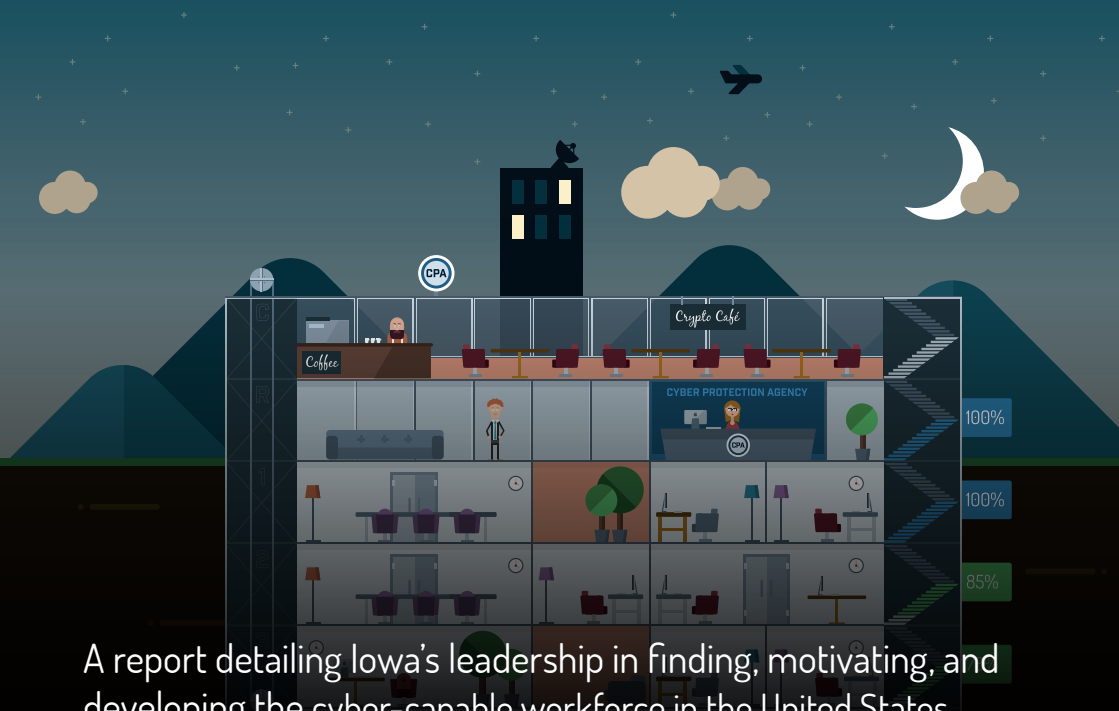
Iowa: Inspiring the next generation of cybersecurity experts



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

Dear Governor Reynolds,

Your insight and leadership in bringing CyberStart to the students of Iowa 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 Iowa. Results of the CyberStart pilot program, ably managed by Jeff Franklin, your Deputy CIO, are summarized below, but it is worth highlighting that the number one ranked high school participant in the country is a 16 year old from Waukee, IA. This is an exciting program result and shows real potential in reducing the skills gap in Iowa. Before you dig into any more numbers and see the lists of high-performing Iowa students, please turn to the back cover and last page 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 474 Iowa students.
- Nearly 70% of them solved at least one of the assessment challenges and 42% 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.
- Five Iowa high school and college students were in the overall top 50 each winning scholarships for more advanced education in cybersecurity.
- The state of Iowa excelled in the Moon Base being above average in all programming topics covered. Topics included: files, sockets, strings and cryptography.
- As you might guess from the students' notes, they liked CyberStart:
  - 93% 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 Iowa.

Sincerely,
Alan Paller

SANS Institute
Director of Research
apaller@sans.org

474 students initially registered to see how well they could do on CyberStart Assess, the program's qualifying exam.

313 students got one or more answers correct in CyberStart Assess.

42% **198** students qualified for the CyberStart Game.

43 students reached the elite levels (7+) in the HQ base of the program.

Scholarships **26**

Iowa's next cybersecurity professionals.

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 eight 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.
- Grow the U.S. cyber capable workforce.
- Inspire the next generation of cybersecurity experts.
- Identify the most elite young talent.

CyberStart Players in Iowa

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

Last Name	First Name	School	Top 100/ Scholarship
Abu	Uma	Iowa State University	
Aldiano	Noah	West Des Moines Valley	
Barker	Charity	Liberty University	
Barker	Elijah	Liberty University	*
Beattie	Jake	Southeast Polk High School	
Biermann	Brett	University of Northern Iowa	
Blicharski	Kevin	University of Iowa	**
Bolton	Tyler	West Des Moines Valley High School	
Brady	Loren	Missouri University of Science and Technology	
Brooks	Roxanne	Iowa State University	**
Brus	Morgan	University of Northern Iowa	
Burroughs	Noah	University of Northern Iowa	
Byerly	Lawrence	Valley High School	
Cervantes	Raul	Scott Community College	
Christoffer	Devyn	University of Northern Iowa	
Crawford	Liam	University of Iowa	
Croell	Morgan	University of Northern Iowa	
Cubit	Andrew	Homeschooled	
Curbow	James	University of Northern Iowa	*

Last Name	First Name	School	Top 100/ Scholarship
Curry	Tony	Kirkwood Community College	
DeCamp	Conor	Southeast Polk High School	
Dietrich	Josh	Simpson College	
Dodd	Angie	North Iowa Community College	
Easler	Maeghan	Iowa State University	
Echer	Brody	DMACC	
Erger	Jesse	University of Iowa	
Fahrenkrug	Benjamin	Waukee High School	**
Farmer	Levi	Kirkwood Community College	
Ferguson	Jeremy	Mount Vernon High School	**
Filip	Konnor	Abraham Lincoln High School	
Fisk	Scott	Iowa State University	*
Forest	Joshua	Iowa State University	
Foster	Daniel	Pocahontas Area Community School	
Fox	Alexander	University of Northern Iowa	
Franklin	Alexander	Iowa State University	
Gertsen	Grant	University of Iowa	**
Glick	Colton	Dike New Hartford High School	**
Grimm	Andrew Scott	Hawkeye Community College	
H	Robert	Ankeny High School	
Hage	Joseph	Iowa State University	*
Hajewski	Jeff	University of Iowa	**
Hall	Bryce	Iowa Christian Academy	**
Hallberg	Andrea	University of Iowa	
Halverson	Jon	University of Iowa	

Last Name	First Name	School	Top 100/ Scholarship
Heinzman	Eric	DMACC	
Henrichs	Miles	University of Iowa	
Hlas	Michael	Briar Cliff University	
Hodges	Jake	University of Northern Iowa	
Houtz	Aaron	University of Northern Iowa	
Karrer	Zachary	Lawton-Bronson	
Kees	Kadin	Valley High School	
Kelley	Lachlan	Iowa State University	
Kelly	Jonathan	Ankeny High School	
Khan	Zain	University of Iowa	
Kiel	Adam	Iowa State University	
Kiely	Philip	Grinnell College	
Kraft	Anna	Heartland Christian School	
Lansing	Tim	Iowa State University	**
Lesthaeghe	Tyler	Iowa State University	
Lin	Kevin	Iowa State University	
Lorenz	Alik	University of Northern Iowa	
Luo	Tiancheng	University of Iowa	
Magri	Josh	University of Iowa	
Mark	Aaron	Southeastern Community College - West Burlington	
Mass	Zachary	Iowa State University	
May	C.J.	University of Northern Iowa	
McCarley	Morgan	Iowa State University	
McTee	Sterling	Hoover High School	
Meng	James	Valley High School	

Last Name	First Name	School	Top 100/ Scholarship
Miller	Mattea	Valley High School	
Miller	Travis	Iowa State University	
Monaghan	Zach	Iowa State University	**
Monroe	Gavin	Iowa State University	
Moody	Jacob	Iowa State University	*
Morrison	Rob	Iowa State University	
Mosher	Samantha	Ballard High School	
Mundus	Cole	Earlham Junior-Senior High School	**
Mundy	Micah	Valley High School	*
Mundy	Zech	Valley High School	*
Nalluri	Dheepak	Iowa State University	
Nelson	Nick	University of Iowa	
Nishimura	Jacob	University of Iowa	
Nwizu	Chioma	Iowa State University	
OBrien	David	University of Northern Iowa	
Ogunsola	Ayo	Valley High School	
Orth	Matthew	Iowa State University	
Pearson	Michelle	The University of Alabama	
Peterson	Connor	Boone High School	
Peterson	Ellissa	Ankeny High School	
Petsche	Nate	Ankeny Centennial	
Pifer	Hunter	Woodward-Granger High School	
Potocki	Mark	University of Iowa	
Potter	Jack	Iowa State University	

Last Name	First Name	School	Top 100/ Scholarship
Powers	Alex	University of Iowa	
Qian	Xinyu	University of Iowa	
Qin	Bradley	Valley High School	
Rickert	William	Iowa State University	
Sangem	Akhil	Iowa State University	
Schaffer	Sarah	Waukee High School	
Schmitt	Abby	University of Northern Iowa	
Schneider	Seth	University of Northern Iowa	
Sedlacek	Patrick	University of Northern Iowa	*
Seidel	Anna	University of Iowa	**
Song	Zhaohe	University of Iowa	
Springer	Nick	Iowa State University	**
Stanbary	Drake	Scott Community College	
Stoltz	Jon	University of Iowa	
Swesey	Kole	Iowa State University	
Tica	Almir	Valley High School	
Timmer	Nick	University of Northern Iowa	
Urban	James	Des Moines Area Community College	**
Van Der Kamp	Blake	Prairie City Monroe (PCM)	
VandeBerg	Andrew	Valley High School	
Velamuri	Radha	Valley High School	
Vissers	Jacob	Iowa State University	
Walberg	Kai	Macalester College	**
Willis	Allison	Kaplan University	
Winheim	Carrie	Capella University	*

Last Name	First Name	School	Top 100/ Scholarship
Wolfe	David	Mount Vernon High School	**
Wolfe	Kevin	University of Iowa	
Wong	Casey	Prairie High School	
Young	Alex	Urbandale High School	
Zhang	Jiahua	University of Iowa	*
Zheng	Zichen	University of Iowa	
Zobler	Derek	Iowa State University	
	Bradlee	Iowa State University	
	Britton	Western Governors University	
	Cole	Iowa State University	
	Daniel	Iowa State University	
	Dhruv	The University of Iowa	
	Eric	University of Northern Iowa	
	Isaiah	Valley High School	
	Jessica	Iowa State University	
	Joseph	University of Iowa	
	Josiah	Kirkwood	
	Megan	Iowa State University	
	Mitchel	Indian Hills Community College	
	Nathan	Iowa State University	
	Nephat	University of Northern Iowa	
	Peter	Prairie High School	
	Rishabh	University of Northern Iowa	
	Sam	Valley High School	
	Spencer	University of Iowa	
	Stacy	Iowa State University	

Strengths & Weaknesses

Headquarters Base categories	State average (%)	Seven state average (%)	Difference (%)
Linux	22.58	20.97	7.69
Web application	31.17	30.84	1.10
Forensics	28.30	28.03	0.97
Binary	9.58	9.21	4.05
Cryptography	44.78	44.83	-0.10
Programming	17.71	16.19	9.33
Open-source intelligence	67.95	68.40	-0.65

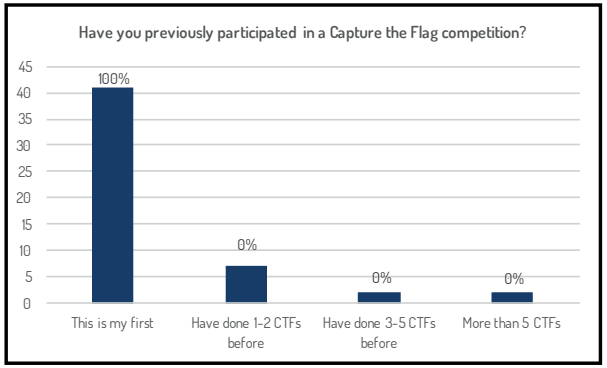
Moon Base categories	State average (%)	Seven state average (%)	Difference (%)
Cryptography	9.63	8.11	18.71
Debug	27.70	23.53	17.74
File	14.86	12.83	15.82
Functions	25.68	22.46	14.32
Loops	8.27	7.42	11.55
Sockets	12.5	11.31	10.54
Strings	8.45	6.55	28.93

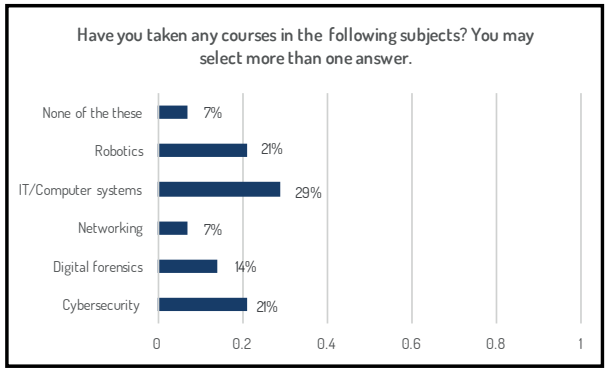
When comparing Iowa's average in challenge categories to the overall competition average, we can see where the students' strengths and weaknesses lie. The above tables show that Iowa students were strongest at programming topics and excelled in the Moon Base. In particular, strings, cryptography and web application challenges.

There are opportunities to further develop cryptography and open source intelligence skills that were the only two topics below average in Iowa. Clearly there are already some very developed capabilities that are applicable to security roles, but opportunities to further develop too.

Student Feedback on 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.





The results show that most students who played the CyberStart Game in Iowa had never been exposed to a Capture the Flag style teaching method. Furthermore, 7% of students had never taken any courses in relevant cybersecurity subject areas. Knowing this, it is encouraging that 42% of players made it through to the CyberStart Game.

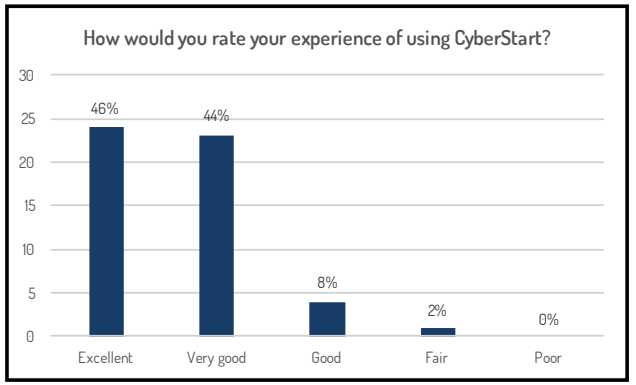
However, there were players from Iowa who had experience in other relevant cybersecurity subject areas - in particular computer systems. This showed that there is a strong group of students keen to build upon their existing knowledge. One of the benefits of CyberStart is that it engaged with this group and developed their interest in cybersecurity. This in turn is likely to accelerate their entry into the profession and fast-track Iowa's next generation of cybersecurity experts.

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.

Examples of Majors of CyberStart Participants:

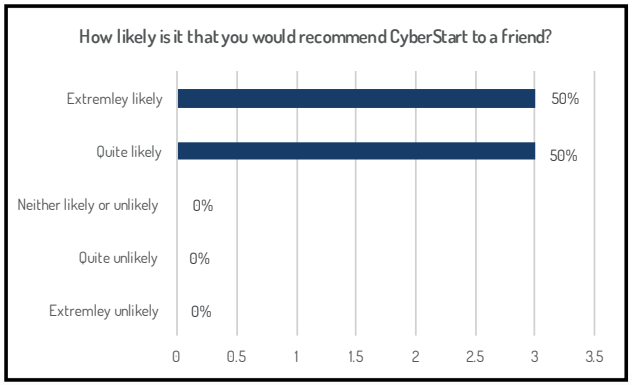
- Computer science
- Computer engineering
- Software engineering
- Management information systems
- Aerospace engineering
- Network administration
- Math
- Electrical engineering
- Information assurance

Student Feedback on CyberStart

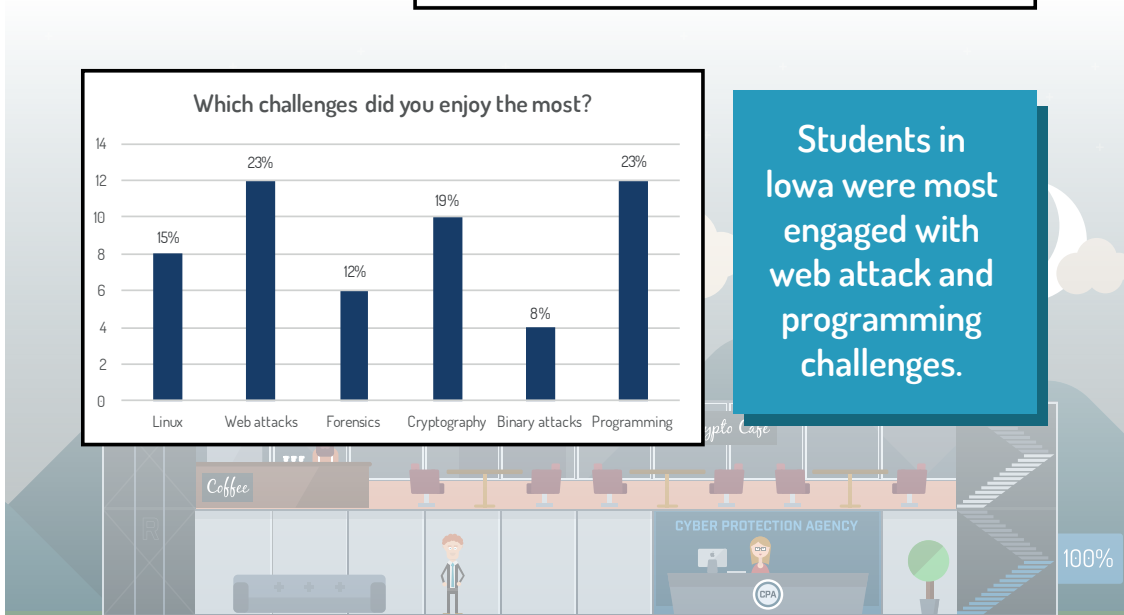


The response to the tool has shown that the training and teaching in CyberStart has engaged the instinctive ways people learn and identified those who naturally think like a cybersecurity practitioner. These encouraging results reflect the enormous success of the program in engaging with a variety of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

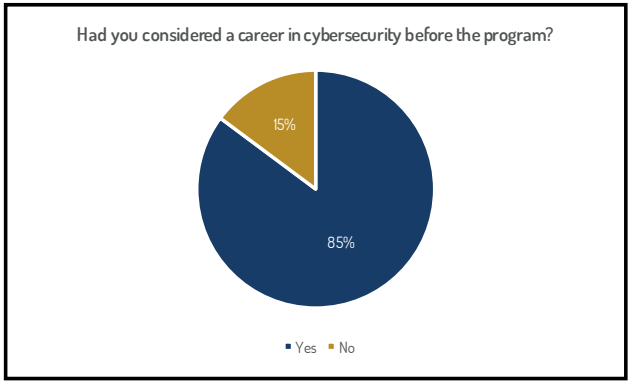
The students' response to the game has been exciting: 90% of students rated the game either "excellent" or "very good," and 93% said they would recommend the program to a friend. Not a single player rated the game "poor" or said it was unlikely they would recommend it to a friend.



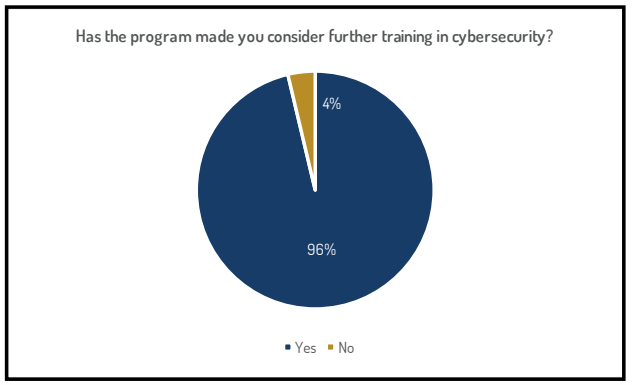
Students in Iowa were most engaged with web attack and programming challenges.



Student Feedback on Career Impact



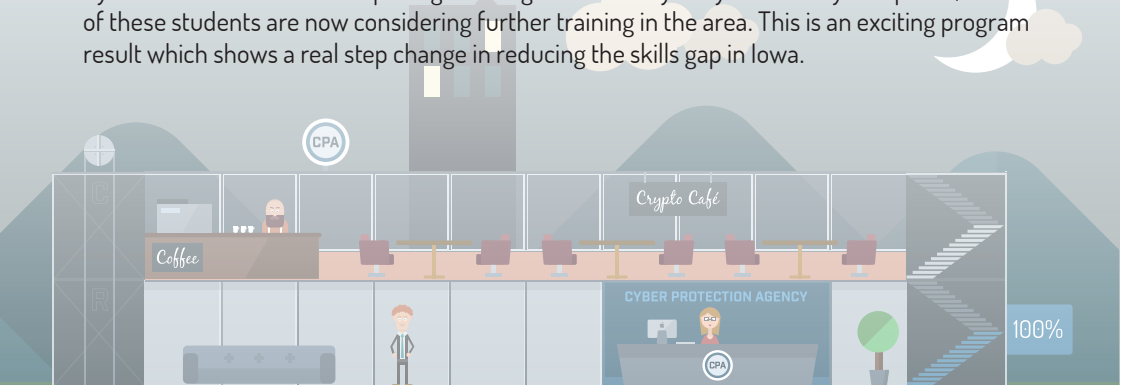
88% of students who answered "no" to considering a career in cybersecurity in the past are now considering further training.



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

The graphs show that 85% of CyberStart players in Iowa were already interested in a career in cybersecurity before the program. However, after the program, this number increased to 96% of players saying that they would now consider further training in the area. This is encouraging when looking at the future of cybersecurity professionals in the state.

In addition, 15% of students had never considered a career in cybersecurity before playing the CyberStart Game. After completing challenges in a variety of cybersecurity disciplines, 88% of these students are now considering further training in the area. This is an exciting program result which shows a real step change in reducing the skills gap in Iowa.



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

"Thanks so much for sponsoring this! With a shortage of cybersecurity professionals and the growing threat risk, it is imperative that we train up the next generation of security professionals. This has been a really fun and valuable program."

Scott Fisk, Iowa State University, College Senior

"Thank you for sponsoring this program and opening it up to anyone that has a passion for cybersecurity and wants to learn more. I have had an interest in IT/cybersecurity for a few years, but thinking that I was too old to get into a program, I never took the plunge. I was excited to find this program was offered in my state and that I could take part (even though I may not be in the demographic this program is aimed at). So again thank you for offering a program that is challenging, informative and an excellent way to get hands-on experience. "

Allison Willis, Kaplan University, College Junior

"I think this is fantastic on two levels. First, it has gotten me extremely interested in cybersecurity. I am very likely to explore opportunities in the cybersecurity area when I finish my PhD. Second, even if I never go into cybersecurity, I have learned a ton about the tools, techniques, and obstacles encountered when attacking various systems. I would love to continue doing something like this throughout the school year, and am hoping I can participate in the NSA CTF this year. Thanks for having Iowa participate! "

Jeff Hajewski, University of Iowa, Graduate

"I would like to thank the governor for her sponsorship of the program, and encourage her to pursue and publicize this and other similar opportunities for students in the future. I would have been incredibly grateful to have access to an opportunity like this during high school, and I'm sure many others who have an interest in computer science feel the same way."

Kai Walberg, Macalester College, College Sophomore

"I think it's really great that we have some government support behind a project like this. Computers and programming really is the future that we're going into. We need as many people as possible to learn the ins and outs of everything. I want to say thank you for giving me this amazing opportunity, allowing me to learn so much more about cybersecurity and how it works."

Colton Glick, Dike New Hartford High School, Grade 12

"Thank you very much for the opportunity to continue to pursue my interests in cybersecurity! I have been very interested in it for the past few years and appreciate every chance I have to get further in the field! Thanks again!"

Aaron Mark, Southeastern Community College, College Freshman

"Thank you for sponsoring this program. It has taught me a lot and given me an interest in a new field. I believe it has the power to introduce programming in a very positive light to many individuals."

Jacob Vissers, Iowa State University, College Sophomore

"This is a great program. It has made me challenge myself and helped me to know that I would enjoy a career in cybersecurity."

Carrie Eim, Capella University, College Junior

"Thank you so much for allowing students in our state to participate in this program. You don't understand how much this helped me improve my skills in multiple programming languages, and with understanding what cybersecurity really is."

Chioma Nwizu, Iowa State University, College Freshman

"Great job! I am proud that of the few states actively encouraging students of all ages to participate in this challenging cybersecurity training, Iowa is one of them. Thank you for this opportunity!!! It has reaffirmed my interest for a career in cybersecurity."

Tim Lansing, Iowa State University, Graduate

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