Proposed Cybersecurity Merit Badge for the Boy Scouts of America

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Problem: Cybersecurity Talent Shortage

Cybersecurity is a significant challenge facing our society, and the industry is in desperate need for more talent. A recent study [4] estimates that the cybersecurity worker shortage will grow to **1.8 million** by 2022. Among professionals surveyed in North America, **68% said there are currently too few cybersecurity workers** in their department, and the majority believe that the main reason for this is the difficulty in finding qualified personnel.

Cyber-crime causes **tens of billions of dollars** damage each year to the U.S. economy, and **hundreds of billions globally** [13]. This problem impacts everyone. One industry leader put it this way: "The cybersecurity talent issue isn't limited to a few sectors; **it runs across the board** from government to education to healthcare and all industries. Strong talent is needed in all communities from **rural farms that increasingly rely on information technology** to **financial service companies in large urban areas**." [12] The U.S. President's Commission on Enhancing National Cybersecurity also identified this challenge, concluding that building the cybersecurity workforce was one of its **strategic imperatives** for bolstering the nation's cybersecurity posture [5].

Badges in STEM Education

Badges are a part of a larger trend in "gamification" in a wide variety of fields, including education. Below is just a sample of recent research on badges in education.

Educational badges have the potential to **increase interest** in a subject as well as **decrease negative motivations** (i.e. not wanting to look bad compared to other students), particularly for low-performing students [1]. However, these **effects can vary** based on multiple factors, and there is a complex interplay between **type of badges**, **skill levels of learners**, and different motivation outcomes.

Badges **can't by themselves create value**, but they can **deepen engagement and interest** in something that already has intrinsic value. This is **most effective in the right social context**, where the social capital embodied by the badges is the reward that drives motivation [6].

Photo credit: Michael H. Dunn

Scouting is a prime example of just such a context. In fact, the **merit badge program** of the Boy Scouts of America (BSA) is held up by experts as a model of the positive impact badges can have [2, 6].

Scouts who complete science-based merit badges **retain content knowledge**, they report doing better in school, and many who go on to **science careers** credit Scouting with helping them get there [10, 11].

One university that conducted computing workshops for Boy Scouts, based on the Computer merit badge, found **increased positive attitudes** about computers across multiple dimensions [14].

Girl Scout STEM programs have also been incredibly successful, increasing girls' **positive attitudes and interest** in STEM subjects and careers [8, 9]. **Earning badges** was one of the most widely-reported **positive experiences** in a survey of Girl Scout alumnae, as were **learning new skills** and **trying new things** (also things like fun, friendship, crafting, and camping) [7].

Suggested Requirements

Below is a selection of suggested requirements to earn the badge sent to the BSA. Final requirements will be determined by a committee of BSA volunteers and cybersecurity subject matter experts.

Knowledge. Define/Describe the following terms or concepts:

Vulnerability	Exploit	C.I.A. triad	Authentication	Multi-factor authentication
Identity	Firewall	Antivirus	IDS/IPS	Mobile device security
Virus	Worm	Trojan Horse	Ransomware	Internet of Things
Botnet	Encryption	PKI	Online scams	Critical Infrastructure

Ethics.

- Discuss what you should do if you **discover a vulnerability** in your school's computers or network, a public website, or a software product.

System Security. Do six of the following (including both marked with *):

- *Check for, download, and install the latest **updates** for your computer. Verify your computer is up-to-date.
- *Run a **virus scanner** on your computer. Review the results.
- Set or change an account **password** to one that is "strong."
- Add a new, non-administrator user account and check that **permissions** are set correctly. Disable the guest account.
- Use two different methods to see what **processes are running** on your computer.
- Use a command line to view your computer's **open network connections**.
- Check the status of your computer's **firewall**. Turn it on if it isn't already.
- Identify one or more other **vulnerabilities** on your home computer or network, and take the necessary actions to **fix it**.

Network Security. Do two of the following:

- If your home has a **WiFi router**, verify that it has the highest available **security settings**. Set a **strong password**.
- Run a network **port scan** on your computer. Discuss what programs could be using the open ports and whether they are needed on your computer.
- Show the **available WiFi networks** nearby, and how to tell which ones are running with encryption. Show **how to connect** to a known, trusted network that uses a passphrase.

Cryptography. Do one of the following:

- Create an **encrypted** ZIP file.
- Create and share your own **PGP email key**. Get someone else's public key and send them an email that has been digitally **encrypted**.
- Use a **hashing** algorithm to create a **checksum** for a file. Have someone change the file. Recreate the checksum, and compare it to the original value.

Boy Scouts of America

The Boy Scouts of America (BSA) is one of the largest youth organizations in the United States, serving over 2.3 million current members, including over 800,000 boys aged 11 to 17 in their core Boy Scout program [3]. The BSA engages youth in experiential learning, emphasizing character, citizenship, outdoorsmanship, leadership, and life skills. Participants are exposed to a variety of hobbies, outdoor activities, technologies, and careers, along the way earning ranks, merit badges, and other awards, including the highest and most prestigious Boy Scout rank, Eagle Scout. Recent program expansions have focused heavily on STEM activities and careers. Related badges include Digital Technology (formerly Computers), Programming, and Robotics merit badges, and the Cyber Chip, a renewable badge on personal online safety.

Image credit: Boy Scouts of America, https://scoutingwire.org/bsa-brand-center/scouting-logos/

Current Status of Effort

- Assembled team of experts from industry, academia, and education
- Drafted proposal and initial set of recommended requirements
- Co-sponsored by $(ISC)^2$, the Center for Cyber Safety and Education, and the ISSA Education Foundation

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- Full proposal sent to BSA national office on January 25, 2018
- Proposal is reviewed by committee of BSA curriculum experts and volunteers
- Initial decision by BSA expected within about 4 months
- BSA just completed recent merit badge surge, expecting delay before any new badges
- Full development of a new merit badge can take up to 2 years once approved

Next Steps

- Gather support from cybersecurity leaders and influencers within the BSA organization
- Follow-up with BSA national staff, give presentation to committee if invited
- Solicit further corporate sponsorship to defray costs of development, deployment

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