



DIGITAL FORENSIC RESEARCH CONFERENCE

Introducing Digital Forensics Science in a Virtual Learning Environment

By

Eoghan Casey, Ph.D., Daryl Pfeif, and Cassy Soden

From the proceedings of
The Digital Forensic Research Conference
DFRWS 2019 USA
Portland, OR (July 15th - 19th)

DFRWS is dedicated to the sharing of knowledge and ideas about digital forensics research. Ever since it organized the first open workshop devoted to digital forensics in 2001, DFRWS continues to bring academics and practitioners together in an informal environment. As a non-profit, volunteer organization, DFRWS sponsors technical working groups, annual conferences and challenges to help drive the direction of research and development.

<https://dfrws.org>



CYBER SLEUTH

SCIENCE LAB

CYBER
SLEUTH™
SCIENCE LAB



Introducing Digital Forensics Science in a Virtual Learning Environment (DFSLE)

<https://cybersleuthlab.org/>

About

Daryl Pfeif,
Founder & CEO, Digital Forensics Solutions (gotdfs.com)

Founder, Digital Security Associates (gotdsa.com)

Founding Member/COO (aka The Kernel) - DFRWS



BACKGROUND

- Women Owned Business Started in 2005 (Digiwhat?)
- Approached by increasing numbers of women and others under-represented CS / STEM for Mentorship, Career Guidance & intro to DFIR
- Unimpressed by workforce development
- Can't do everything - but can Do Something



Leadership Team

Eoghan Casey, Ph.D., Principal Investigator
Research Scientist & Partner, Digital Forensics Solutions

Daryl Pfeif, Co-Principal Investigator
CEO & Founder, Digital Forensics Solutions

Karen Peterson, M.Ed., Co-Principal Investigator
CEO, The National Girls Collaborative Project

Cassy Soden, Web & Media Senior Producer



Pilot Site Partners

CodeWorks, Baltimore City Schools, Maryland

Core Element, New Orleans, Louisiana

WANIC Everett School System,
Washington State



DFSLE Project Objectives

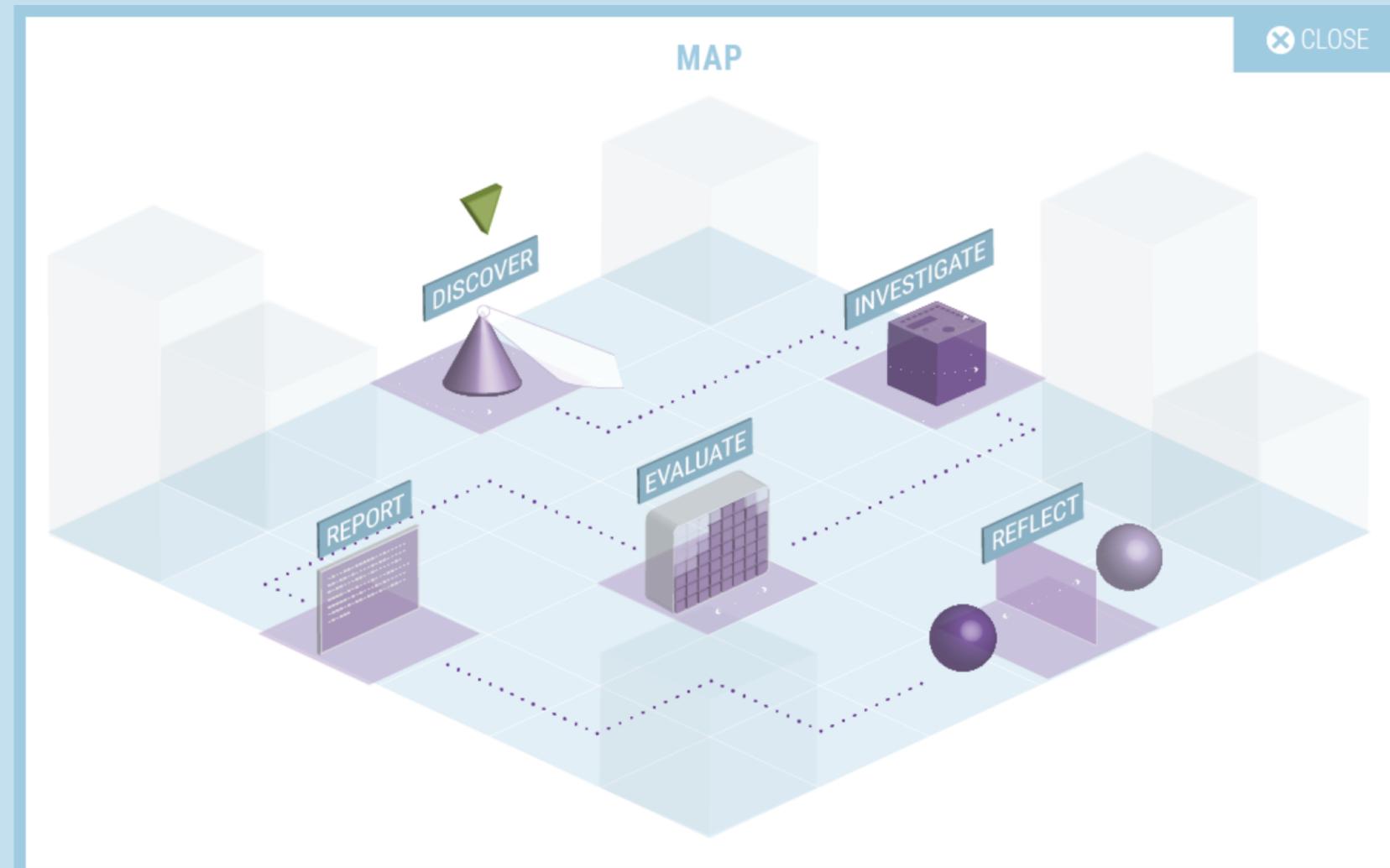
- Inspire more young women and underrepresented students to pursue education and careers in Digital Forensics and Computer Science
- Develop a STEM learning environment well suited to these students by immersing them in a process of computational thinking, scientific inquiry and problem solving in the context of **complex social issues**.
- Teach “**digital street smarts**” to help these students develop digital literacy and 21st century skills, by familiarizing them with online risks and laws, and encouraging responsible and safe behavior in a digital society.



Pedagogical Framework

Based on the Investigate & Decide Learning Environment model

- Cognitive apprenticeship
- Goal-based scenarios
- Problem-based learning
- Role-model guidance
- Peer collaboration
- Computational thinking



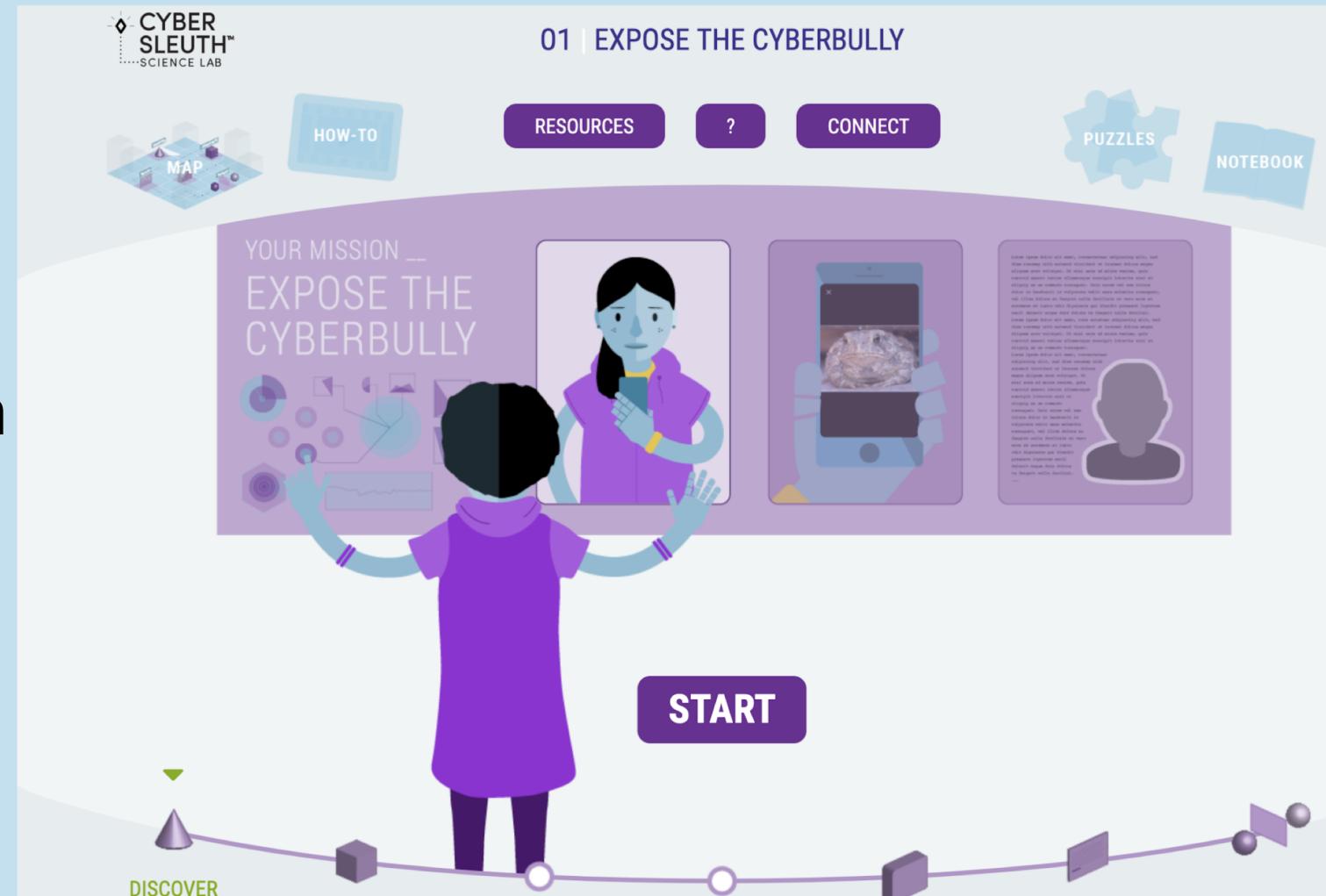
Virtual Laboratory

Engaging, age-appropriate, life-relevant investigative missions

- Deleted photo recovery
- Cyberbullying
- Embarrassing photo
- Account hijacking

Built-in data collection

- Summative questions
- Backend activity logging



Virtual Toolkit

Remote Desktop

- Dedicated student VMs
- Cloud hosted

Digital forensic tools & scenario datasets

- Autopsy
- Magnet
- MSAB



The screenshot shows a Microsoft Remote Desktop session. On the left, there's a sidebar with icons for Autopsy, AXIOMExaminer, XRYViewer, JPEGsnoop, and FTK Imager. The main area is titled "Mission 0" and contains three sub-missions: "Mission 1" (PDF file icon), "Mission 2" (file folder icon), and "Recycle Bin" (trash bin icon). To the right, a "FILTERS" section is visible with dropdown menus for Evidence, Artifacts, Content types, Date and time, and Tags. Below it is a "EVIDENCE (107)" section with a table showing counts for various categories: ALL EVIDENCE (2,796), REFINED RESULTS (164), WEB RELATED (957), CHAT (147), MEDIA (768), DOCUMENTS (5), MOBILE (549), and OPERATING SYSTEM (206). The "Artifacts" tab is selected. The table lists 107 entries under the "Identifier" column, such as 12028486096, James Lee, 13153165956, etc.

Identifier	Count
12028486096	ID
James Lee	Full
13153165956	ID
12532608067	ID
(202) 848-6096	Phone
+13153165956	Phone
Mom	Full
Mom	Given
James	Given
(253) 260-8067	Phone
Miles Thomas	Full
Miles	Given
Sarah Jackson	Full
Sarah	Given
12028486096	Sen

Teacher Dashboard

Manage class

Track progress

Group work credit



GOALS

NEWS

ABOUT

MISSIONS

DASHBOARD

EVERETT WA: JUNE 2019

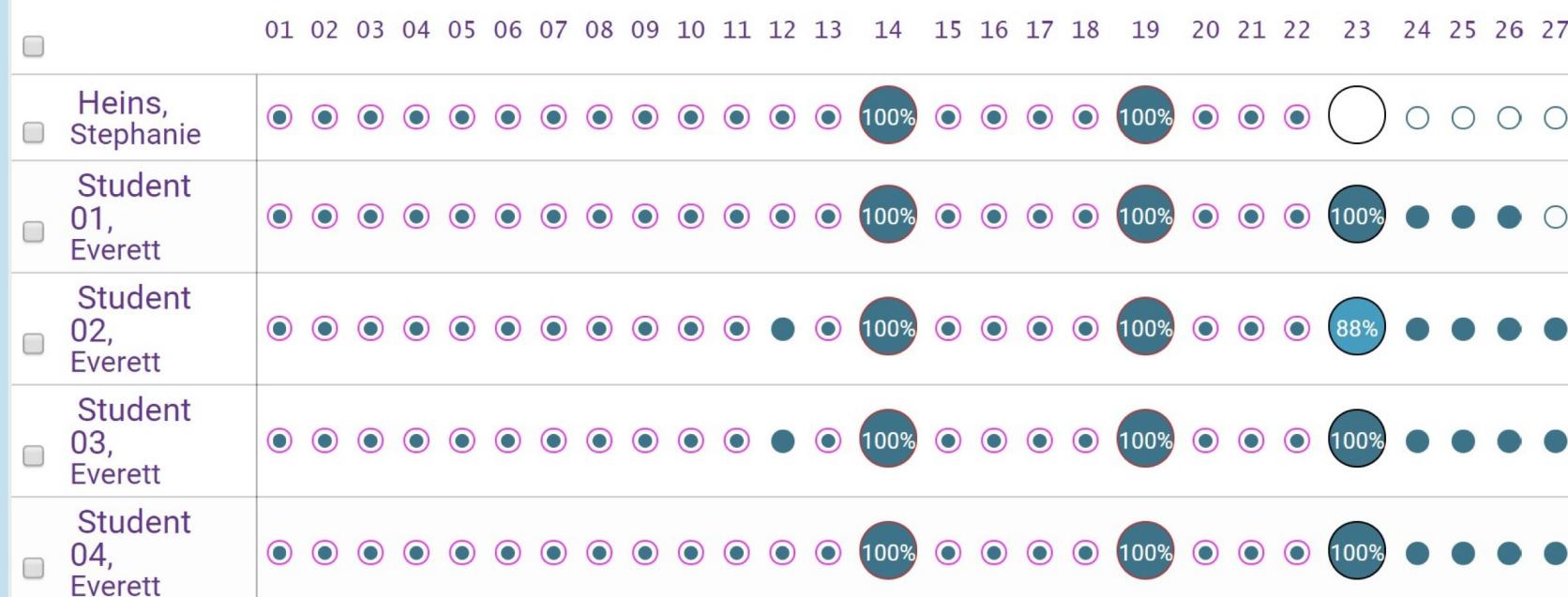
[« BACK](#)

SELECT A MISSION

Mission 0: Find Grandma's Dog ▾

MANUALLY UPDATE

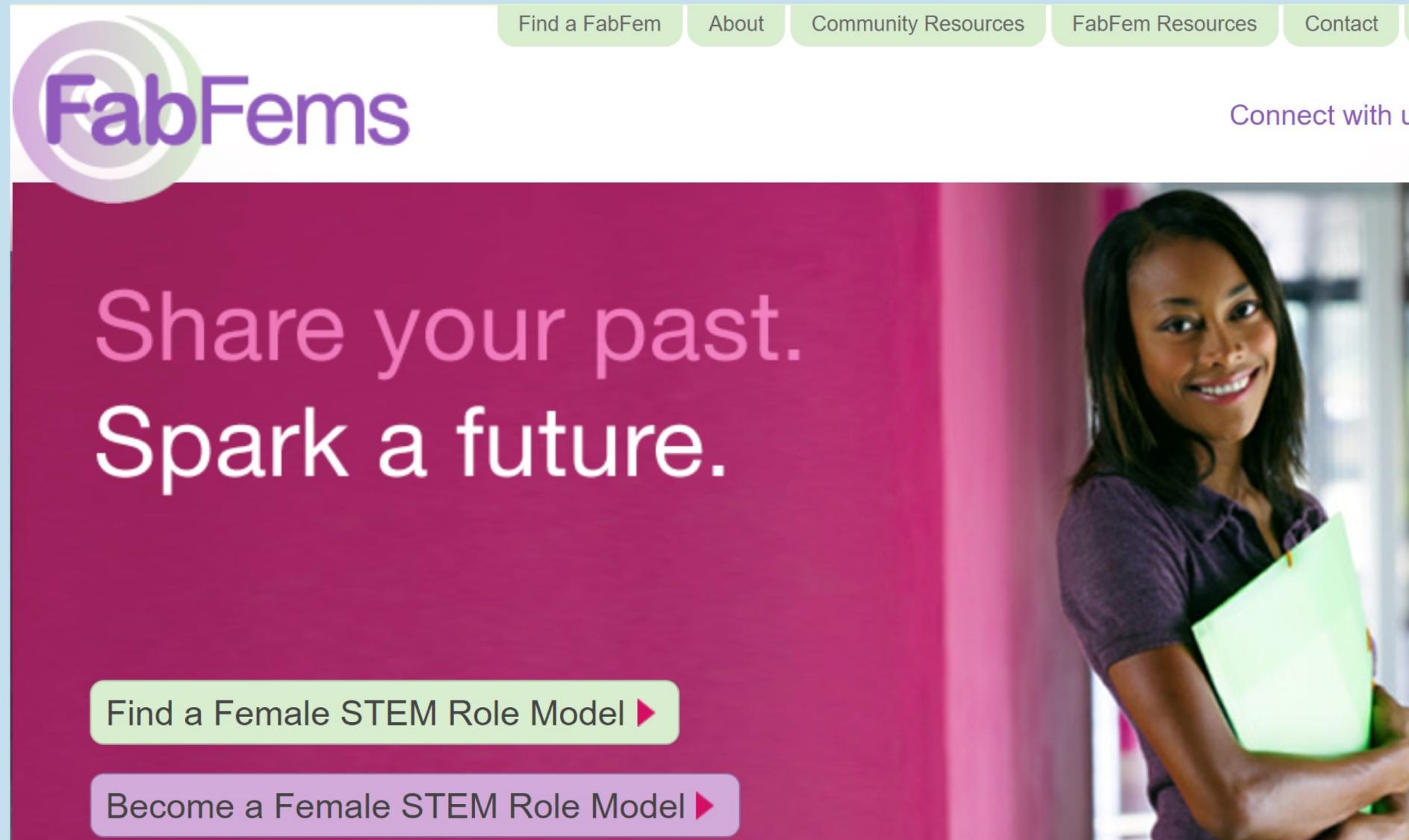
TRACK ACTIVITY



Role Models & Network Building

FabFems.org

- Role models
- Professional perspectives
- Community
- Events
- Partnerships



The screenshot shows the homepage of FabFems.org. At the top right, there is a navigation bar with five green buttons: "Find a FabFem", "About", "Community Resources", "FabFem Resources", and "Contact". Below the navigation bar, the FabFems logo is displayed, featuring the word "FabFems" in a purple, lowercase, sans-serif font inside a circular graphic with concentric purple and green rings. To the right of the logo, a woman with dark hair, wearing a purple shirt, is smiling and holding a bright green folder or book. The background of the main content area is a solid pink color. Centered on this pink background is the text "Share your past." above "Spark a future." in a large, white, sans-serif font. At the bottom of the page, there are two green call-to-action buttons: "Find a Female STEM Role Model" and "Become a Female STEM Role Model", each with a small red arrow pointing to the right.

Career Vision Quest

Students explore their future possibilities by asking themselves

Who am I...

What kind of problem do I enjoy solving...

What activities do I enjoy doing

What resources do I need to get where I want to be...

Education & Career Resource Guides

Growing compilation of potential opportunities for students

Educational programs, scholarships, certificate programs, etc.

Career pathways

Professional Organizations & Events

Fundamental Forensic Science Concepts

Themes

- Forensic science principles
- Protect yourself personally and professionally
- Mathematics concepts
- Forensic processes and activities
- Handling digital evidence
- Conclusions and reports

Principles of Effective Design & Instruction

- 1. Engage** - give them a reason to care
- 2. Enculturate** - foster a sense of belonging
- 3. Immerse** - situated cognition & realistic context
- 4. Guide** - cognitive apprenticeship & scaffolding
- 5. Practice & Iteration** - case-based reasoning
- 6. Synthesize** - build a logical argument
- 7. Communicate** - report writing and testimony
- 8. Reflect** - consider pros, cons and broader societal impact

Casting students in the role of investigators supports these principles

Summer of 2018, Baltimore, MD

Working with CodeWorks in Baltimore in the summer of 2018 we introduced 79 students to Digital Forensics in the the Cyber Sleuth Science Lab beta version.

CodeWorks Teachers were trained and taught the week long class with support from trained Cyber Sleuth Facilitators.





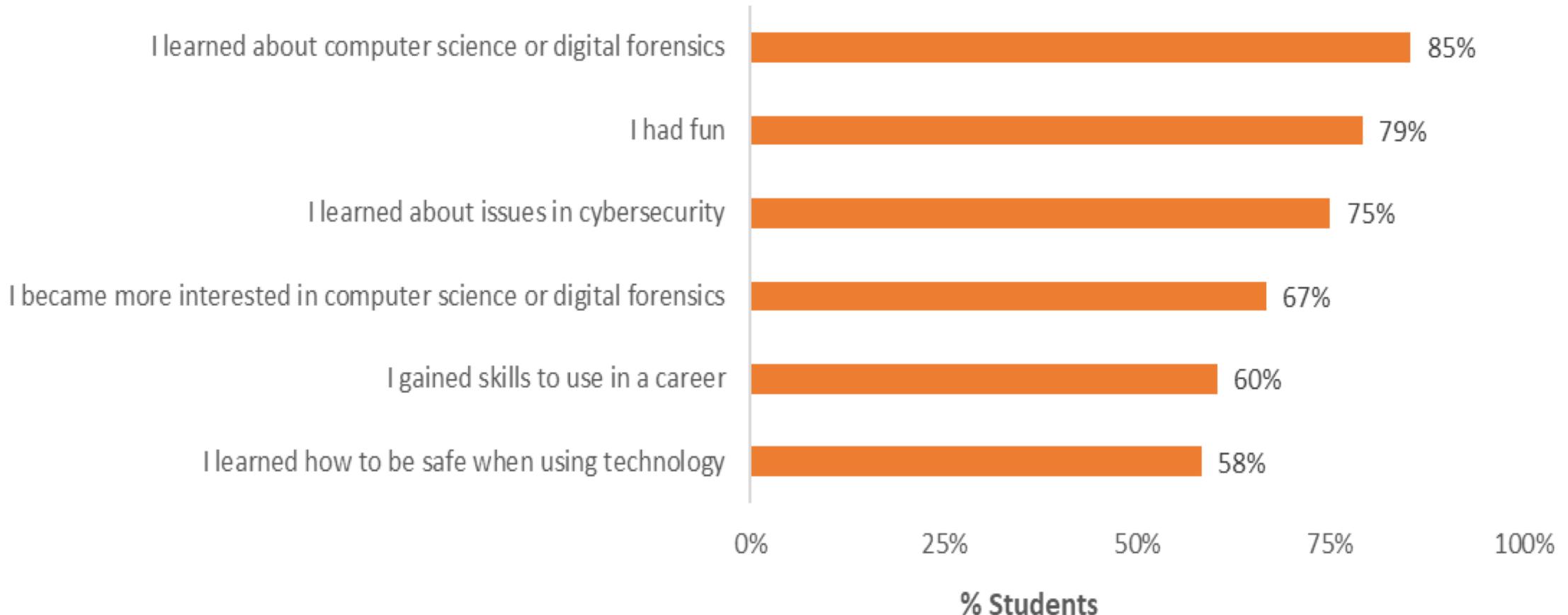
"I enjoyed recovering all of the text message conversations and figuring out what happened and why it happened."

"I enjoyed learning and using the different applications like Autopsy and JPEGsnoop."

"The Lab report, it was really engaging and it made me feel like the work I did was useful and professional"

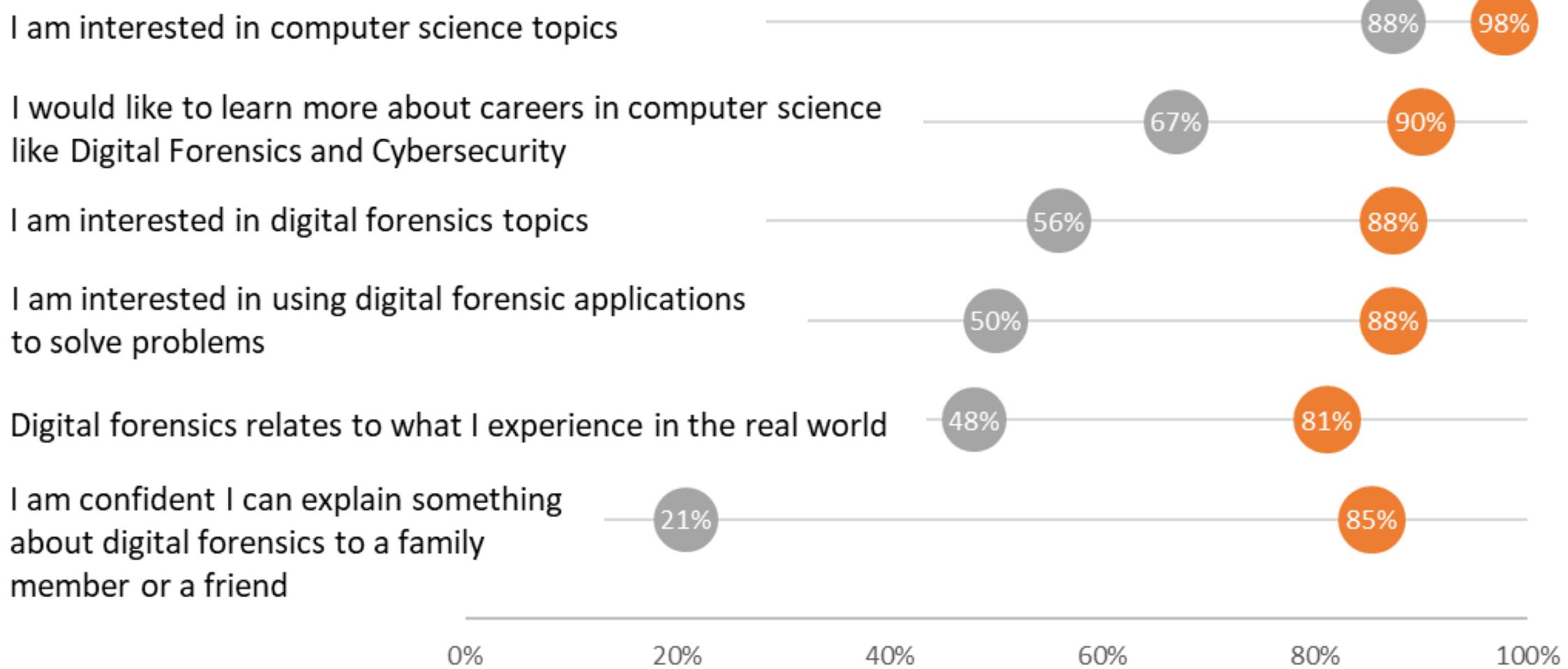
Initial Outcomes

"How do you feel you have benefited from your experience in CSSL?"
(n=48)



Initial Outcomes

Students Who Agree or Strongly Agree Before and After CSSL (n=48)



What's Next...

- Module Development
- Teacher Professional Development Enhancement
- Baltimore, Summer 2019
- Everett, Washington, 2019
- Research Results





Why teach
Digital
Forensics and
Cybersecurity?

3.5 million

Unfilled job openings in
CyberSecurity by 2021

- *Forbes, August 9, 2018*

In 2017...
WOMEN made up

11%

of the CyberSecurity workforce

Next Steps

- Recruiting role models!!!!
- Recruiting facilitators and trainers
- Developing partnerships
- Broadening participation
- Adding more modules & more professional development
- Adapting CSSL for other audiences



**Thank you for letting us share the innovative
Cyber Sleuth Science Lab project with you!**



QUESTIONS ? PLEASE CONTACT:

Daryl@CyberSleuthLab.org

SPECIAL THANKS TO:



The Cyber Sleuth Science Lab is a project of Digital Forensics Solutions made possible by the National Science Foundation. This material is based upon work supported by the National Science Foundation under Grant No. 1640107. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.