Challenges of Moving Cybersecurity Curriculum

Competency Based Education
Hands-On to Online

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TSTC
Texas State
Technical College

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NSF Small ATE Grant

- TSTC Online Competency-Based Education (CBE) Project

- Grant #1901776
  - Award: 2019 through 2022
  - *"Develop and implement online competency-based programs"*
    - Cybersecurity
    - Architectural Design and Engineering Graphics (ADEG)
  - *"Focus on serving non-traditional students and individuals living in rural areas, populations that have less access to technical education programs"*

Cybersecurity Program

- **Cybersecurity**
  Associate of Applied Science
  (15 courses)

- **Digital Forensics Specialist**
  Advanced Technical Certificate
  (4 courses)

- **18 Faculty across 6 out of 10 TSTC Campus Locations**

- **Primarily Face-to-Face in 2019**

BRECKENRIDGE

MARSHALL

SWEETWATER

ABILENE

NORTH TEXAS

BROWNWOOD

WACO

WILLIAMSON COUNTY

FORT BEND COUNTY

HARLINGEN

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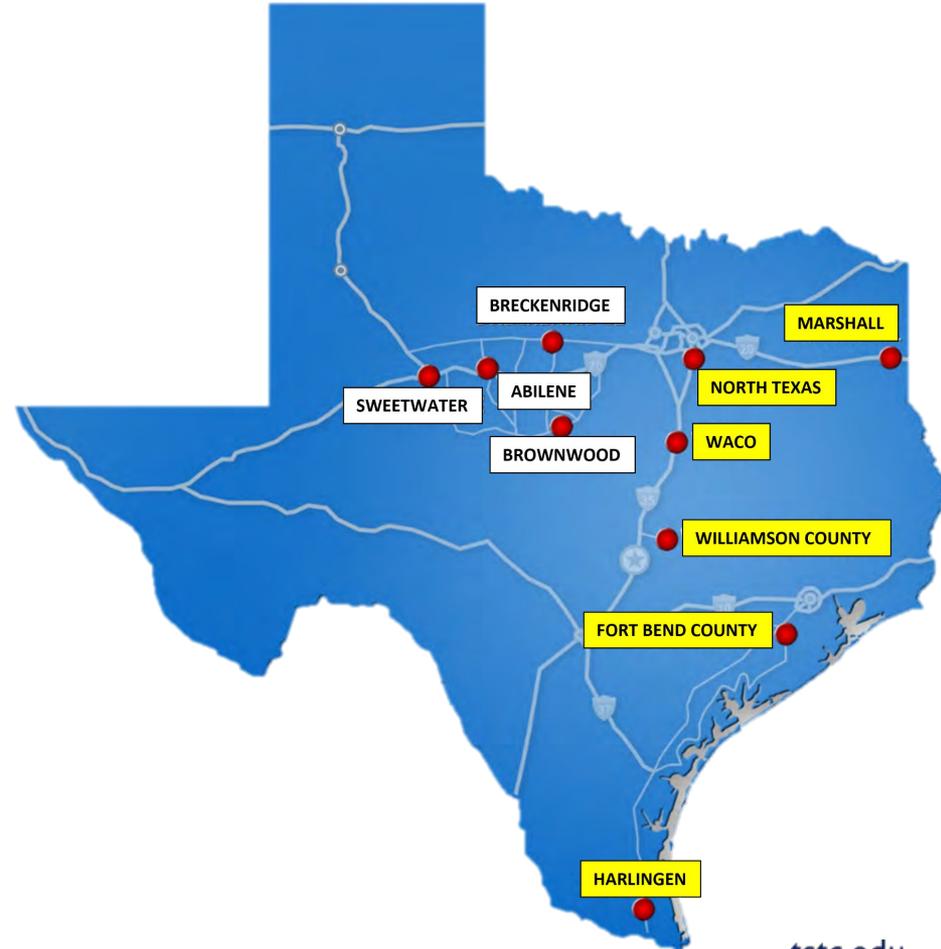
"Returned Value Formula" at TSTC

- Mission Statement
  - The Texas State Technical College System mission is published in Vernon's Texas Education Code Section 135.01
    - Place more Texans in great paying jobs!

- Unique "Returned Value Formula"
  - Success not measured by the number of students or training time, but on the placement of graduates in high paying jobs
  - State's funding allocation to TSTC and the individual campuses within the system calculation based on value that higher earnings from TSTC students add to the state economy
    - Employed in field (preferably in state)
    - Keeps employment for 3 years
    - Makes over minimum wage

Performance Based Education (PBE)

- Texas State Technical College's Competency-Based Education (CBE) initiative
  - **Cybersecurity [Pilot Program]**
- Focus on mastery of industry skills / competencies [employment]
  - Score of 80% or higher
  - Grades of A, B, or F
  - Multiple Assessments
- Self-directed
- Fully online or in a blended learning environment
  - Flips traditional lecture to online
  - Emphasis on hands-on learning in a technical lab environment

https://www.tstc.edu/performance-based-education/

- Move at a Flexible Pace
- Access Coursework Online
- Master the Skills
- Add Flexibility to Learning
- Enjoy Multiple Entry/Exit Points

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Performance Based Education (PBE)

PERFORMANCE-BASED EDUCATION (PBE) DEVELOPMENT PROCESS

Focus on mastery of specified industry skills or competencies

TSTC-Experienced Faculty
- 5+ years working in industry (technical)

Validated Industry Skills Standards
- Texas Workforce Investment Council
- NICE Framework/Center of Academic Excellence (CAE) – Cyber Defense (CD)

Industry Recognized Certifications
- Security+
- CHFI, ACE

Workforce Education Manual (WECM✻)

Industry-Based Advisory Board
- Calibrate, SkillsEngine

✻ Industry-established skill standards for Texas Workforce education career cluster

Course Competencies

Course Deconstruction— Course Matter Expert (CME)/ Subject Matter Expert (SME)
- Course Outline
  - Course Outcomes
  - Learning Objectives

Learning Journey
- Lesson (Competency)
- Assessment Preparation Activities
  - Skills-Building Hands-On Labs
  - Knowledge/Theory — Check for Understanding
- Mastery Assessment
  - Knowledge
  - Performance
- Module Progression
  - Self-directed (Acceleration possible)
  - Demonstrated Proficiency of Knowledge/Skills
  - Grading Policy
    - Mastery Met: A or B (80–100)
   - Mastery Not Met: Reteach/Reassess

Acceleration!

- COVID-19 - Spring 2020

- Conversion of all courses to Online after Spring Break!

Challenge #1: Finish SP20

Internet Connectivity - Student Access

- No Internet Access, Low speeds, Inconsistent (Satellite/Phone) connection, or Metered connections

- Solutions: Extended WiFi connection to parking lot, WiFi in public spaces (McDonald's), Grade of "Incomplete"
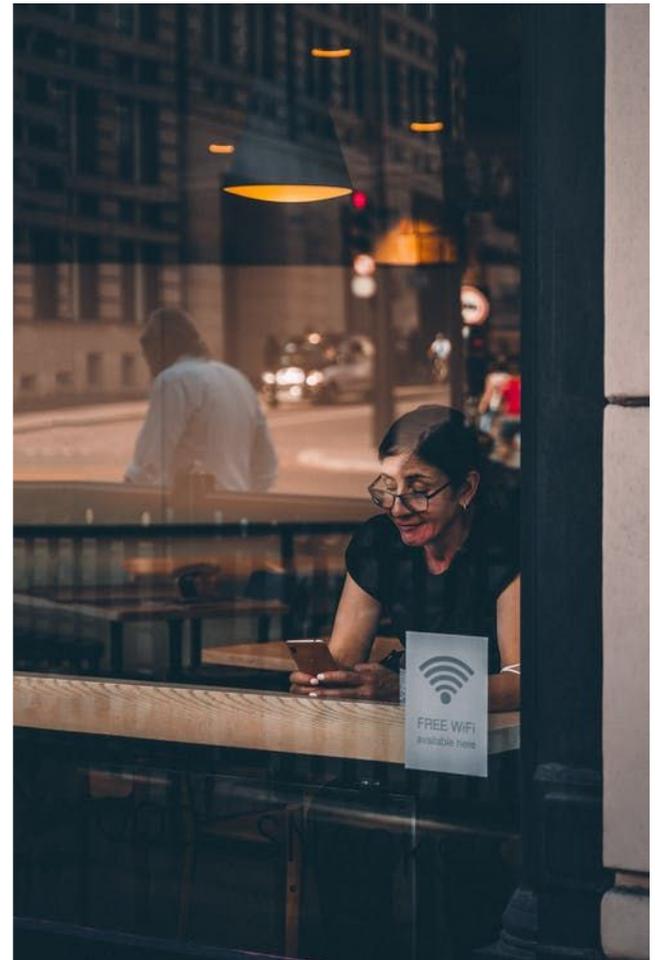
Challenge #1: Finish SP20

No Student Home PC

- Solution: CARES Funding to purchase a PC

Student PC Hardware Deficiencies

- Insufficient RAM, processor
- Single vs. dual monitors
- Solution: Remote Access via Google Remote, scaled back labs, focus on core competencies

Challenge #1: Moving Forward - Summer 2020-21

ITSC 1325 - PC Hardware
- Assemble, troubleshoot, and upgrade a PC
- Solution: PC Building Simulator from Galaxy of Games - $20

ITNW 1325 - Fundamentals of Networking
- Assemble and troubleshoot network cables and drops
- Solutions
  - Student purchased toolkit - $40
  - "Fake" Ethernet drops (RJ45 ⟵⟶ Keystone)
  - Student Video Submission(s) - Creating and testing cable

ITSY 2330 - Intrusion Detection
- Live Malware Analysis on separate physical network
- Solution: Virtual Machines not connected to NIC

Challenge #1: Moving Forward - Summer 2020-21

ITNW 2355 - Server Virtualization
- Resource-intensive Virtual Machines with ESXi and Hyper-V
- Solution: Remote Access via Google Remote and AnyDesk on Fort Bend and Waco campuses

ITSY 2359 - Security Assessment and Auditing
- VMs attacking and scanning each other for Pen Testing and vulnerabilities identification
- Need for nested virtualization and Kali Linux
- Solutions:
  - Temporary bare metal environment hosted at Fort Bend and Harlingen campuses
  - Terminal server jump station into virtual apps being hosted by VMware
  - Accessed via a VPN

Challenge #1: Moving Forward - Summer 2020-21

ITDF 2420 - Digital Forensics Collection

- Hardware-based write blockers to produce forensically sound images of computers and USB drives
- Solution: Software-based write blocker via Registry

Challenge #1: Moving Forward - Summer 2020-21

ITNW 2321, ITNW 2312,
ITSY 2301

- Cisco switches,
  routers, and firewalls
- Lower-level solution:
  Cisco Packet Tracer
- Upper-level solution:
  NETLAB+
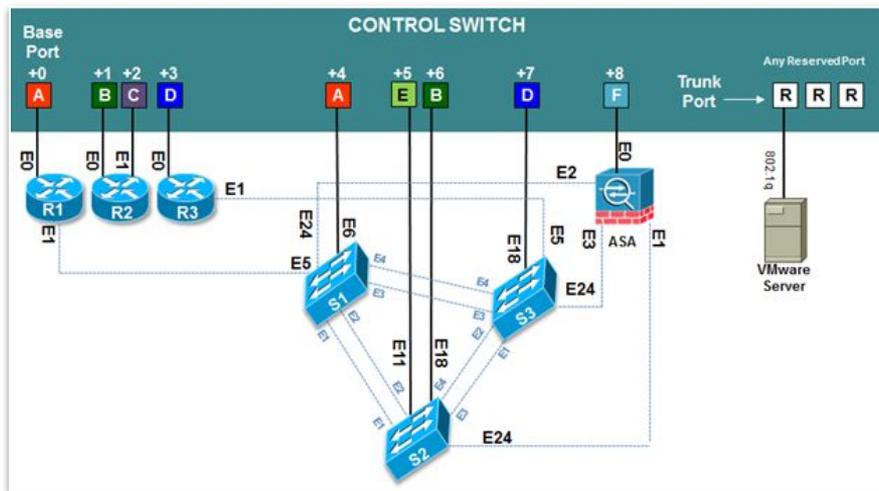
16 PODs
- 1 Cisco 3750X Switch
- 2 Catalyst 2690 Switches
- 3 Cisco ISR 4321 Routers
- 1 Cisco ASA 5506-X Firewall

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Challenge #2: Student Software Licensing

Azure for Education
- Word, Excel, Visio

Kivuto
- VMware Workstation Pro
- VMware vCenter
- VMware ESXi

AccessData/Exterro
- Forensics Toolkit (FTK) Suite taught only on Waco campus with licensing dongle
- Converted to Virtual CMStick

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Challenge #3: Student Engagement

Notable Changes to student availability

- Pre-COVID
  - Face-to-face: 2 days a week, 3 hours each day per course

- Post-COVID
  - Shift from full-time to part-time
  - Working additional hours, Working additional jobs, altered work schedules

Shift from Full Time to Part Time Students

	Fall 2021	Prior to Fall 2021
Part Time Students	52	60
Full Time Students	48	40

■ Part Time Students ■ Full Time Students
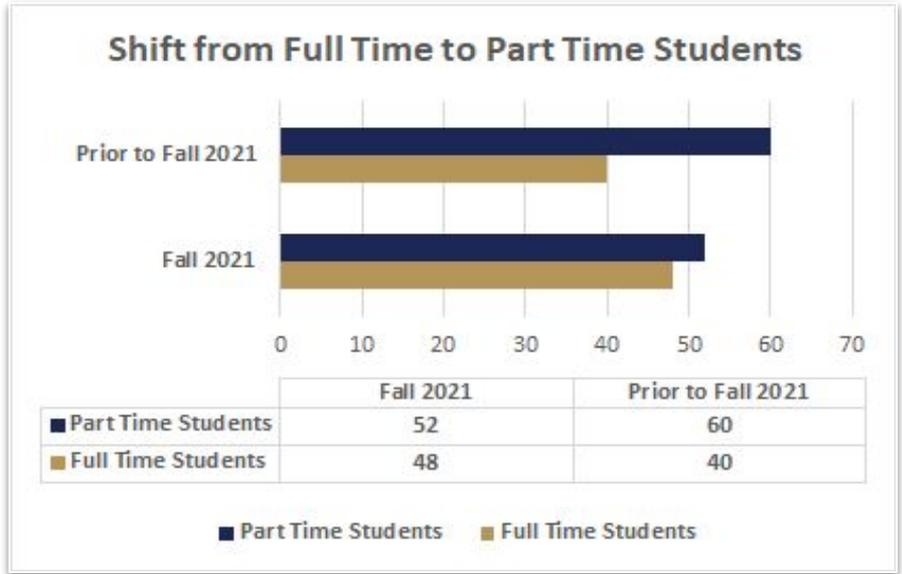
Challenge #3: Student Engagement

Unified Support Model

- Google Meet/WebEx "office hours"
  - Two hour blocks
  - Monday - Friday 8am to 8pm

- Instructor Availability spreadsheet
  - Contact any Subject Matter Expert (SME)

- Slack Workspace
  - Channel for each course as well as Career Services, announcements, tutoring, and with a coach
  - Popular on nights and weekends

Monday		Tuesday	
Instructor	**Lecture/Lab**	**Instructor**	**Lecture/Lab**
8:00 AM		**8:00 AM**	
Doug Peters	Open Lab	Doug Peters	Open Lab
Joel Bryant	Open Lab	Daniel Follis	Open Lab
Daniel Follis	Open Lab	Tim Janssen	ITSY-2301
Jan Nesmith	Open Lab	Joel Bryant	Open Lab
Tim Janssen	ITSY-2359	Cesar Ibarra	Open Lab
Cesar Ibarra	Open Lab		
10:00 AM		**10:00 AM**	
Alan Sulak	ITNW2312/2321	Doug Peters	Open Lab
Doug Peters	Open Lab	Keith Kooyman	Open Lab
Keith Kooyman	Open Lab	Jan Nesmith	Open Lab
Jan Nesmith	Open Lab	Tim Janssen	Open Lab
Tim Janssen	Open Lab	Cesar Ibarra	Open Lab
Cesar Ibarra	Open Lab	Linda Shorter	Open Lab
		Daniel Follis	Open Lab
Jon Owens	Open Lab	Jon Owens	Open Lab

Challenge #3: Student Engagement

- Cyber Student Resource Site [Internal]

CYBERSECURITY
Student Resources

CONNECT	ENGAGE	SOFTWARE	TECHNOLGY	VIDEOS	PBE POLICY
Connect to Instructors for Questions or Assistance on Course Assignments -- or Just General Tech Talk	Use mymail credentials for Cyber Slack Channel -- Engage with your Peers, Instructors, or Enrollment Coaches	Access Course Software and ISOs for Lab Assignments	Review Hardware/ Technology Requirements	View "How to" Tutorials & Videos	Review Grading and Mastery Assessment Policy
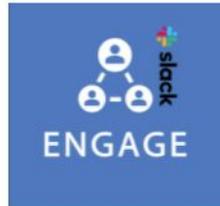
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Challenge #4: Instructor Nervous Breakdown(s)

- Re-engineering/re-designing courses with time constraints
  - Rewriting labs, lectures, and recording videos [real time]

- Identification of CME/SME Teams for development
  - Instructor collaboration (Google Chat and Google Meet)

- Instructional Designers hired
  - Continuous Process, Quality, Course Improvement
  - LMS Transition- Moodle/Canvas

- Instructor student availability
  - *No longer 8 to 5*
  - Flexible schedule

Impact of Transition to PBE Online Learning

#1: Shift In Grade Distribution

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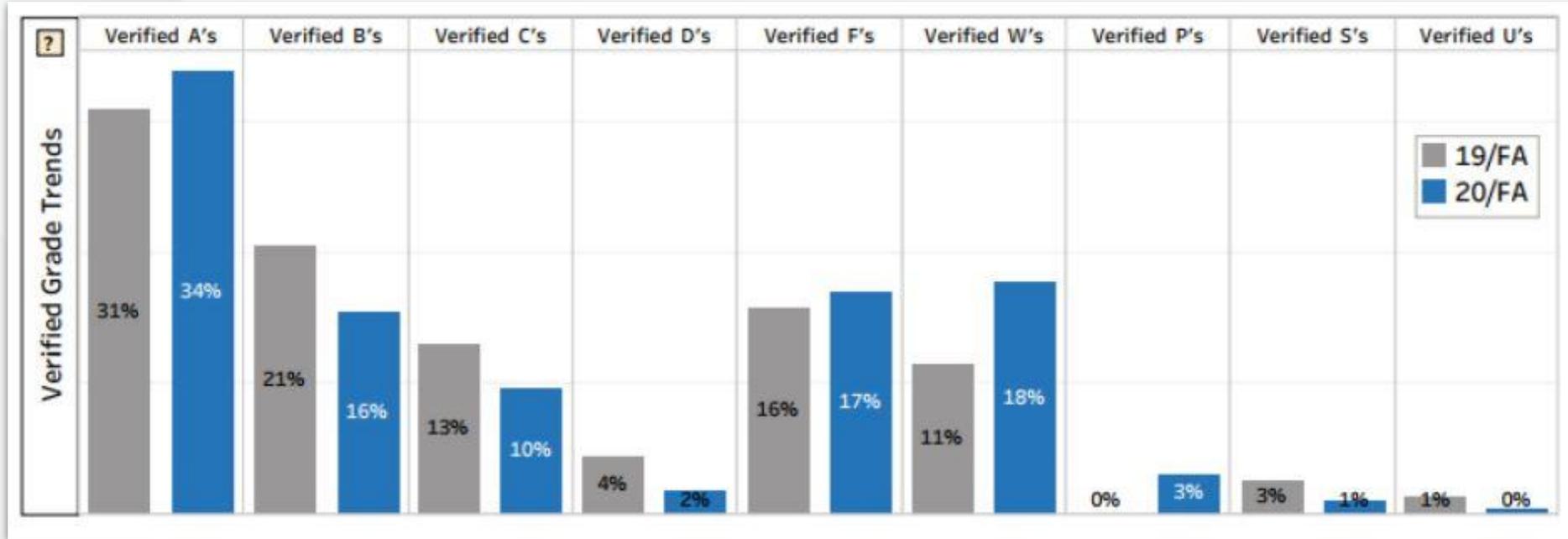
#2: Shift In Graduation

Anticipated vs. Actual Graduates
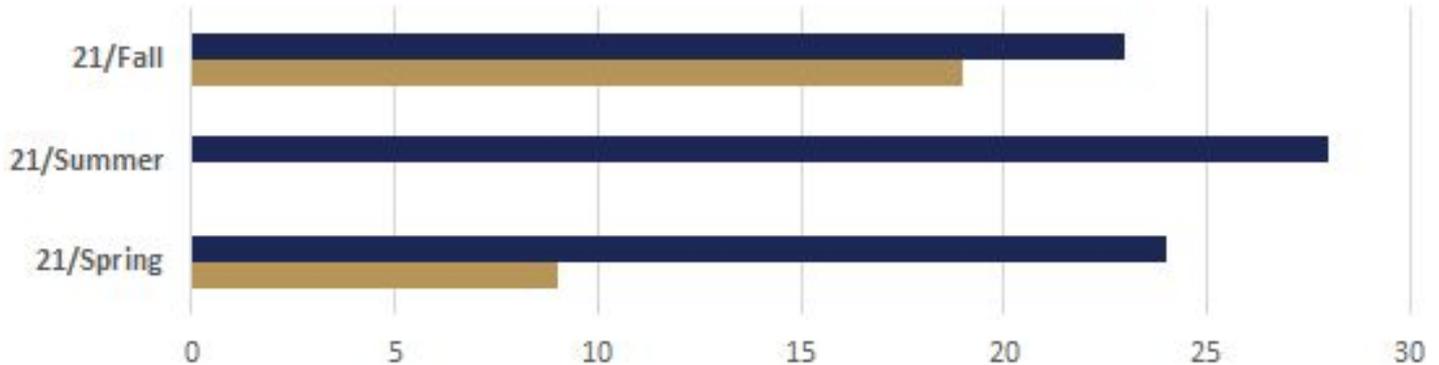
	21/Spring	21/Summer	21/Fall
■ Anticipated Graduates	24	28	23
■ Actual Graduates	9	0	19

■ Anticipated Graduates ■ Actual Graduates

#3: Shift In Placement

❯ What's Next?

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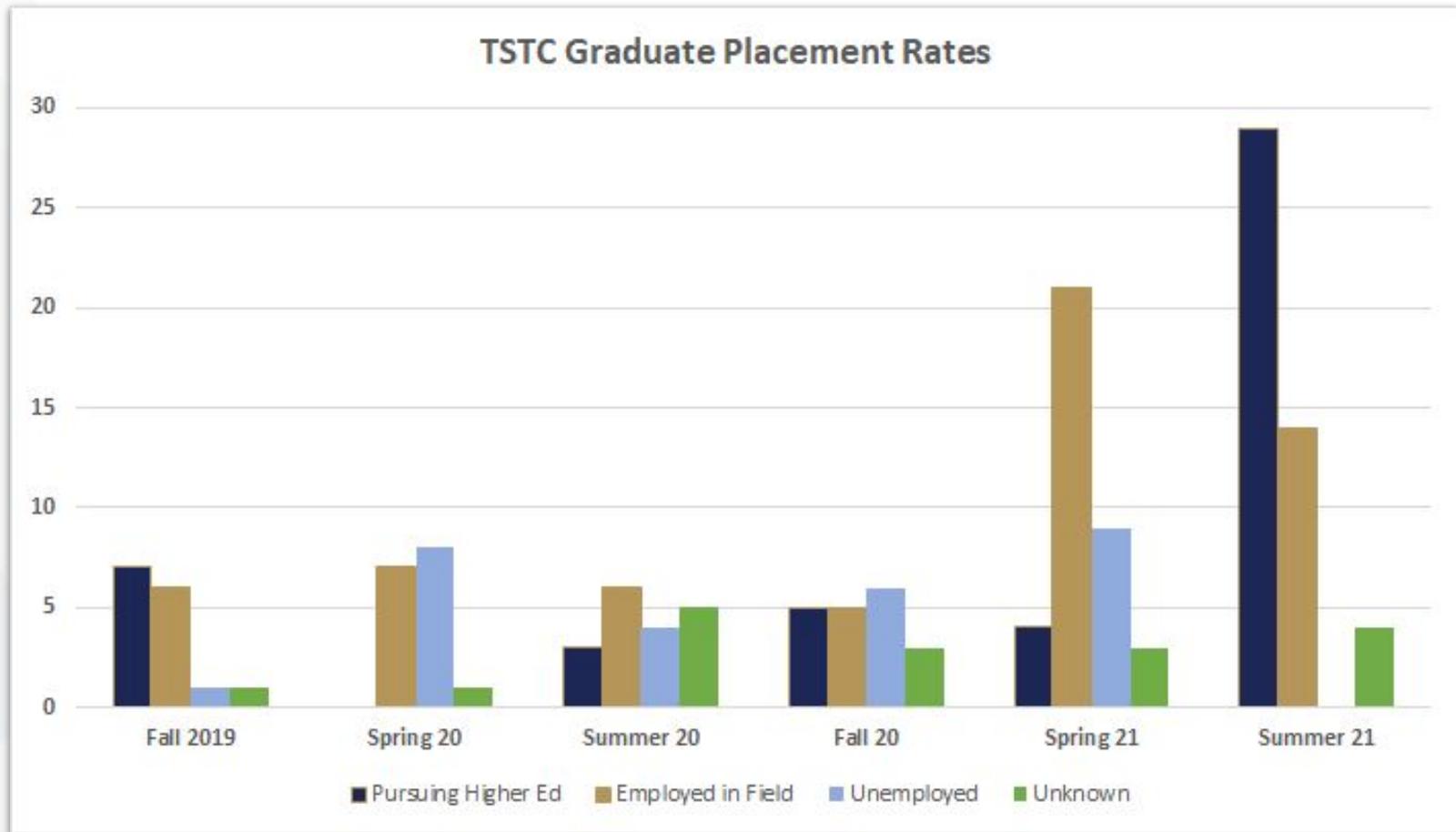
Key Initiatives - FA 21/SP22/SU22

- Official PBE "roll out" Option
  - Traditional teachout [Non-PBE] Students
  - PBE Students
    - Grading/Assessment Policy
      - A, B, or F
      - Multiple Attempts
    - Self-Directed
- Prior Learning Assessment/Credit
- Career Impact Audit [Workforce Talent Educators Association]

PERFORMANCE-BASED EDUCATION

LEARN AT YOUR PACE IN THE PERFORMANCE OF YOUR CAREER.

CONGRATULATIONS

Your program has been selected to teach in a performance-based education (PBE) model, often referred to as competency-based education, or CBE. This will enable you to have more flexibility in scheduling your classes and require you to perform at a higher standard for all your assessments. However, you will be provided with the opportunity for multiple attempts for your assessments, and you will not be restricted to a "one and done" model like you may be used to in traditional classes. In this personalized approach to instruction, success is measured by your results. Some students may require multiple attempts for mastery. This can result in increased retention of information and skills, versus the traditional "one and done" approach to assessment.

YOUR RHYTHM. YOUR BEAT.

ADDITIONAL BENEFITS OF PBE

▶▶ SCHEDULE
Flexible scheduling opportunities can enable you to work your class schedule around your life. You have the flexibility to determine how much time you spend on specific assignments, as long as all assessments are mastered at the appropriate level by the course completion date. With reduced time also comes the benefit of tuition savings. Utilizing your prior knowledge and motivation, you may have the opportunity to accelerate through your courses, with the potential to pick up additional courses at no additional cost.

▶ COURSE DELIVERY
Lectures and some assignments will be done online, outside of scheduled class time. Responsibility for completing online content will be yours as a student, and a program enrollment coach will work with you to set your schedule, track your progress, and help you identify any additional support you may require. This places the focus of learning on the lab environment with the goal of increased faculty-student interaction.

▶ INDUSTRY SKILLS TRANSCRIPT
In addition to a traditional transcript, you will receive an industry-verified, skills-based transcript that identifies the specific competencies you have earned to share with potential employers.

FOR MORE INFORMATION:
Contact your program enrollment coach, or visit: tstc.edu/performance

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Key Initiatives - FA 21/SP22/SU22

- Enrollment Coaches as Mentors
- Progress Pathways Reporting
  - Participation
  - Poor Course Performance
  - Academic/Personal difficulties
- Pacing Guides
- Accelerated Subscription Rate
 - One course free, no consequence if not completed - can continue

Key Initiatives - Fall 2022

- Increased persistence - student engagement
  - PBE Mentors
  - Staff Training for updated curriculum
  - Club/Competitions
  - VR/XR/AR

- Increase Placement
  - Apprenticeships/Internships
    - Co-op course [ITNW 2380]
  - Program Pathways
    - Occupational Skills Award (OSAs)
    - Certificate 1 and 2
    - Advanced Technical Certificate (ATC)
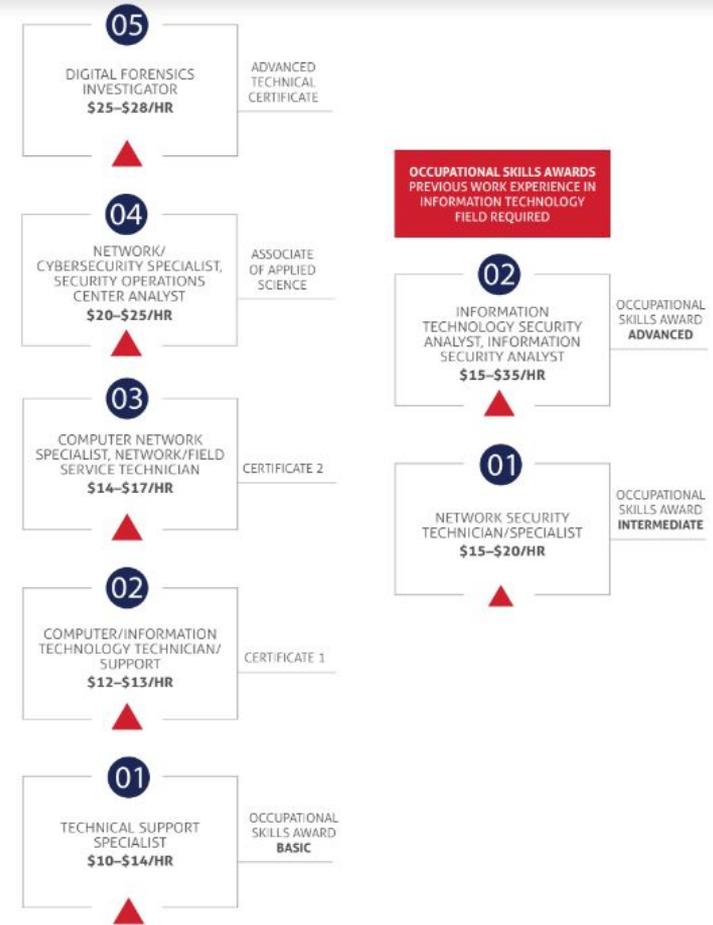
Key Initiatives - Fall 2022

- Continuous Improvement/Quality Control
  - Implement Audit Recommendations

- Expansion of PBE Online Implementation
  - Tier 2 Programs [ADEG]
  - Tier 3+ Programs

- Return to Campus, Fall of 2022 - PBE Hybrid Courses
  - Return to Physical Hands-on labs
  - **Instructor Presence**
  - Introduction of PBE Mentors

> Questions?

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THANK YOU!

❯ MORE INFORMATION

- Performance Based Education @ TSTC
The next level of performance education at TSTC
https://www.tstc.edu/performance-based-education/

- TSTC NSF Project
https://tstc.edu/nsf

- Cybersecurity Program
https://www.tstc.edu/programs/cybersecurity/

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