

Developing and Piloting a Cybersecurity Curriculum for Middle Schools

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National Cyber Summit

Project

Develop middle school cybersecurity curriculum for U.S. grade 8 students.

In collaboration with Columbus State University, Rothschild Leadership Academy (RLA) a Title I middle school in Columbus, GA Muscogee County School District (MCSD)

Funded by NSA MEPP (Mathematics Education Partnership Program)

Project Goals

- Provide a good foundation for students in cybersecurity knowledge and skills,
- Enhance students' ability to behave in a secure manner online as well as to secure their environment, and
- Increase their interest in cybersecurity education

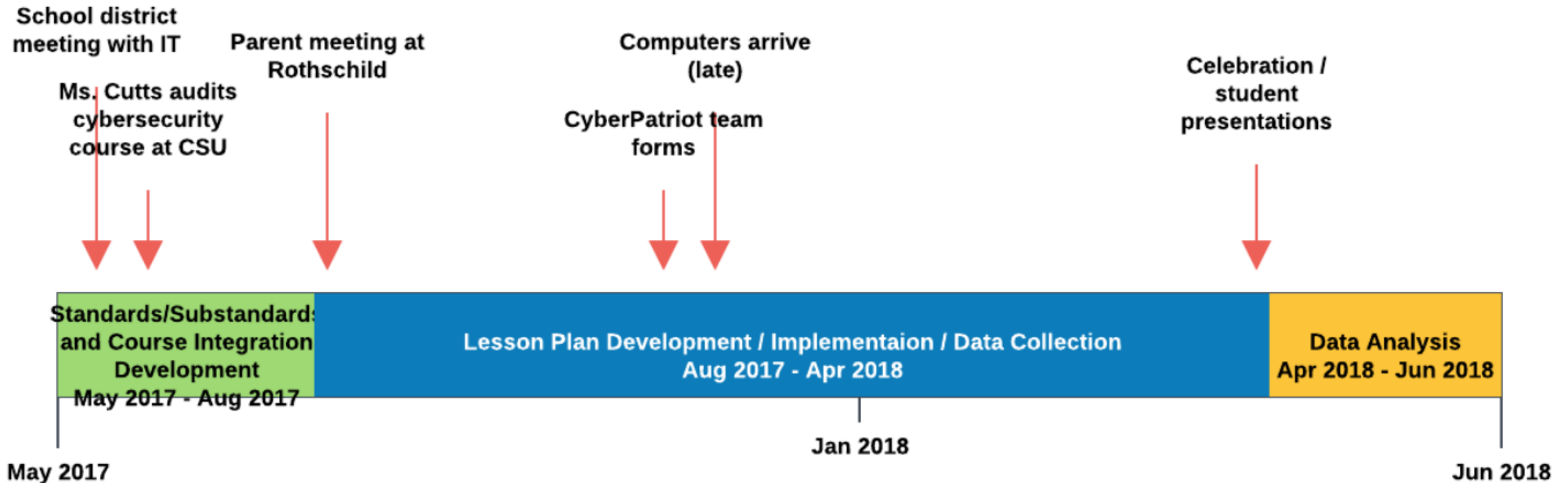
Motivation

- Raising a generation with more security-aware minds: Children of today are parents, teachers, professionals of tomorrow
- High need for well-trained cybersecurity professionals to protect our networks, computer systems, and infrastructure.
- Early exposure to basic cybersecurity concerns and concepts is key to developing awareness, piquing student interest, and laying foundation for more complex skill development.

Phases of the Project

- Curriculum Development
 - Standards and objectives
 - Assessment
- Teacher Preparation
- IRB approval
- Curriculum Delivery and Data Collection
- Analysis of Results
- Reflection

Project Timeline



Curriculum Development

- Develop standards and learning objectives

Make sure the standards mesh well with business standards

- Collect available resources

- Teacher preparation

Ms. Cutts took the introductory Information Security course in Summer

- Develop lesson plans (?)

Standards

Students will

- 1.examine the basics of cybersecurity needs for business, government, and organizations.
- 2.examine the principles of cybersecurity and basic mechanisms used for protecting data and resources
- 3.understand the basics of computer organization
- 4.demonstrate the ability to solve problems related to security

Standards continued

Students will

5. examine the basics of networking and the Internet
6. examine common cyber attacks
7. demonstrate an understanding of social engineering
8. demonstrate an understanding of cybersecurity ethics, digital citizenship, and laws governing privacy
9. examine the impacts of cybersecurity and cybercrime

1. Students will examine the basics of cybersecurity needs for business, government, and organizations.

List and define the elements of the CIA triad (confidentiality, integrity, and availability)

Explain components of access control: Identification, Authentication, Authorization, Accountability, Non-repudiation

Be able to create a strong password and identify weak passwords

List and describe the basics steps in security risk management

Discuss the importance of physical security

Explore career paths in cybersecurity

Assessment

Pre and post test

Consisted of identical multiple choice questions

Pre and post survey

Consisted of

Other assessment activities

Cyber awareness module by CSU

Nova Cybersecurity Labs

Day of Cyber by NSA

Student presentations

Kahoot exercise

Curriculum Delivery

- The course was piloted with ~55 grade 8 students in two classes at RLA
- Taught as part of a year-long Business Course
- Two days business, two days cybersecurity, Fridays reteach and assessment
- Student assistant present in class at least once every week
- Faculty taught in RLA the technical (non Business) topics
- Weekly meetings with the teacher

Pre and Post Test Results

- Identical 32 question multiple choice questions

Which of the following is NOT a principle of cybersecurity?

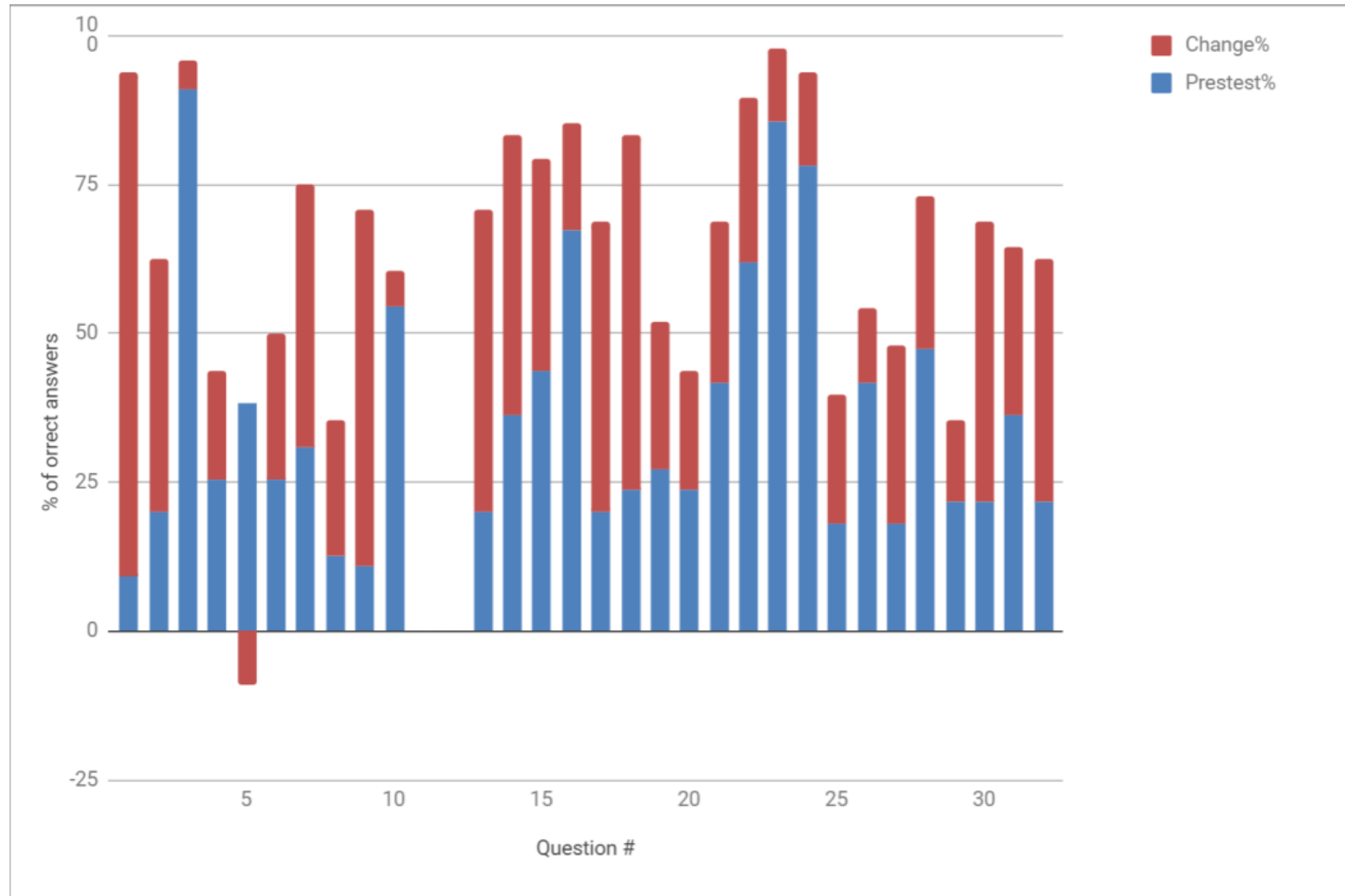
- a) Domain separation
- b) Resource sharing
- c) Simplicity
- d) Layering

When a document is transmitted over the Internet _____.

- a) The whole document is sent directly
- b) The document is compressed
- c) The document is broken into equally small pieces called packets
- d) None of these

- 55 students took the pre-test, 48 students took the post-test
- Results show significant growth in mastery of key cybersecurity concepts

Pre and Post Test Results



Pre and post survey

- 14 Likert scale questions
- Could not be used in the results as very few (12) students took the post survey
- Post survey had two additional feedback questions

Survey Feedback Question #1

What impacts, if any, did the cybersecurity lessons have on your behavior in the cyber world?

“It impacted me so much. Cyber security is bery [sic] important, you have to make sure that you dont [sic] put no personal information on the internet & always be aware of what you post.”.

“What I think the cyber security lessons have on my behavior in the cyber security world is that things in life are important, I learned about computers and how to keep yourself save on the computers. I learned how to know if a website is a safe website or not. I learned a lot in cyber security that i could name of if I thought about them.”

Survey Feedback Question #2

Did you share any of your learning from the cybersecurity lessons with people outside the cybersecurity class? Explain.

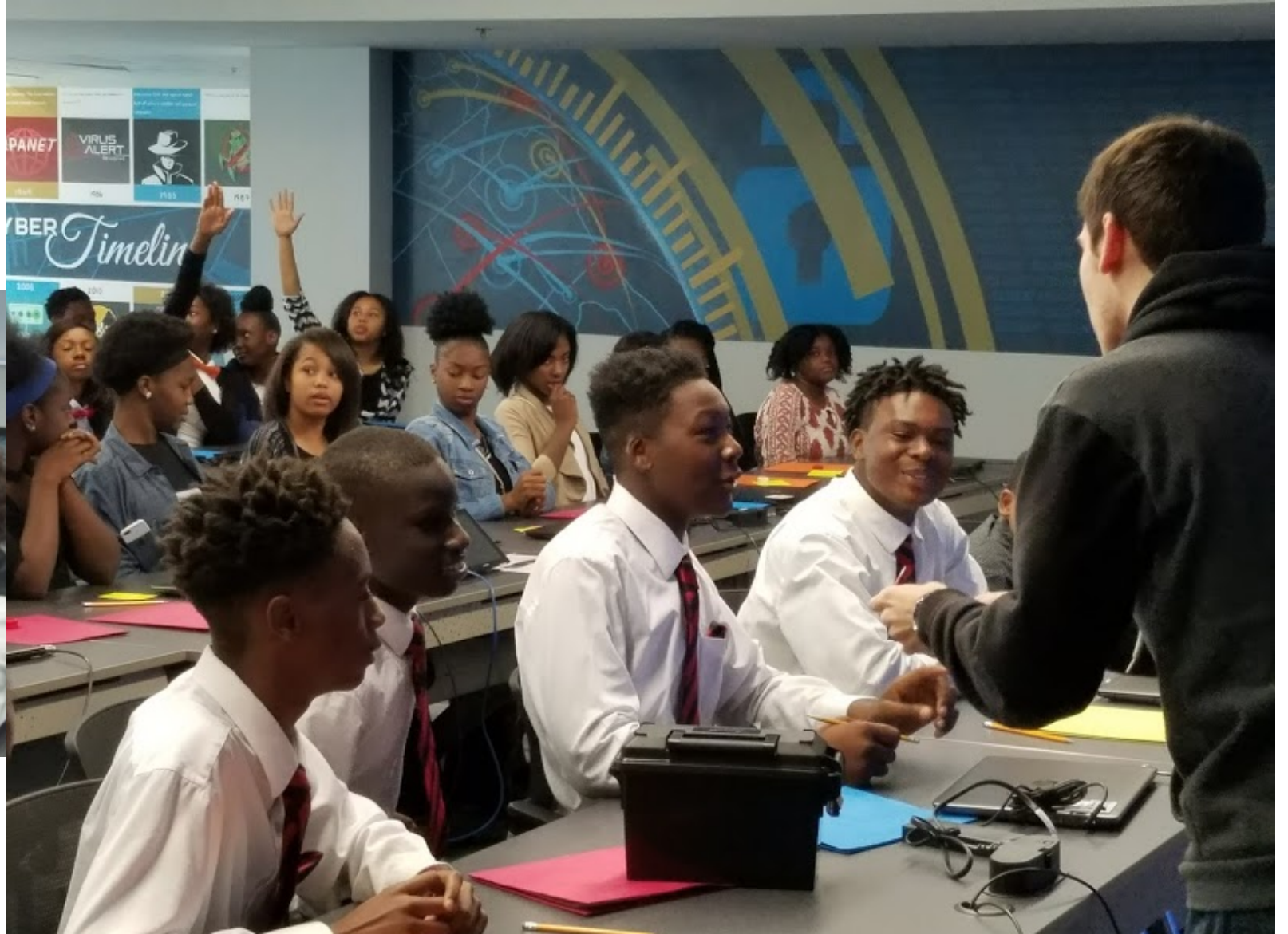
“yes i have discussed the things i have learned to others outside of my classroom and they was so surprised on my knowledge of cyber security and that for my age most people don't even know about it so they told to keep doing what i am doing because i am good at it and i want to purse [sic] a career in the cyber world.”

“I have been outside enough to get to share my knowledge about cyber security with others, but if I did I would have lots of good things to say about cyber security to the point where my actually want to think about learning more about cyber security them self so that they can also tell others.”

Artifacts

- Artifacts collected from activities such as
 - Cyber awareness module by CSU
 - Nova Cybersecurity Labs
 - Day of Cyber by NSA
 - Presentations
- Artifacts from the course indicate an increased student interest in cybersecurity

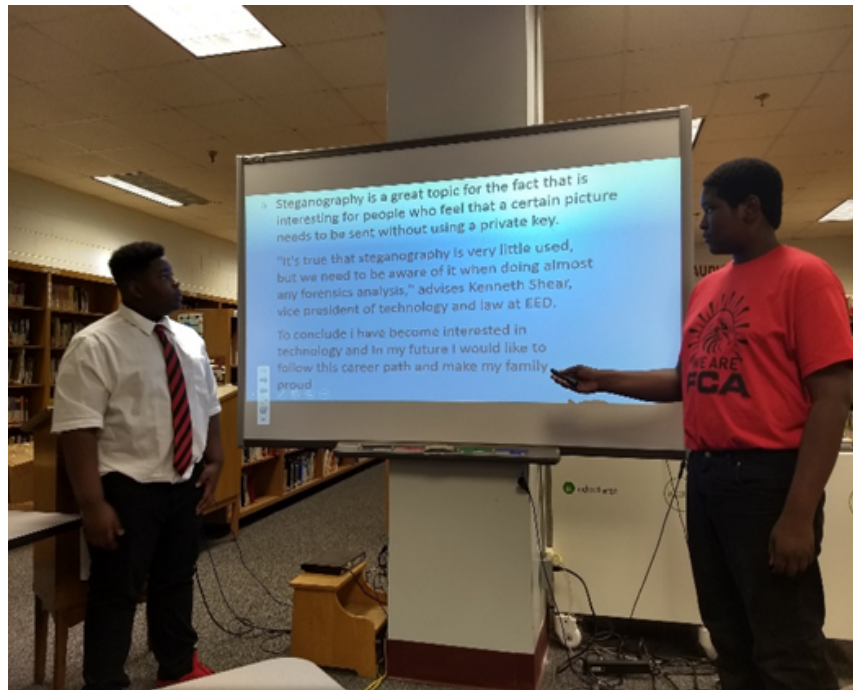
Students at CSU learning Linux



Student cybersecurity awareness posters



Student celebration presentation



Cyber Patriot



Reflection

Challenges

- Teacher background and overload
- Working with the policies and procedures of the school district
- Unforeseen school closures or field trips that reduced the time for cybersecurity

Best Part

- Working with young minds
 - A small exposure to cybersecurity goes a long way!
- The State of Georgia now has a middle school curriculum for Information Systems Security

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Questions?