

Hawaii: Inspiring the next generation of cybersecurity experts



A report detailing Hawaii's leadership in finding, motivating, and developing the cyber-capable workforce in the United States.

Dear Governor Ige,

Your insight and leadership in bringing CyberStart to the students of Hawaii is already paying dividends for them in the form of learning and scholarships, and it can lead to future job growth and improved cybersecurity in Hawaii. Results of the CyberStart pilot program, ably managed by Reynold Hioki, Cybersecurity Manager for your Department of Defense, with help from Arnold Kishi and IT and security leaders at the University of Hawaii, are summarized below. But before you dig into the numbers and see the lists of high-performing Hawaii students, please turn to the last page and back cover of this booklet to enjoy personal notes that participating students wrote specifically for you.

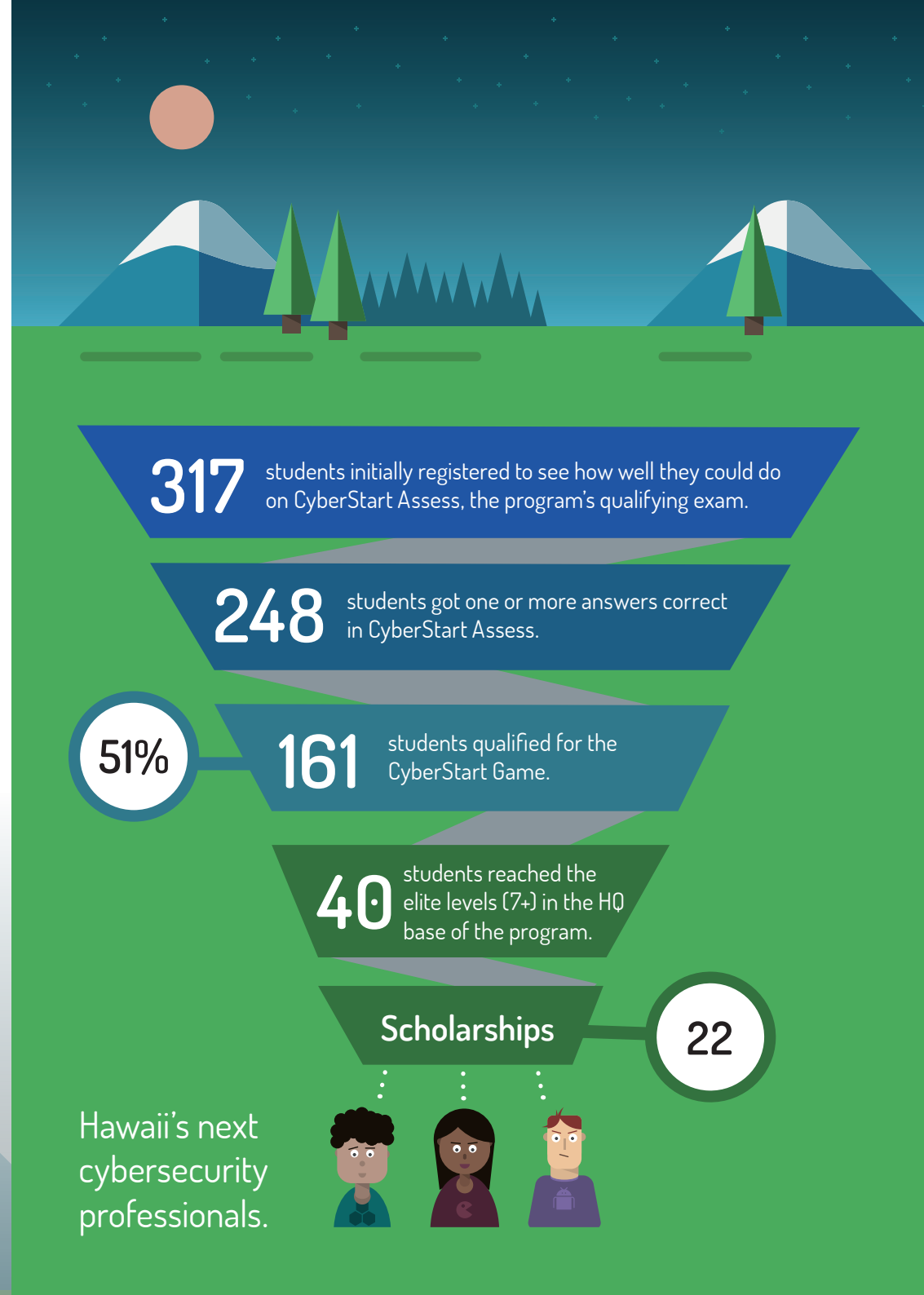
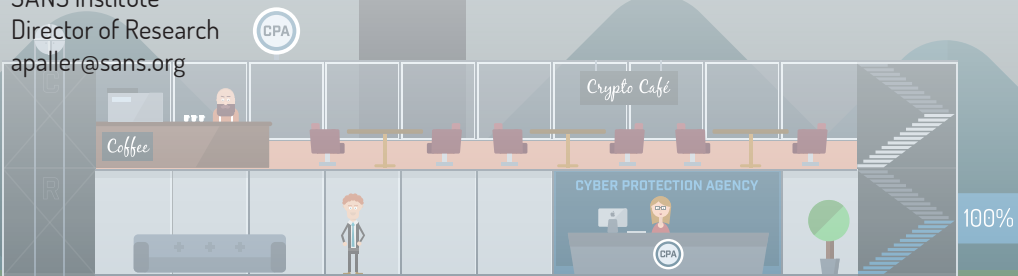
Program Highlights:

- In just two weeks in July, your communications team was able to sign up 317 Hawaii students.
- 78% of them solved at least one of the assessment challenges and 51% solved enough to be invited to test their cyber aptitude on the 250+ challenges of the full CyberStart program, which they did during August 2017. At the same time your fellow governors in six states signed up a total of nearly 3,300 students.
- Eight Hawaii high school and college students were in the overall top 50 nationally, and 22 Hawaiian students won scholarships for more advanced education in cybersecurity. Of special note is that Hawaii had a far larger number of high scorers and scholarship winners on a per capita basis than any of the other states.
- The state of Hawaii excelled in the program, being above average in all topics covered. Topics included: Linux, web application, forensics, cryptography and programming.
- As you might guess from the students' notes, they liked CyberStart:
 - 95% said they would recommend the program to a friend
 - 98% are considering further cybersecurity training after the program

Please let me know if there is anything I can do to help as you continue to identify talent and grow the next generation of cybersecurity experts in Hawaii.

Sincerely,
Alan Paller

SANS Institute
Director of Research
apaller@sans.org





Program Introduction

CyberStart is a forward-thinking skills program designed to supply specialist cybersecurity education to young people across the United States. Using a suite of online challenges, tools and games it aims to inspire the next generation of cybersecurity professionals while identifying the best and most talented young Americans.

We are facing a significant shortage of trained and skilled cybersecurity professionals at a time when online technologies continue to evolve, and cybercriminals are becoming more sophisticated. The only way to solve this problem is to introduce, develop and help young people in high school and college pursue a career in this sector.

Phases

CyberStart Assess is a set of 8 questions that test a student's aptitude and existing knowledge of computer security. Based on identifiable, measurable key skills and traits, it works to find young people who possess the innate qualities of an effective security practitioner. Questions look for traits such as problem solving, logical extrapolation and attention to detail, all of which have been proven to be crucial to succeed in a security career.

CyberStart Game is where students become exposed to specialist cybersecurity education. Using a suite of online tools, challenges and games, players attempt to solve more than 250 challenges, all of which are realistic examples of tests and threats faced by practicing cybersecurity engineers in their day-to-day lives. The CyberStart Game enables students to start studying security with challenges written by experts who practice these skills in the real world.

Goals

- Supply specialist cybersecurity education for 16+ year olds.
- Inspire the next generation of cybersecurity experts.
- Grow the U.S. cyber capable workforce.
- Identify the most elite young talent.

What Do Players Learn?

The CyberStart Game has over 300 hours of content and covers 14 main topic areas. There are two "bases" that make up the game, each containing several levels and challenges that candidates move through: the Headquarters Base and the Moon Base.

Bases

The **Headquarters Base** forms the main part of the game. Players take on the role of a junior agent in the Cyber Protection Agency, where they deploy their forensics and offensive skills to sleuth through challenges and tackle various online cyber criminal gangs. As they work their way up through the organization, their training develops each of the security disciplines.

The HQ Base teaches students skills in:

- Binary
- Cryptography
- Forensics
- Linux
- Open-source intelligence
- Programming
- Web application

The **Moon Base** is where players learn how to program. Players go through a series of challenges, building up progressively, to write their own programs in Python. The aim of the Moon Base is for players to use all the skills they have learned to stop an alien invasion. The Moon Base has three training levels that are step by step guides to the basics of programming.

Later levels teach students skills in:

- Programming cryptography
- Debugging
- Files
- Functions
- Loops
- Sockets
- Strings

CyberStart Players in Hawaii

| Key | |
|-----|--|
| ** | In the top 100 and awarded a scholarship |
| * | Awarded a scholarship |

| Last Name | First Name | School | Top 100/ Scholarship |
|-----------|------------------|---------------------------------|-------------------------|
| Agarano | Joshua | University of Hawaii, Maui | |
| Ahloo | Sean | Kapiolani Community College | |
| Alvarez | Jeffrey | Leeward Community College | |
| Amandin | Chyba Rabeendran | Homeschool | |
| Antiado | Carl | H.P. Baldwin High School | |
| Arnobit | Aiyana Noelle | Sacred Hearts Academy | |
| Barrar | David | Homeschool | |
| Bay | Christian | Kapiolani Community College | |
| Bolibol | Mark Jonel | Honolulu Community College | |
| Borgonia | Lyndon | Leeward Community College | |
| Boyce | Kainoa | Northern Arizona University | |
| Briggles | Bryce | University of Hawaii, West Oahu | |
| Buenafe | Marvin Arnold | University of Hawaii, West Oahu | ** |
| Chan | Philip | University of Hawaii | |
| Chang | Edward | University of Hawaii | ** |
| Chen | Wendy | University of Hawaii, Manoa | |
| Chiques | Jacques Galarza | Leeward Community College | |
| Chong | Tyler | University of Hawaii, Manoa | ** |

| Last Name | First Name | School | Top 100/ Scholarship |
|-------------|------------|---|-------------------------|
| Chun | Lauren | Sacred Hearts Academy | |
| Cobbs | Justin | University of Hawaii, West Oahu | |
| Decker | Dylan | Kalani High School | ** |
| Dedicatoria | Kenneth | University of Hawaii, West Oahu | |
| DiRienzo | Vincent | University of Hawaii | ** |
| Domingo | Joshua | University of Hawaii, Manoa | |
| Domingo | Warren | University of Hawaii, Manoa | |
| Dossey | Stephen | University of Maryland University College | |
| Drumeller | Michael | Kapiolani Community College | |
| Eshelman | Ian | Mililani High School | |
| Evans | Janice | University of Hawaii, West Oahu | |
| Goo | Tallas | University of Hawaii, Manoa | |
| Graham | James | Kapiolani Community College | |
| Grayson | Oliver | Hawaii Preparatory Academy | ** |
| H | Dan | Homeschool | |
| Hayworth | Jayson | University of Hawaii, West Oahu | |
| Hellum | Addison | Myron B. Thompson Academy | |
| Higashionna | Ryan | Assets High School | |
| Ho | Ky | University of Hawaii, Manoa | |
| Hom | Scott | Universit of Hawaii, Manoa | |
| Horiuchi | Nathan | Honolulu Community College | ** |
| Ito | Elliot | University of Hawaii, Manoa | |
| Kam | Darren | Iolani School | ** |
| Kansaki | Allen | University of Hawaii, West Oahu | |
| Kaohi | Alexandra | University of Hawaii, West Oahu | |

| Last Name | First Name | School | Top 100/ Scholarship |
|-------------|-----------------|-----------------------------------|-------------------------|
| Kay | Sara | Punahou School | |
| Kim | Brian | University of Hawaii, West Oahu | |
| Kitagawa | Ryuto | Kalani High School | |
| Kobayashi | Marco de Lannoy | University of Hawaii, Manoa | ** |
| Krug | Kolton | Leeward Community College | |
| Kuakini | Robert | University of Hawaii, West Oahu | * |
| Kumar | Aditya | University of Hawaii, Manoa | |
| Lau | Jaime | Kapiolani Community College | |
| Lau | Kinaole Mulan | Homeschool | |
| Lauw | Megan | Mililani High School | |
| Law | Evan | University of Hawaii, Manoa | ** |
| Le | Duong | University of West Oahu | * |
| Lee | Jason | Kapiolani Community College | |
| Lee | Kelly | University of Hawaii, Manoa | |
| Levesque | Kyle | University of Hawaii, Manoa | |
| Li | Dan | University of Hawaii, Manoa | |
| Lin | Helen | Sacred Hearts Academy | |
| Luke | Korry | Iolani School | * |
| Mansilungan | Rachelle | University of Hawaii, West Oahu | |
| Matsuda | Christelle | University of Hawaii | |
| Matsushima | Mele | Eastern Gateway Community College | |
| McCann | Jared | Homeschool | |
| Miller | Robert | Hawaii Technology Academy | |
| Naito | Maile | Santa Clara University | |
| Nakagawa | Elton | Hawaii Community College | |

| Last Name | First Name | School | Top 100/ Scholarship |
|-----------|------------|---------------------------------|-------------------------|
| Nakahodo | Dylan | University of Hawaii, Manoa | ** |
| Nakamatsu | Keith | University of Hawaii, Manoa | |
| Nakashima | Cole | Punahou School | |
| Nakata | Ryan | University of Hawaii, Manoa | * |
| Nasca | Joseph | University of Hawaii, Manoa | * |
| Nash | Monnisa | University of Hawaii, Maui | |
| Nitta | Kara | University of Hawaii, West Oahu | |
| Oh | Courtney | Leeward Community College | |
| Okabe | Jun | University of Hawaii, Manoa | |
| Palmer | Catherine | Sacred Hearts Academy | |
| Pang | J | Leeward Community College | |
| Paul | John | University of Hawaii, West Oahu | |
| Perry | Lily | Iolani School | |
| Reimer | Cameron | Pearl City High School | |
| Ryan | Kevin | University of Hawaii, West Oahu | * |
| Sarte | Catherine | University of Hawaii, West Oahu | * |
| Seki | Ryota | University of Hawaii, Manoa | |
| Shaw | Nicholas | Mililani High School | |
| Spain | Skyler | Hilo High School | |
| Stallings | Emiley | HOCO | |
| Stoycheff | Brittany | University of Hawaii, West Oahu | |
| Taga | Max | University of Hawaii, Manoa | |
| Takafuji | Sean | University of Hawaii at Manoa | * |
| Tay | Jason | Punahou School | ** |
| Thai | Mindy | Sacred Hearts Academy | |
| Topinio | Jacob | Mililani High School | |

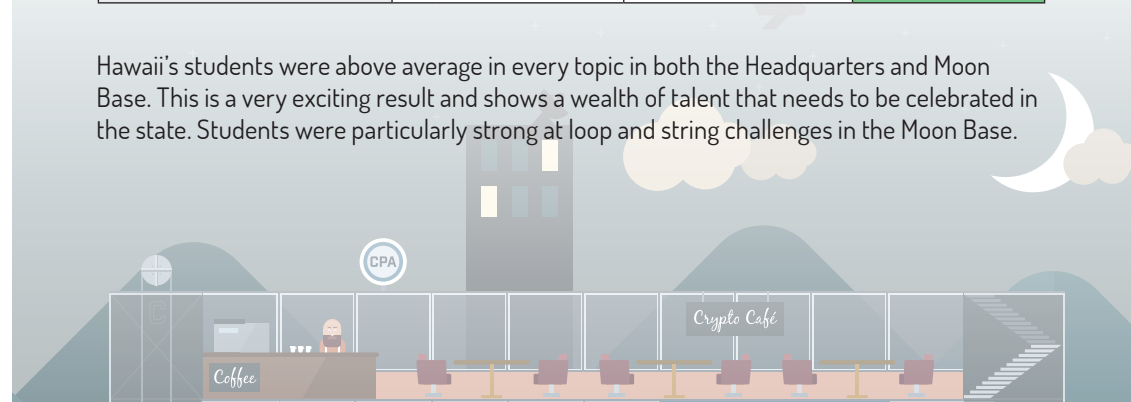
| Last Name | First Name | School | Top 100/ Scholarship |
|-----------|----------------|---------------------------------|-------------------------|
| Torigoe | Jonathan | Kapiolani Community College | |
| Torikawa | Jason | University of Hawaii, West Oahu | |
| Uyeda | Logan | University of Hawaii, Manoa | ** |
| Viloria | Rodney-Jerrome | University of Hawaii, Manoa | |
| Weeks | Nathaniel | University of Hawaii, West Oahu | |
| Wong | Nick | Kamehameha Schools Kapalama | |
| Yee | Brandon | Punahou School | ** |
| Young | Jason | University of Hawaii | |
| Yuu | Ian | University of Hawaii | |
| | Alice | University of Hawaii, Manoa | |
| | Allen | University of Hawaii, West Oahu | |
| | Angela | University of Hawaii, Manoa | |
| | Ashley | Sacred Hearts Academy | |
| | Bryan | University of Hawaii, West Oahu | |
| | Bryson | Honolulu Community College | |
| | Chad | University of Hawaii, Manoa | |
| | Chris | University of Hawaii, Manoa | |
| | Dennis | University of Hawaii, Manoa | |
| | Gabriel | University of Hawaii, West Oahu | |
| | Herman | University of Hawaii, Manoa | |
| | Kea | University of Hawaii, Manoa | |
| | Melvin | University of Hawaii | |
| | Sola | Sacred Hearts Academy | |

Strengths & Weaknesses

| Headquarters Base categories | State average [%] | Seven state average [%] | Difference [%] |
|------------------------------|-------------------|-------------------------|----------------|
| Linux | 25.04 | 20.97 | 19.40 |
| Web application | 34.75 | 30.83 | 12.68 |
| Forensics | 32.35 | 28.03 | 15.43 |
| Binary | 11.67 | 9.21 | 26.71 |
| Cryptography | 48.54 | 44.83 | 8.23 |
| Programming | 19.32 | 16.19 | 19.34 |
| Open-source intelligence | 71.43 | 68.40 | 4.43 |

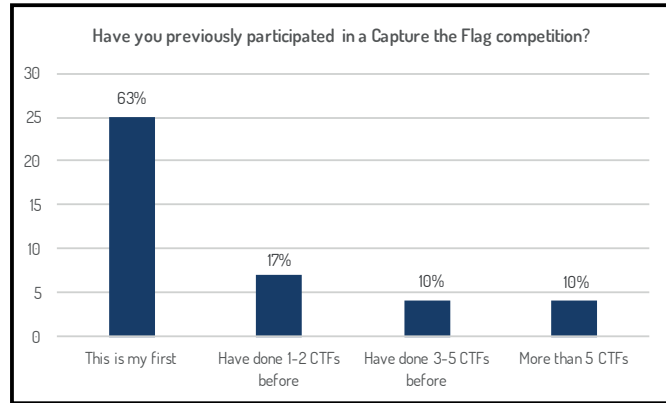
| Moon Base categories | State average [%] | Seven state average [%] | Difference [%] |
|----------------------|-------------------|-------------------------|----------------|
| Cryptography | 11.02 | 8.11 | 35.84 |
| Debug | 25.42 | 23.53 | 8.05 |
| File | 16.44 | 12.83 | 28.10 |
| Functions | 23.73 | 22.46 | 5.65 |
| Loops | 11.23 | 7.42 | 51.34 |
| Sockets | 14.94 | 11.31 | 32.09 |
| Strings | 9.32 | 6.55 | 42.30 |

Hawaii's students were above average in every topic in both the Headquarters and Moon Base. This is a very exciting result and shows a wealth of talent that needs to be celebrated in the state. Students were particularly strong at loop and string challenges in the Moon Base.



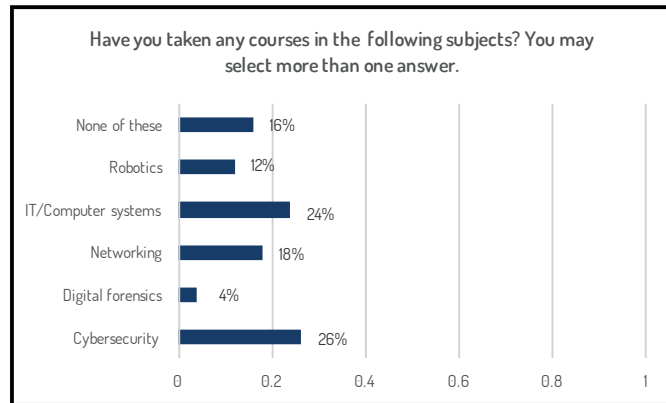
Student Feedback - Previous Knowledge

A survey sent to everyone who played the CyberStart Game asked players for feedback on their previous knowledge, what they had learned, and what they enjoyed most about the program.



These charts demonstrate that most students who played the CyberStart Game in Hawaii had never been exposed to a Capture the Flag style teaching method. Knowing this, it is encouraging that 51% of players made it through to the CyberStart Game.

However, players from Hawaii did have quite a lot of experience in other relevant cybersecurity subject areas - in particular computer systems. In comparison to some other states, the talent pool of students playing CyberStart in Hawaii was high, showing a strong group of students keen to build upon their existing knowledge. Their engagement with the tool is likely to accelerate their entry into the profession.

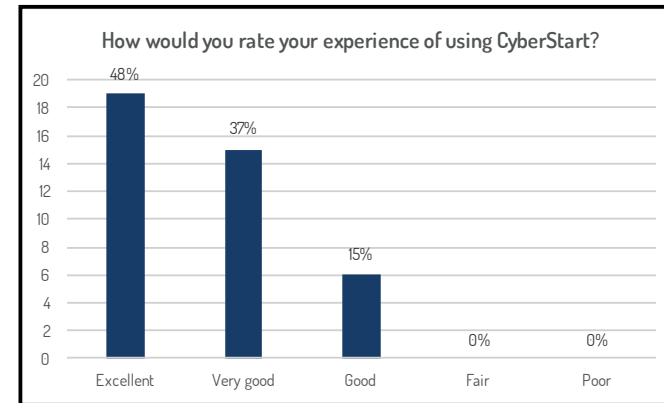


Example of Majors of CyberStart Participants:

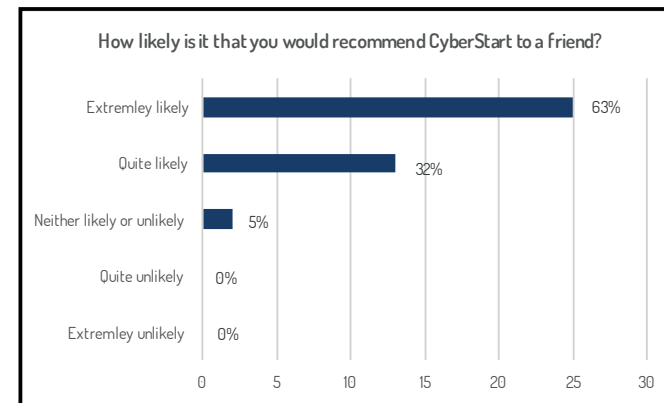
- Computer science
- Civil engineering
- Math
- Computer Engineering
- Information security
- Robotics
- IT

It is encouraging to see that students who had no previous experience were able to engage with the CyberStart tool and progress as well as students already interested in the industry and with a basic foundation of knowledge.

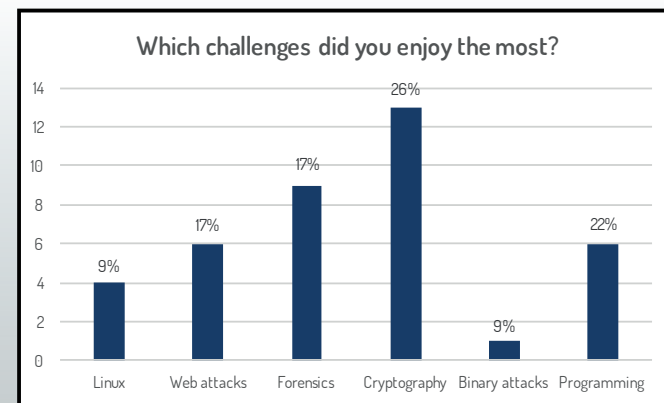
Student Feedback on CyberStart



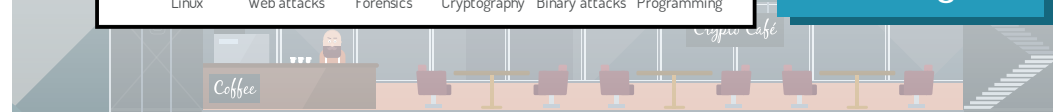
The response to the tool has shown that the training and teaching in CyberStart has engaged the instinctive ways people learn and identified those who naturally think like a cybersecurity practitioner. These encouraging results reflect the enormous success of the program in engaging with a variety of ages, genders and skill level.



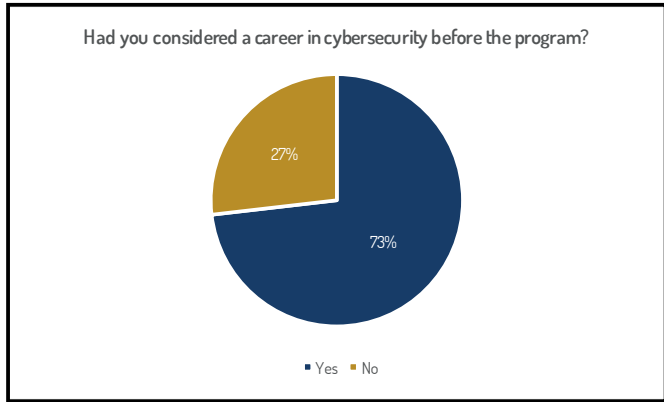
The students' response to the game has been exciting: 85% of students rated the game either "excellent" or "very good" and 95% said they would recommend the program to a friend. Not a single player rated the game "fair" or "poor" or said it was unlikely they would recommend it to a friend.



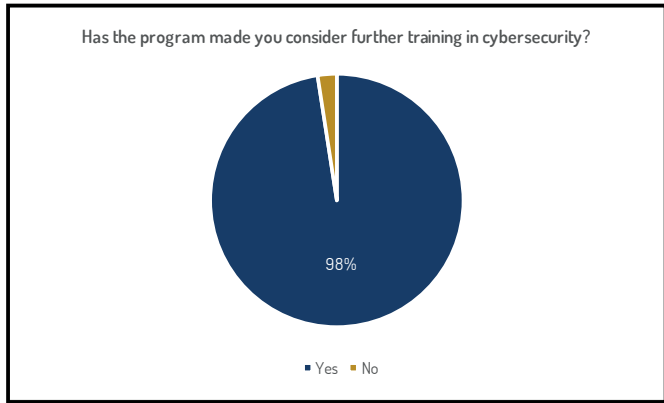
Students in Hawaii were most engaged with cryptography and programming challenges



Student Feedback on Career Impact



100% of students who answered “no” to considering a career in cybersecurity in the past are now considering further training.



The aim of the CyberStart program is to grow Hawaii’s cyber-capable workforce and promote cybersecurity as an exciting and recognized career. These graphs support our mission and present a group of young people who are now on the right path to a cybersecurity career.

Of the CyberStart participants in Hawaii, 73% of players were already interested in a career in cybersecurity before the program. After the program, this number increased. 98% of players are now considering further training. This is encouraging when looking at the future of cybersecurity professionals in the state.

In addition, 27% of students had never considered a career in cybersecurity before playing the CyberStart Game. After completing challenges in a variety of cybersecurity disciplines, 100% of these students are now considering further training in the area. This is an exciting program result that shows a real step change in reducing the skills gap in Hawaii.

Is there anything you would like to say to the governor sponsoring the program?



“I honestly think this is a fantastic way to get more people thinking about a career in cybersecurity. This program does a good job of showing that cybersecurity isn’t boring, that there may be something for everyone to enjoy, and that might put them on the path to a career in the field. Thank you for giving me and the rest of the community an opportunity to participate in the competition and making it as fun and engaging as it is.”

Nathan Horiuchi, Honolulu Community College, College Sophomore

“Thank you for creating a fun site. The puzzles helped me practice some of the things I have learned in school and made me more confident in my abilities. I will share CyberStart with some teachers and students that I work with to get more people involved. I think this is a great scholarship opportunity that I wish I knew about sooner and I am glad that one of my professors introduced me to this.”

Janice Evans, University of Hawaii, West Oahu, College Sophomore



“I am a college sophomore participating in the CyberStart challenge you sponsored. Thanks, it really has been a lot of fun, and I’ve learned a number of new skills from it. It’s made me think of being more active in my clubs and participating in other CTF competitions too. So really, thank you for this opportunity, it’s been great.”

Logan Uyeda, University of Hawaii, Manoa, College Sophomore

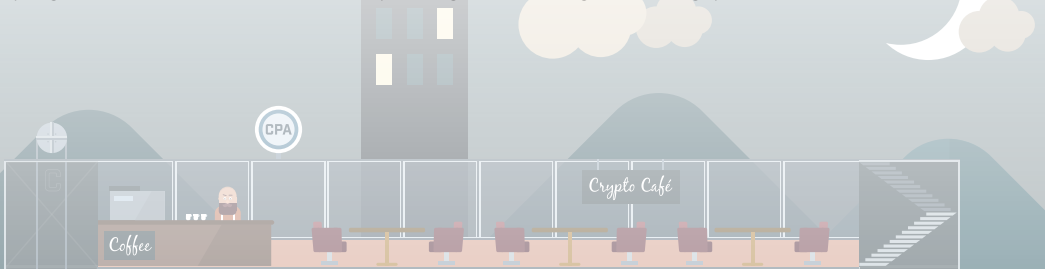
“Thank you for giving me the opportunity to participate in this learning experience. It has been not only helpful and educational, but fun as well.”

Megan Lauw, Mililani High School, Grade 12



“I would like to thank the governor who sponsors the CyberStart program, after this past month I can truly say that my skillset and grasp of a wide amount of the topics covered and tested in the competition has expanded. The program has given me a platform to jump from and compete in future CTFs. I insist that you all continue to sponsor and improve this competition so that many others like myself can be inspired and feel confident in exploring the deeper realms of cybersecurity.”

Nicholas Shaw, Mililani High School, Grade 12





"Thank you so much! I've loved learning and solving the challenges and puzzles within this CTF. You've inspired me to take more of an interest in cybersecurity."

Kinaole Mulan Lau, Homeschooled, Grade 12



"Thank you for sponsoring this program! I learned more in the last few weeks about cybersecurity than I have in any other course."

Darren Kam, Iolani School, Grade 12



"I have no clue as to who else on the island or the state has taken this amazing opportunity but as a message from all of us, thank you. In my high school, there are rarely any opportunities like this where someone like me who knows nothing about cybersecurity gets to learn about it and love everything about it. I hope that an opportunity like this will come again to not only me, but all those who have been waiting for this golden opportunity in their lives."

Carl Antiado, H.P. Baldwin High School, Grade 11



"This program taught me more than an entire semester of college."

Ryan Nakata, University of Hawaii, Manoa, College Junior



"Thank you for providing this wonderful opportunity to Hawaii residents. Growing up, I often felt a lot of the more interesting/fun events and conferences for a lot of academic areas were on the mainland or were otherwise prohibitively expensive for Hawaii students. Thank you for taking the effort to make this great training available for no cost to Hawaii residents."

Korry Luke, Iolani School, College Junior

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