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AN ACADEMIC DIVISION OF THE CYBER INNOVATION CENTER

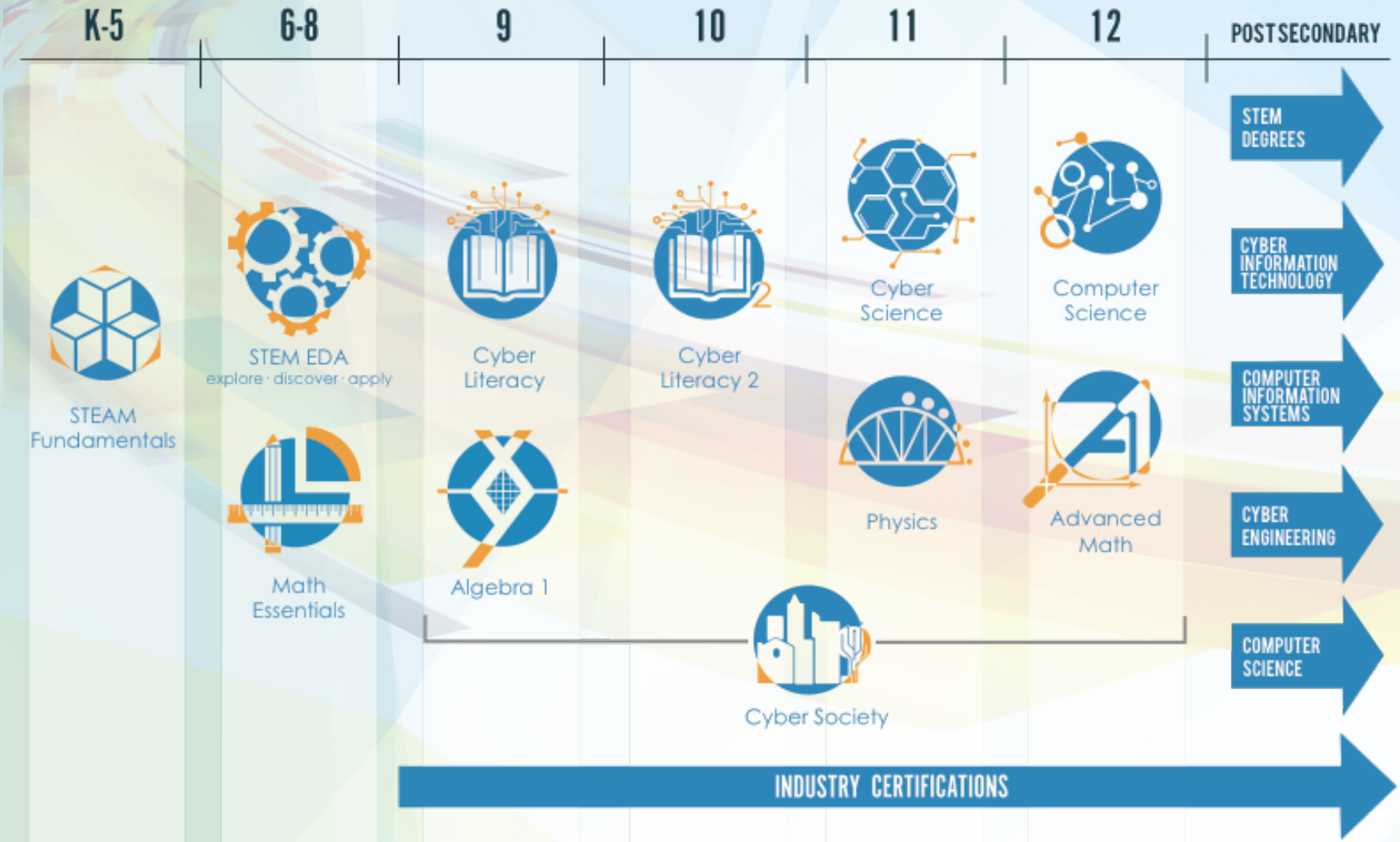
NICERC's Cyber Interstate: The Next Generation of Cyber Worker can be Found at the Intersection of Classroom Content and Teacher Support

June 11, 2018

Building the Nation's Cyber Interstate

- Foster integrated curricular experiences across multiple disciplines in primary, secondary, and post-secondary environments.
- Promote a culture of educational innovation across a network of college and K-12 faculty around the nation.
- Develop the nation's cyber workforce through the creation and enhancement of STEM and cyber educational opportunities for teachers and students.
- Create and nationally disseminate innovative practices in education.
- Serve as a catalyst for future research in cyber education.
- Offer teacher professional development to ensure teachers are empowered to create a 21st century learning environment.

CYBER INTERSTATE™



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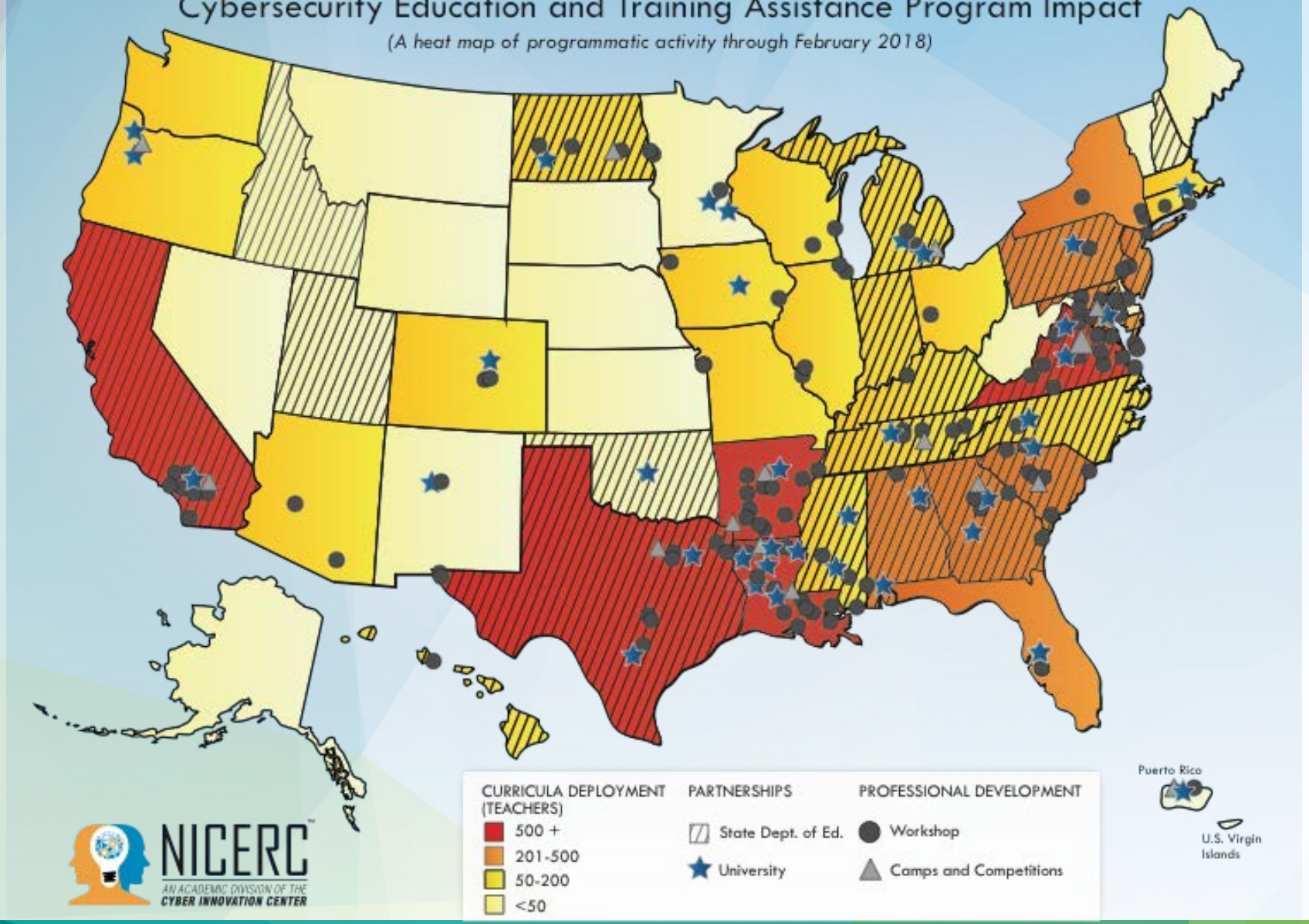
Cybersecurity Education and Training Assistance Program Impact

(A heat map of programmatic activity through February 2018)



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NICERC Curricula Overview

- **Modular** format provides maximum flexibility for teachers
- Student engagement and learning improved through NICERC's **project driven lessons**
- Infusion of **cyber context** promotes **STEM, Cyber and Computer Science awareness** into daily instruction
- Builds **STEM, Cyber and Computer Science foundation** essential for future **cyber professionals**
- "**Soft Skill**" development integrated into lessons
- Maps to **national standards**
- Links to **industry certifications**
- Increases preparedness and participation in **cybersecurity education** and **cyber degree** programs

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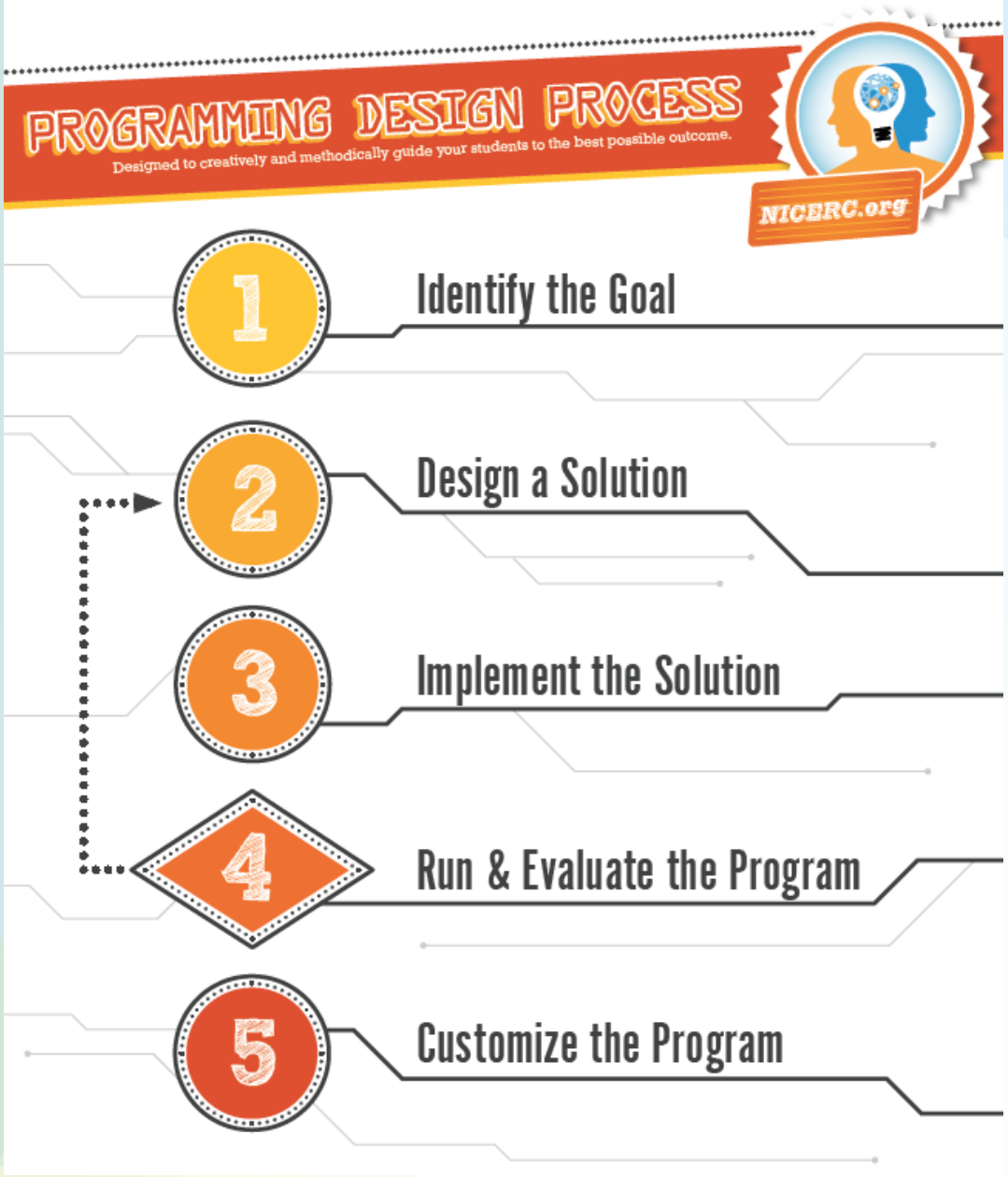
Identify the Problem
Research the Problem
Brainstorm Solutions
Choose a Solution
Create & Develop a Prototype
Test & Evaluate the Prototype
Improve & Redesign
TM

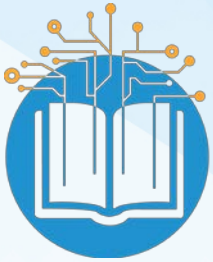

PROGRAMMING DESIGN PROCESS
Designed to creatively and methodically guide your students to the best possible outcome.
NICERC.org
1
Identify the Goal
2
Design a Solution
3
Implement the Solution
4
Run & Evaluate the Program
5
Customize the Program

Introduction to NICERC content

- Modular, student-centered content
- Builds literacy across all STEM areas
- Introduces engineering by challenging students with real-world problems that have a variety of solutions
- In addition to solving engineering challenges, students engage in soft-skill development through team collaboration and research assignments
- Instead of the *Sage on the Stage*, the teacher becomes that *Guide on the Side* that students so desperately need. This increases student perception of responsibility and in turn, ability to self-advocate.

Module	Explore	Discover	Apply
Egg Drop	Protect a stuntman	Protect a skydiver	Airlift supplies
Volcano	Build a safety plan for nearby city	Design a city near a volcano	Build a scale model for movie set
Roller Coaster	Small scale design	Build within budget	Build within zone
Electricity	Cyber blackout	Civil War telegraph	Game design
Genetics	Genetic adaptation	Offspring probability	Eukaryotic cell design
Catapult	Physical modeling of slingshot game	Trebuchet tee launch	Multifunctional catapult game
Cars	Edible racecar - nutrition & physics	Rubberband parade float	Elastic eco-car
Music	Pan flute to unlock a music-keyed safe	Time machine instruments	HARP
Alternative Energy	Solar cooker	Planet colonization	Solar home heating
Earthquakes	Shake table design	Shake table II	Post event rebuild
Aerospace	VFW Gliders	Google XPRIZE	Kite design
Coding	LEGO Mindstorms	Scratch	HTML and CSS

Introduction to NICERC content



Cyber Literacy

- Hands-on curriculum
- Builds a strong cyber foundation
- Introduces cyber by blending robotics, programming, electricity, and elements of liberal arts
- Students learn about the opportunities, threats, responsibilities, and legal constraints associated with operating in cyberspace
- *Liberal Arts* illustrates real world applications and implications of computers and the internet in our society today. Students are challenged to intensely deliberate the historical and societal context of cyber.

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Virginia CyberCAMP 2016

An Introduction To Careers In Cybersecurity for Students and Teachers

Virginia Department of Education
Office of Career, Technical, and Adult Education

Introduction to NICERC content

- Non-technical cyber content
- Research and project-based content
- Includes many “ripped from the headlines” cyber discussion topics such as: Law, Politics, Terrorism, Ethics, Communities, Business, Artificial Intelligence
- Cyber Society modules are designed to enable teachers to use liberal arts concepts and ideas as an approach to increase cyber awareness among high school students

Introduction to NICERC content

- The Regional Autonomous Robotics Circuit (RARC) is a series of three robotics competitions for students in grades 3-12. The competitions build upon one another and allow students to showcase their STEM (science, technology, engineering, and math) and cyber skills by competing against other students in their division (elementary, middle and high school) in a series of integrated challenges.
- NICERC partners with community partners to bring RARC competitions to multiple regions across the country. School districts or organizations interested in hosting a competition, consider becoming a community partner!

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NICERC's Approach to PBL

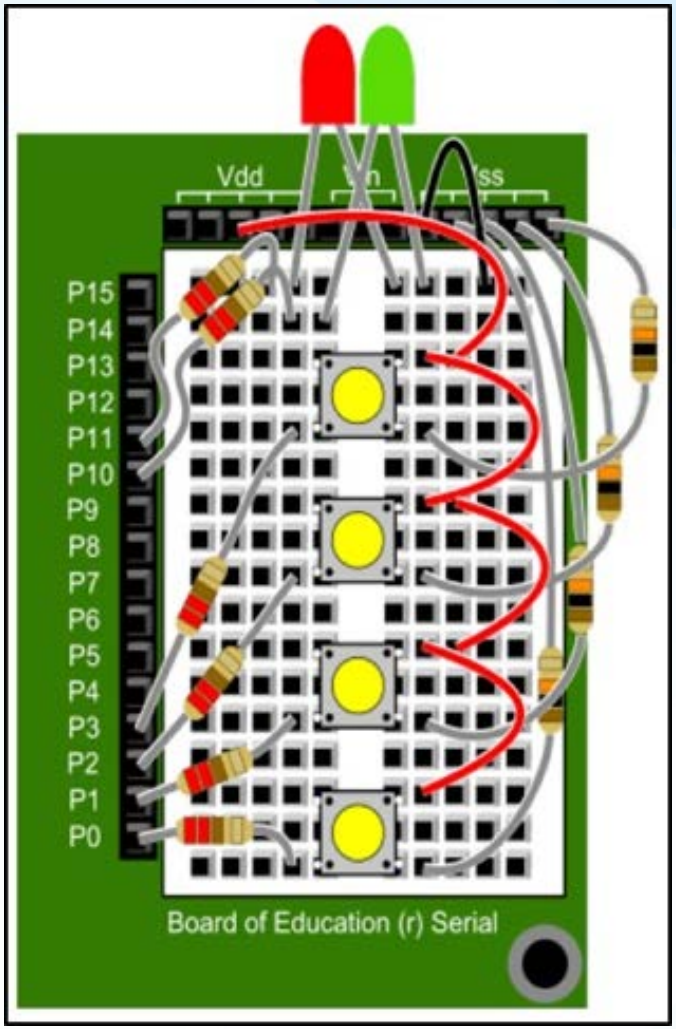
- A variety of studies have been performed over the last decade on the pros and cons of problem-based learning (Kostaris, Sergis, Sampson, Giannakos, & Pelliccione, 2017; Mishra & the Deep-Play, 2012; Navarrete, 2015; Niemel & Helevirta, 2017; Wirkala & Kuhn, 2011)
- Throughout the reporting on the topic, one thread that appears time and time again is that problem-based learning is beneficial to student engagement and retention

NICERC's Approach to PBL

- Wirkala and Kuhn define problem-based learning as "a teaching and learning method in which students engage a problem without preparatory study and with knowledge insufficient to solve the problem, requiring that they extend existing knowledge and understanding and apply this enhanced understanding to generating a solution" (2011)
- Navarrete defines it as an "authenticity of experience" (2015) that helps students make connections and provides satisfaction in the work that they do in the classroom

NICERC's Approach to PBL

- NICERC prefers to approach PBL from the perspective of a project rather than a problem



A Parallax BOE-Bot breadboard with sample Bank Vault circuit

NICERC's Approach to Soft Skills

- Many recruiting and job sites are caught up in the current buzz around employees lacking a credible set of soft skills (Brathwaite, 2017; Doyle, 2017; Lesonsky, 2017; Ward, 2017)
- Soft Skills include the ability to:
  - work well with others,
  - think critically,
  - organize your space and your thoughts, and
  - communicate with colleagues and supervisors
- Lesonsky observes that it's seemingly "easier to remedy a lack of hard skills than a lack of soft ones" (2017)

NICERC's Approach to PD

- "Today's teachers are faced with the challenge of educating digital natives, the technologically connected students of the 21st century" (Gardner, 2013)

- How many classrooms have under-utilized or even un-utilized technology?

NICERC's Approach to PD

- Studies show that teachers do not receive adequate preparation to use the technology, they lack the time to prepare to incorporate the technology into their classrooms and content, or the technology purchase just does not line up with the school's or student's specific needs
  - Carver, 2016; Clatworthy, 2014; Dickey, 2011; Hew & Brush, 2007; Katehi, Pearson, & Feder, (Eds.), 2009; Kostaris et al., 2017; Mishra, 2012; Navarrete, 2105; Niemel & Helevirta, 2017; Wirkala & Kuhn, 2011

NICERC's Approach to PD

- A school's decision to support teachers with technical support staff often results in less productive teachers as the teachers then come to rely on the support personnel to answer simple questions rather than gaining the self-confidence to solve even simple problems themselves (Hew & Brush, 2007)
- Students are scoring "higher than their teachers on all areas of accessing, managing, integrating, evaluating, and creating information", when it came to specific technology skill levels (Carver, 2016)

NICERC's Approach to PD

- The NICERC PD model flips the learning environment
  - Teachers are led through the content as if they were the learners in the classroom
  - They learn from subject matter experts who have taught the content in the classroom and can often provide classroom management insights
  - The intent of the PD model is not to make the teacher a subject matter expert - there's not enough time for that. Instead, get them confident enough to want to look around the next corner

The Teacher PD Experience

I liked that all materials are easily accessible and were not an additional charge. I loved that we got to go through the process ourselves in a structured environment before expecting our students to do it. It was very helpful to see experts conduct those lessons and give pointers and tips throughout. I feel I left with confidence to teach the lesson and experience to aid in problem solving within my classroom.

I loved how modules were presented in the same way they would be for the students but differentiation techniques we're also given. I also loved how the cyber situations were connected back to the core content.

I liked that the format of the workshop was divided into rapid, intense content presentations followed by extended periods of application, troubleshooting, and expansion.

Going through the modules like students help the instructor to understand the challenges and potential modifications required to fit her classroom.

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