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Innovation in STEM Education

Training Teachers to Integrate Cybersecurity

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Background: Secondary Setting & Participants

- This study and activities took place in primarily rural Mississippi middle and high school teachers of mathematics, physics, chemistry, engineering, English, social studies, gifted, special education, and vocational courses.
- Secondary teachers tend to operate in "silos" rather than collaboratively due to their content standards and expectations.



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Background: Supporting Literature

- Interdisciplinary collaborations strengthen US cybersecurity capabilities and help build the cybersecurity workforce .
- Research supports building a comprehensive cybersecurity education and workforce development model that standardizes interdisciplinary curricula and integrates with existing programs (Burley, 2017).



Background: Teacher Challenges

- By allowing teachers with different subject matter background to collaborate on teaching cyber security topics you open up a that multi-level, multi-discipline approach to cyber education with the goal of providing all educated individuals a level of cyber education appropriate for their role in society.
- At West Point how they demonstrate interdisciplinary approach to cybersecurity in the classroom is by offering electives that are incorporated into multiple interdisciplinary courses taught by faculty of different departments (Sobiesk, et al. 2015).



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Overview of Experience

- One-week GenCyber Teacher Workshop (40 contact hours)
- Content- and Pedagogy-focused lessons
- Team Planning
- Cybersecurity and Programming
- Cyber First Principles



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Cyber First Principles

- Domain Separation
- Process Isolation
- Resource
- Encapsulation
- Least Privilege
- Layering
- Abstraction
- Information Hiding
- Modularity
- Simplicity of Design
- Minimization



Bulldog Bytes

GenCyber Teacher Workshop Goals

- Increase cybersecurity knowledge and awareness in ways which align with teachers' respective content standards,
- Promote appropriate pedagogical practice which can be used to engage students in problem solving, collaborative and cooperative learning, and critical thinking skills vital to solving cyber challenges, and
- Plan lessons which integrate cybersecurity concepts in teachers' classrooms bridging cross-curricular content to cybersecurity topics.



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Learning Modules and Participant Outcomes

[See handout Table 1.]

Modules and activities were selected and adapted by the project team which was comprised of:

- Computer scientist
- Teacher Educator
- Classroom Teacher (Lead Instructor)



Discussion: Challenges of Integration

- Balance of content standards
- Time constraints
- Self-efficacy toward technology (intrinsic barriers)
- On-site support and resources (extrinsic barriers)



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Evaluation & Research

- TPACK Survey
 - Many pre-test items were marked at lowest levels
- Pre- and Post- Assessments of Principles
 - Pre-test responses were often blank
- Daily Reflections
- Lessons



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Closing

- Continued and expanded efforts include a collaborative Computer Science Engineering Course for pre-service secondary education students and CSE students (includes a service component in the local school setting).
- Progress in state and region continues. Details on these efforts can be found at:
<https://www.bulldogbytes.online/>

