- Training and conference presentations showcase best practices on how to use the components.
- Strategies are piloted for keeping skill standards current.

A version of this flowchart explaining the steps of the ITSS grant work originally appeared in the original 2018 project proposal to the National Science Foundation. Revised versions have been a part of presentations and conference handouts throughout the grant's funding period.

SUBJECT MATTER EXPERTS

The "IT Skill Standards 2020 and Beyond" NSF project grant was powered by the Business and Industry Leadership Team (BILT) model that was developed by the NSF-funded National Convergence Technology Center. The BILT Model offers a dynamic and robust alternative to traditional business advisory councils that often only deliver passive approval of faculty-designed curriculum. The BILT Model, by contrast, puts businesses in a more active co-leadership role. This allows employers to provide direct input into the knowledge, skills, and abilities (KSAs) graduates need 12-36 months into the future, ensures curriculum stays current with workforce demands of the industry, and gets students "workforce ready."

The ITSS project recruited two groups of employers – Thought Leaders and Cluster Subject Matter Experts (SMEs). All of the employers were asked to look 12-36 months into the future when providing their expert feedback. Thought Leaders kicked the project off by identifying the most in-demand IT job clusters. This work spanned multiple meetings and ultimately included over 100 Thought Leaders. From there, Cluster SMEs were convened cluster by cluster across multiple meetings. Using the BILT Model's prioritization process, these Cluster SMEs voted on pro forma lists of KSAs plus also Tasks (KSA+Ts). Immediately after the vote, employers discussed the results to provide additional detailed feedback and job skills perspectives. ITSS staff synthesized the results of those multiple cluster meetings, which were verified by the Cluster SMEs. In addition to KSA+Ts, the Cluster SMEs answered questions related to Key Performance Indicators and Employability Skills.

The work of the ITSS project would not have been possible without these business leaders donating their invaluable time and expertise.
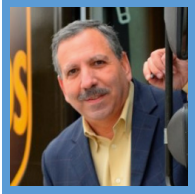
The process for creating this work was collaborative, thoughtful, and creative. The dedicated individuals involved were true thought leaders with deep insight into the domain, needs, and trends. I'm proud to be associated with such a great group of dedicated people with a common goal of best preparing our future generations."

 - *Jack Levis, Consultant, ESP Logistics Technology*

It has been an honor to have contributed to this national movement that is helping shape the very fabric of IT education and employment standards, ushering in a new era of proficiency, crucial for empowering individuals with the skills needed to thrive in an ever-evolving digital landscape."

 - *Matthew Glover, Managing Director, Global CIO LLC*

The ITSS grant not only broadened the effective BILT Model but also introduced extra tools such as KPIs and SLOs for educators. The consistent, continuous need for well-matched workers persists, underscoring the importance of technical schools and community colleges working hand-in-hand with industry."

 - *Kim Yohannan, Education Manager – Americas East & EMEA, Alteryx*

The alchemy of sharing and developing crucial aptitudes, performance indicators, and employability skills has not only shaped countless college programs but also sculpted destinies, igniting the careers and lives of our student graduates, seeding a future brimming with promise and possibility."

 - *Aaron Burciaga, Chief Technology Officer, MNLY*

The ITSS Grant established an engaging platform for thought leaders to convene, fostering vibrant discussions and debates about the skills workforce ready graduates need. Our conversations were robust but laser-focused, aiming to deliver practical and applicable models. Together, we crafted a robust outline that I am confident will significantly benefit the next generations of students, educational institutions, and businesses alike."

 - *Shelly Gore, Cloud ERP Architect and Netsuite Manufacturing Expert, A Bigger View*

Clockwise from top left: Employer SMEs discuss entry-level skills at a 2019 technical project management job cluster meeting; Ann Beheler leads a 2023 job cluster meeting in Frisco, TX; employer SME Ferdi Serim (r) shares his perspective on the results of a KSA vote at a 2019 job cluster meeting; employer SMEs discuss infrastructure KSAs in 2019; an employer SME reviews the KSA list at a 2023 job cluster meeting in Frisco, TX; employer SMEs Justin Edwards (l) and Daniel Cannon (r) network at a 2019 job cluster meeting; employer SME Glenn Wintrich considers his KSA vote during a 2019 infrastructure job cluster meeting; employers and educators gather in a classroom in 2019 to discuss the vote on entry-level job skills.

SME IMPACT METRICS

265 total employers

187 cluster meeting SMEs

142 Thought Leaders

64 participated both as a Thought Leader and a cluster meeting SME

30 states (plus Washington DC) and two foreign countries

53 total meetings spanning 139 hours

8 Thought Leader meetings (more than 15 hours)

33 KSA + Task cluster meetings (more than 108 hours)

12 cluster verification meetings (more than 15 hours)

SUMMITS

The "IT Skill Standards 2020 and Beyond" NSF project grant hosted six special "ITSS Summit" three-day workshops in 2023 and 2024 - one online (December 2023) and five in person (April 2023, October 2023, March 2024 at Collin College; April 2024 in Seattle, Washington; and June 2024 in Alexandria, Virginia) with educators from 45 schools across 21 states. The Summits were designed both to showcase ITSS products and to teach the process by which those products were developed, allowing attendees to create – and use – their own employer-led, future-facing technical skill standards. Summit attendees were encouraged to register as teams of at least one faculty member and one administrator to increase the likelihood of institutional adoption of ITSS resources and practices.

The Summits – which featured a number of hands-on, interactive exercises – walked attendees through the entire ITSS process, starting with strategies to recruit employer subject matter experts and developing successful "elevator pitches" and ending with best practices for updating curriculum using employer feedback. Summit teams spent the last morning of the workshop presenting their customized "action plans" – a list of concrete goals they intended to pursue at their home school.

In addition to longitudinal checks on the progress of the Summit attendee action plans (e.g., the April 2023 Summit cohort was contacted in November 2023 to track the status of their goals), 2023 Summit attendees were offered the chance to participate in a free mentoring program, whereby ITSS grant staff would discuss one-on-one with each team every 4-6 weeks how to best pursue their action plan goals.

66 As a technical college, it is crucial to not only stay informed of industry workforce needs but to strengthen relationships with industry partners. The Summit provided in-depth training from preparation to engagement to sustaining win-win relationships with industry partners. As a result, students will benefit from both the industry partnerships and relevant and quality curriculum."

- Katie Robinson, Associate Vice President of Curriculum Quality and Alignment Operations, Texas State Technical College

66 Learning the BILT Model and getting access to three ITSS skill standard documents (Tasks and KSA+Ts, Employability Skills, and Student Learning Outcomes) on the "Data Analytics and Predictive Modeling" job cluster have prepared me to begin knowledgeable conversations with the Dean of Workforce and the coordinator of Career Advising and Job Placement. Our goal is to establish a Data Analytics Advisory Board of Subject Matter Experts in our community and improve our newly established Data Analytics program."

- Leezet Llorance, Data Analytics Professor, Lone Star College

66 The ITSS Summit workshop offered effective training and useful strategies for our institution to improve enrollments, expand connections with local businesses, and ensure our students graduate with the knowledge, skills, and abilities to give them a competitive advantage on the job market."

- Kyle B. Carpenter, Ph.D., Associate Vice Chancellor of Academic Affairs, History Instructor, University of Arkansas Rich Mountain

66 I was very pleased with the training I received at the ITSS Summit. The instruction was presented in perfect form and very worthwhile and valuable. In fact, it was one of the most useful professional development events I've attended. My training will definitely be put to good use as I move forward with my Low Voltage and Construction Management programs."

- Alan W. Mullenax, Program Director, Electrical – Low Voltage, Construction Management, Palm Beach State College

66 While attending ITSS' "Employer Engagement" track at Winter Working Connections, I experienced multiple revelations about how the information provided could help me increase employer engagement with one of the programs I am responsible for. I am looking forward to breathing life back into my Advisory Board, implementing the concepts I learned in the three-day session. I am also grateful to have the continued support of the ITSS team to help guide me through this revitalization."

- Faith Bryant, Work Experience Coordinator -School of Technology, Daytona State College

Clockwise from top left: Educators from Johnston Community College (NC) pose with "ITSS Summit" instructor Ann Beheler in 2023; "ITSS Summit" attendees play human bingo as a workshop icebreaker; Christina Titus leads a virtual version of the "ITSS Summit" in 2023; educators from Amarillo College (TX) develop their "ITSS Summit" action plans; educators from Houston Community College (TX) in 2024 prepare to present their action plan; educators in 2024 participate in the marshmallow challenge leadership activity; Rajiv Malkan from Lone Star College (TX) explains how he developed student learning outcomes for ITSS; educators in 2023 participate in the marshmallow challenge leadership activity.

SUMMIT METRICS

6 "Summit" events – 5 in person, 1 online

80 total "Summit" contact hours

115 attendees from 45 schools across 21 states

34 team action plans submitted consisting of 106 goals

94% (n= 51) "strongly agree" or "agree" with statement "I am confident I can implement our action plan"

10 teams participated in optional mentoring

37 individual 1:1 team mentor meetings

87% (n=31) mentored team action plan items completed

CASE STUDY

Dr. Brenden Mesch
Technical Campus Provost, Collin College

We used the IT Skill Standards material for "Software Development" as the basis for developing a new Bachelor's of Applied Technology degree in software development. Most of these knowledge, skills, and abilities items were included in the analysis, but we also used an industry team to enhance the list for Junior and Senior level classes.

The state of Texas has adopted ITSS' skill standards for software development. This was the first time that a state-recognized skill standard was used at Collin College to create a new degree. One key piece is that this becomes a resource for many stakeholders to develop programs with a greater sense of consistency in the KSAs. We know that students do not always complete degrees at the college that they started, so having that consistency among colleges in a region or state makes it more likely that credits will transfer. Additionally, the resource becomes a tool for secondary educators to understand what is happening at the post-secondary level as a reflection of industry-driven skill standard development.

We also worked with employers on a survey-based ranking system for KSAs to determine the most important elements to integrate into the new bachelor's degree. Many of these high-ranking items were also consistent with a deep dive analysis into job descriptions for positions in software development. The use of the ranking system was derived from ITSS, but we used Microsoft Forms as the vehicle instead of a Google platform with great success.

We most definitely believe that the work of the IT Skill Standards project sped up our curriculum development process and ensured that we were focused in the right areas so the graduates are well prepared for career success. While our programs are mandated by the Texas Higher Education Coordinating Board to have advisory committees, it was valuable to have the ITSS resources a national level view to help validate KSAs and understand why there might be a regional need in the Dallas Fort-Worth area.

CASE STUDY

Joey Bryant
Professor, IT-Data, Web, and Software Development, Department Chair– IT-Programming & Software Development, Forsyth Technical Community College

The ITSS process really opened up my eyes. We've always had advisory board members, but this was a different level for us. Learning the difference between BILT and traditional advisory boards led me to get a BILT started here within my department. We're also working on another. Learning the KSA voting and discussion process – what's worked, what hasn't worked, how to look at the curriculum to find out what should we have in our program versus what should not be in there – has provided us a better way to serve our students. Understanding how our advisory board can better lead us in an everchanging technology world has allowed them to give us excellent advice. Keeping open lines of communication helps us get support when we need something from our employers.

"Project Management" is the one we started with. We've already seen a really good response. We were able to go to our advisory board members and say to them "Hey, this is a great opportunity to help drive what we're teaching, drive how our department is moving." And so we're getting good feedback from business and industry, which has driven changes in the curriculum. We're strengthening and adjusting what we teach, what tools students learn in project management, and what certifications we offer to better boost their ability to find employment.

This is a model I think all community colleges would benefit from because it really brings the employers in and lets them see what an associate's degree graduate can do for their company. They're saying "Hey, you're teaching them all of this so let's go ahead and get them employed." I think that is huge for community colleges to get past the stigma of "it's just an associate's degree." We're teaching the actual technical knowledge that they need on the job and I think that's opening the eyes in our community.

CASE STUDY

Muna Saqer, Ph.D
Program Director of Computer Science, Wharton County Junior College

The work of the "IT Skill Standards 2020 and Beyond" project has significantly impacted Wharton County Junior College's IT programs. These skill standards provide an outline for colleges to update and advance these programs by confirming they align with the current industry requirements and trends. By adopting the ITSS process, WCJC curriculum programs can better prepare students for the job market by equipping them with the necessary skills and knowledge.

Specifically, our IT program had four AAS tracks and one certificate but they all suffered from low enrollments. After adopting the ITSS process and using their skill standard materials, our BILT worked with us to completely change the program. We created a new AAS degree and three new certificates that launched in Fall 2024. The employers on our BILT evaluated the goals of the curriculum, established workplace competencies for the program, suggested revisions, identified local businesses/industries that could benefit the program and students, and even assisted in promoting and publicizing the program to community and business leaders. Next we'll be looking at improving our Data Analytics and Digital Communication programs.

The "ITSS Summit" also helped WCJC administrators understand the student learning outcomes and link them with current job tasks and requirements. WCJC's administrators can therefore help students gain a competitive edge in the job market. Because employers are looking for candidates with the skills outlined in the ITSS skill standards, I believe students who graduate from programs that follow the ITSS process – and the BILT Model of employer engagement – are more likely to be hired by employers.

CASE STUDY

Linda Muñoz
Dean of Employer Engagement and Experiential Learning, Amarillo College

I brought faculty with me to the "ITSS Summit" meeting. What I needed to do was to energize my faculty. I was already convinced that the BILT Model worked. I had already done some of the training. But when my faculty got fired up and then they took it home and fired up others, getting them to buy in on the ITSS process—that was better than me trying to do it myself as the Dean.

Two programs (Commercial Driving License; Construction) are on board now with the ITSS process and the BILT Model. Construction had already something, but I don't think they fully understood what they were doing. Now they do. The Construction program manager – who attended the "ITSS Summit" – gets it. And now he's the chair of Manufacturing, so he's over all the programs and he's influencing all of those other coordinators to better understand the ITSS Process. Have we made any changes yet to student level outcomes or anything like that? No, we're not there yet, but I think just being able to get the faculty on board on what the BILTs are and what that process is going look like to ultimately improve industry engagement – all of that is so important. We had a KSA vote already for Construction and while we only had seven employers, they liked the process. They liked the conversation. It's a close-knit community, so everyone had suggestions of who else should be invited to the meeting.

We're working to make these employer meetings relevant and industry-led. We're not going to just have the faculty report out. Now, we do have programs that are still there, that are still just reporting out. We're not 100% there yet. But we're a lot further along this year than we were last year before we attended the "ITSS Summit."

CASE STUDY

Becky Callister
Director of Career
and Technical
Education,
Snow College

The "ITSS Summit" encouraged us to engage with businesses. The workshop provided us best practices and strategies – creating the elevator pitch, developing the action plan goals – that we found very helpful. And so we went to visits with employers. Not just a phone call, not just an email; we went and visited them in person. We started by visiting our current advisory board members, then we started the process of trying to reach out to additional businesses to include them.

We've already had our first employer orientation meeting following the ITSS process and the BILT Model. Reaction from the businesses was very positive. In fact, this year, when we've gone out to visit different industries, and we've been to several different industries a couple of times by this point, the employers are asking "So when is this meeting?" They want to make sure they're there. They're excited because they want to have a say in what we need. "We need technicians and this is how skilled we want them when they come to us."

As a result of ITSS, other programs at Snow College are now interested in learning what BILT really is. They're asking "How do we approach our advisory boards? What do we do?" Instructors who attended ITSS last year are messaging out with other faculty, while I'm messaging on the administrator side. I have no doubt the BILT Model will give value to our programs, curriculum and certificates.

This is the interesting part: I work with the Central Region CTE Consortium, and high school CTE directors from 12 school districts. They attended a recent KSA voting meeting to learn more about the BILT. One of our District CTE Directors said "The BILT members definitely had a more invested interest in this KSA meeting because their input was valued and appreciated. I am excited for my high school teachers to observe this meeting next year. They will definitely see the value." Our goal is to create stronger partnerships between K12, Snow College and industry. BILT is the missing link! Allowing high school faculty to see the voting process and listen to industry discussions will motivate high school teachers to stay current and relevant in the curriculum they teach. This will create stronger pathways from K12 to Snow College to industry.

BILT speaks for itself! There's not much to a "typical" advisory board, when you compare it to what the BILT Model provides.

IT SKILL STANDARDS 2020 AND BEYOND

WORKING WITH BUSINESS AND INDUSTRY TO UPDATE NATIONWIDE IT SKILL STANDARDS

THE GOAL

Widen the pipeline of qualified IT workers by creating a future facing set of skill standards for the most critical IT job clusters.
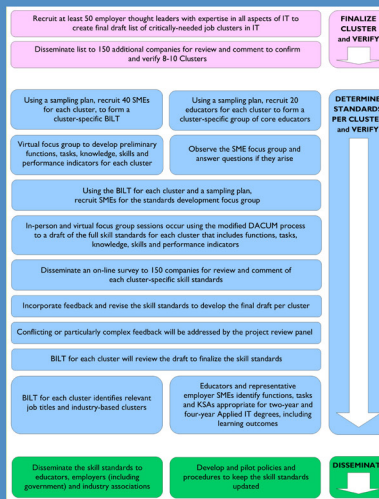
https://www.thesalesexperts.com/5/

Thousands of IT technician jobs going unfilled.

Job category	Postings Sep 18-Feb 19	Unfilled jobs Sept 18-Feb 19	Projected change through 2026
Business Intelligence Analyst	31,141	~50%	9.3%
Computer Support Specialist	108,509	>40%	11.3%
Cyber/Information Security Analyst	71,935	>45%	28.5%
Database Administrator	51,863	>50%	11.5%
IT Project Manager	93,092	>40%	9.3%
Network Administrator	56,892	>60%	6.1%
Network Engineer/Architect	76,707	>40%	6.5%
Software QA Engineer/Tester	63,179	>50%	9.3%
Systems Analyst	76,707	>35%	9.1%

Data courtesy Labor Insights tool from Burning Glass Technologies

THE PROCESS

Use IT industry subject matter experts to identify the job clusters and then create the knowledge, skills, and abilities for those clusters.

Recruit at least 50 employer thought leaders with expertise in all aspects of IT to create final draft list of critically-needed job clusters in IT

Disseminate list to 150 additional companies for review and comment to confirm and verify 8-10 Clusters

FINALIZE CLUSTER and VERIFY

Using a sampling plan, recruit 40 SMEs for each cluster, to form a cluster-specific BILT

Using a sampling plan, recruit 20 educators for each cluster to form a cluster-specific group of core educators

DETERMINE STANDARDS PER CLUSTER and VERIFY

Virtual focus group to develop preliminary functions, tasks, knowledge, skills and performance indicators for each cluster

Observe the SME focus group and answer questions if they arise

Using the BILT for each cluster and a sampling plan, recruit SMEs for the standards development focus group

In-person and virtual focus group sessions occur using the modified DACUM process to a draft of the full skill standards for each cluster that includes functions, tasks, knowledge, skills and performance indicators

Disseminate an on-line survey to 150 companies for review and comment of each cluster-specific skill standards

Incorporate feedback and revise the skill standards to develop the final draft per cluster

Conflicting or particularly complex feedback will be addressed by the project review panel

BILT for each cluster will review the draft to finalize the skill standards

BILT for each cluster identifies relevant job titles and industry-based clusters

Educators and representative employer SMEs identify functions, tasks and KSAs appropriate for two-year and four-year Applied IT degrees, including learning outcomes

Disseminate the skill standards to educators, employers (including government) and industry associations

Develop and pilot policies and procedures to keep the skill standards updated

DISSEMINATE

THE CURRENT STATUS

Following four February-March "thought leader" meetings to identify the clusters, the national clusters meetings for "Infrastructure" have started.

IT Job Clusters
1 Data Analytics and Predictive Modeling
2 Data Management and Engineering
3 Infrastructure Connectivity, Management & Engineering
4 Security
5 Software Development
6 Technical Project and Program Management
7 Technical Support
8-10 TBD

The first "Infrastructure" meeting held May 14, 2019.

FOR MORE INFORMATION

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Suzanne Ames, suzanne.ames@lwtech.edu

Central U.S.
Ann Beheler, abeheler@collin.edu
Deborah Roberts, droberts@lonestar.edu

East Coast
Gordon Snyder, gordonfsnyder@gmail.com
Peter Maritato, maritap@sunysuffolk.edu

This ITSS overview poster was presented at the June 2019 American Society for Engineering Education (ASEE) conference in Tampa, Florida.

ITSS DISSEMINATION

ITSS employed a number of tools to disseminate materials, best practices, and processes.

The **public website** offered links to the employer-led skill standard products (KSA+Ts, key performance indicators, employability skills, and student learning outcomes) as well as general overviews of grant goals and processes. Visitors interested in the products filled out a short online form to permit longitudinal follow-ups for measuring use and impact of the products.

YouTube provided a platform to share overview webinars, many of which were repurposed 2020-2022 conference sessions when COVID converted in-person events to virtual ones. One three-minute video – created for the National Science Foundation-funded STEM for All Video Showcase – featured testimonials from employers and educators.

In 2022, ITSS produced a small informational **brochure booklet** that was mailed to over 1000 schools across the country to raise overall awareness about the project, promote the skill standard products, and extend an invitation to an overview webinar. The brochures provided a key role in dissemination for the remainder of the grant.

National and regional educator **conferences** ultimately provided the most effective avenue to disseminate materials, best practices, and processes. Conference dissemination typically featured traditional lecture presentations and exhibit hall booths, but ITSS also hosted two half-day workshops at the 2024 HITEC conference that provided a deeper dive into ITSS process with hands-on exercises and group work. ITSS also published papers and presented posters at two American Society for Engineering Education (ASEE) conferences.

DISSEMINATION IMPACT METRICS

43 conference appearances (workshops, presentations, exhibit halls) in 13 states plus Washington DC

12 of those 43 conference appearances were virtual
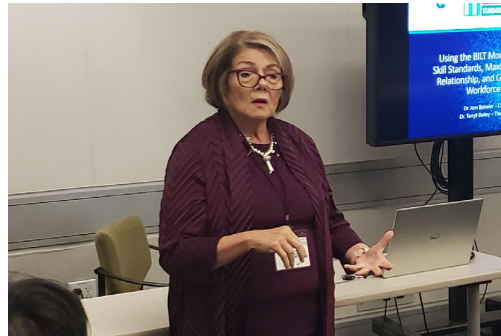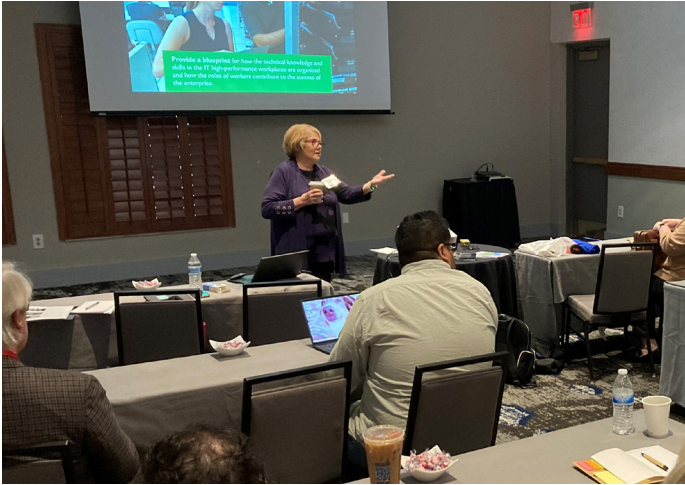
222 KSA "test votes" cast by conference session attendees

8 professional development webinars

14 YouTube videos

1123 online views "STEM for All" showcase video

2562 informational brochures mailed to 1087 schools across 50 states

1586 total skill standard product downloads, including 381 complete product packets

Clockwise from top left: Pete Maritato explains ITSS to an educator at the 2023 ATE Principal Investigators conference in Washington, DC; Ann Beheler and employer SME Matt Glover discuss ITSS at the 2023 NCPN conference in Charlotte, NC; Pete Maritato presents at the 2019 HITEC conference in St. Louis, MO; Ann Beheler (l) leads an ITSS session at the 2019 Innovations conference in New York City; Ann Beheler (l) and Terryll Bailey present on ITSS at the 2019 HITEC conference in St. Louis, MO; Ann Beheler presents at the 2024 WASTC conference in San Jose, CA; Christina Titus explains the KSA vote at the 2024 TCCTA conference in Frisco, TX; Ann Beheler leads a presentation at the 2024 TACTE conference in Grapevine, TX.

STAFF QUOTES

66 Work done through this grant answered a call to address the fact that colleges have been basing curriculum upon skills that had not been updated on a national level since 2003. Hundreds of business partners across the nation graciously donated hours of their time to help us identify key skills that they are looking for in IT new hires. Many of them quickly saw the value in these meetings and signed up to attend more than one meeting and often ended up engaged in lively skills discussions with competitors."

- Helen Sullivan

66 The project has forged a beneficial partnership between businesses that understand key IT skills and educators who are responsible for shaping a curriculum that imparts these skills. Students are the ultimate beneficiaries, graduating with "workforce ready" knowledge and positioning them for success in the competitive field of information technology. The project's holistic approach ensures graduates possess both theoretical and practical skills."

- Gordon Snyder

66 KSA+Ts and SLOs developed for each of the seven IT fields will provide a head start to colleges in modifying existing curriculum or developing new ones for future IT workforce in their region. ITSS has provided a tremendous resource for providing graduates with the right skills to address the IT workforce employability needs."

- Rajiv Malkan

66 Working closely with employers has always been a cornerstone of the ITSS grant. A brief conversation with an employer at one of our earliest meetings sparked an innovation in how we tally employer votes. I'm very proud of our ability to pivot – with some trial and error – from cumbersome manual counting of raised hands to an automated, online voting method that's made meetings run faster and more efficiently."

- Christina Titus

66 The ITSS grant provides two invaluable resources to educators. There's the job skill material, developed with the expertise of the employers. Then there's also this structured process that we used to develop that material. I sometimes think of it as ITSS offering educators a two-for-one deal."

- Mark Dempsey

OUTPUTS

The "IT Skill Standards 2020 and Beyond" NSF project grant developed four output items, or "products," for each IT job cluster.

Employer SMEs created three outputs:

1. The Tasks, Knowledge, Skills, and Abilities (KSA+Ts) were developed with a focus 12-36 months in the future for an entry-level employee working in that specific cluster.

Tasks: Specific things an entry-level person would be expected to perform on the job with little supervision.

Knowledge: Knowledge focuses on the understanding of concepts. It is theoretical. An individual may have an understanding of a topic or tool or some textbook knowledge of it but have no experience applying it. For example, someone might have read hundreds of articles on health and nutrition, many of them in scientific journals, but that doesn't make that person qualified to dispense advice on nutrition.

Skills: The capabilities or proficiencies developed through training or hands-on experience. Skills are the practical application of theoretical knowledge. Someone can take a course on investing in financial futures and therefore has knowledge of it. But getting experience in trading these instruments adds skills.

Abilities: Abilities have historically been used to describe the innate traits or talents that a person brings to a task or situation. Many people can learn to negotiate competently by acquiring knowledge and practicing the required skills. A few are brilliant negotiators because they have the innate ability to persuade. In reality, abilities may be included under skills or may be separated out.

2. Key Performance Indicators (KPIs), also referred to as "Performance Characteristics," answer the question, "How do we know when a task is performed well?" and were developed from the "Tasks" portion of the KSA+Ts.

A search was performed to locate validated/verified KPIs for technician-level work in IT fields. Sources included the Texas Skill Standards System, the National Skill Standards Board, and the National Institute of Standards and Technology. The identified KPIs were then cross-referenced to the tasks for the ITSS job clusters. They were reviewed and revised by the same subject matter experts who developed the tasks and KSA+Ts for the cluster in a structured, facilitated verification session.

3. Employability Skills are essential for every IT job and are based on the work's requirements. SMEs were offered three clearly defined "proficiency levels" for each employability skill. The proficiency scale is defined as Level 1 – basic, Level 2 – intermediate, and Level 3 – advanced. The levels are cumulative, so a "Level 3," for example, assumes the employee can perform all characteristics of "Level 1" and "Level 2."

For each employability skill, SMEs selected the competency level that best aligned with what would be expected from an entry-level worker for the job cluster.

Educator SMEs created the fourth output:

4. Student Learning Outcomes are for use in the creation of curriculum to help define what the students will know and be able to demonstrate. Each SLO can be observed, measured, and demonstrated.
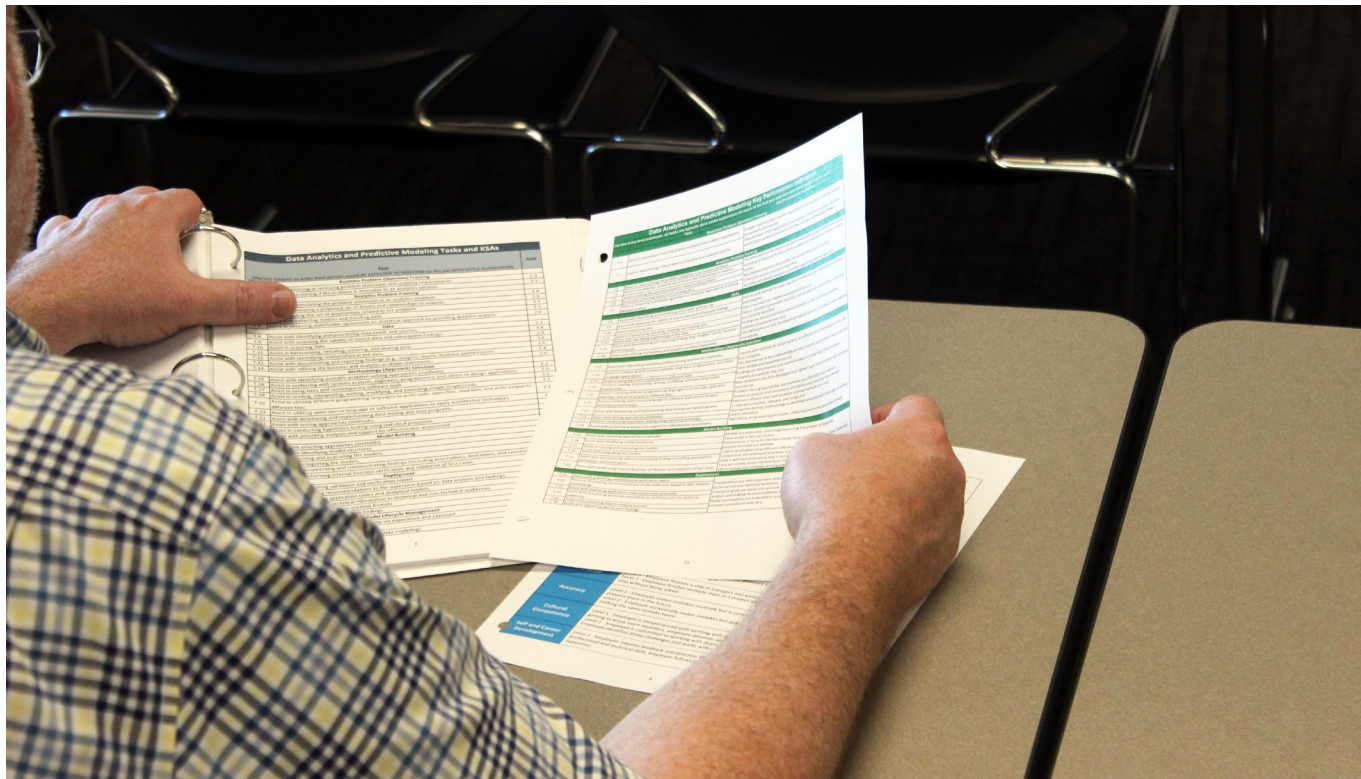
EVALUATOR REMARKS

Dr. Deborah Hecht
Director of the Center for Advanced Study in Education at the Graduate Center of the City University of New York

The "IT Skill Standards 2020 and Beyond" external evaluation used formative and summative evaluation to document and assess how the project was implemented, whether it was meeting its goals and benchmarks, the outcomes and impacts of the work, and the decision-making processes involved in achieving these goals. Formative and summative evaluation feedback was used to guide data-driven programmatic decisions and optimize successes.

The multi-method evaluation collected and analyzed quantitative data (e.g., website analytics, KSA prioritization ratings, project metrics, survey data) and qualitative data (e.g., observations, interviews, document reviews.) Data were collected from multiple stakeholders before, during, and after project activities. Data analytics identified and described common themes across sources, examined the context in which activities occurred, and empirically examined changes and group differences. Including multiple stakeholder perspectives and varied data sources allowed for triangulation and increased confidence in the findings. Evaluation feedback was ongoing throughout the-planning and delivery of project activities.

ITSS successes

- The BILT Model approach successfully used.

- IT job clusters identified by a national group of employer-thought leaders.

- IT Skill Standards, Key Performance Indicators, Student Learning Outcomes, and critical employability skills identified and validated by over 200 industry experts from large and small companies.

- The employer-validated materials received positive feedback from employers, faculty, and state curriculum representatives.

- The BILT-like process for engaging employers shared through professional development for educators, administrators, and industry partners.

- The IT skills standards, resources, and processes were shared with thousands of stakeholders through conferences, workshops, and online channels.

Insights gained

- Input from employers and educators was crucial.

- Thoughtful facilitation optimized employer participation.

- Effective recruitment of employees often required personal connections and ongoing communication.

- Employers involved in reviews and validation needed to represent a national and diverse group.

- A project team with diverse expertise, experience, and networks helped when recruiting employers and distributing the standards.

- Virtual convenings required shorter, more focused meetings. In-person meetings provided for more community building.

- Recruiting employers to review and refine the standards became more challenging over time, particularly as in-person meetings replaced COVID-required virtual meetings.

- Ongoing updates of standards in rapidly changing fields is needed but challenging.

Table 5. SMEs feedback about the KSA+Ts meeting (n=45)

Characteristics of the meeting	Level of Agreement				Mean
	Strongly disagree (1)	Disagree (2)	Agree (3)	Strongly agree (4)	
Important KSAs were addressed during the meeting	1 (2.22%)	0 (0.00%)	20 (44.44%)	24 (53.33%)	3.49
The meeting attendees were representative of employers in the job cluster	1 (2.22%)	1 (2.22%)	23 (51.11%)	20 (44.44%)	3.38
There was adequate time for discussion	0 (0.00%)	5 (11.11%)	25 (55.56%)	15 (33.33%)	3.22
Different opinions were respected and welcomed	0 (0.00%)	1 (2.22%)	18 (40.00%)	26 (57.78%)	3.56
The meeting was well facilitated	0 (0.00%)	0 (0.00%)	16 (35.56%)	29 (64.44%)	3.64
The voting process was easy	0 (0.00%)	1 (2.27%)	19 (43.18%)	24 (54.55%)	3.52
It was important to spend time discussing employability skills	0 (0.00%)	0 (0.00%)	18 (40.00%)	27 (60.00%)	3.6
Being able to participate virtually was important to me	0 (0.00%)	5 (11.11%)	13 (28.89%)	27 (60.00%)	3.49
The meeting was relevant for my own work	0 (0.00%)	2 (4.44%)	25 (55.56%)	18 (40.00%)	3.36

This table from Dr. Hecht's 2021 report provides an example of the level of evaluation detail she provided. Here, she summarizes results from employer SME surveys.

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Thank you to the 188 other employers we do not have permission to name.

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Patrick Logue
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RESOURCES

Visit bit.ly/ITSSLegacy to access resources, including:

ITSS "Resources" Booklet
Best Practices for Developing Future-Facing Technical Skill Standards

"Data Analytics and Predictive Modeling" Job Cluster Products
Updated 2023 (KSA+Ts, Employability Skills, Key Performance Indicators, Student Learning Outcomes)

"Data Management and Engineering" Job Cluster Products
Updated 2024 (KSA+Ts, Employability Skills, Key Performance Indicators, Student Learning Outcomes)

"Infrastructure Connectivity Management and Engineering" Job Cluster Products
Updated 2023 (KSA+Ts, Employability Skills, Key Performance Indicators, Student Learning Outcomes)

"Software Development" Job Cluster Products
Updated 2023 (KSA+Ts, Employability Skills, Key Performance Indicators, Student Learning Outcomes)

"Technical Project Management" Job Cluster Products
Updated 2023 (KSA+Ts, Employability Skills, Key Performance Indicators, Student Learning Outcomes)

"Technical Support" Job Cluster Products
Updated 2023 (KSA+Ts, Employability Skills, Key Performance Indicators, Student Learning Outcomes)

"Cybersecurity" Skillset Products
Created 2022 (Knowledge Areas)

ITSS Process Timeline