



PROBLEM STATEMENT

There is a growing need for highly-trained cybersecurity professionals. Providing the best training possible for the next generation requires continued development of educational tools and techniques.

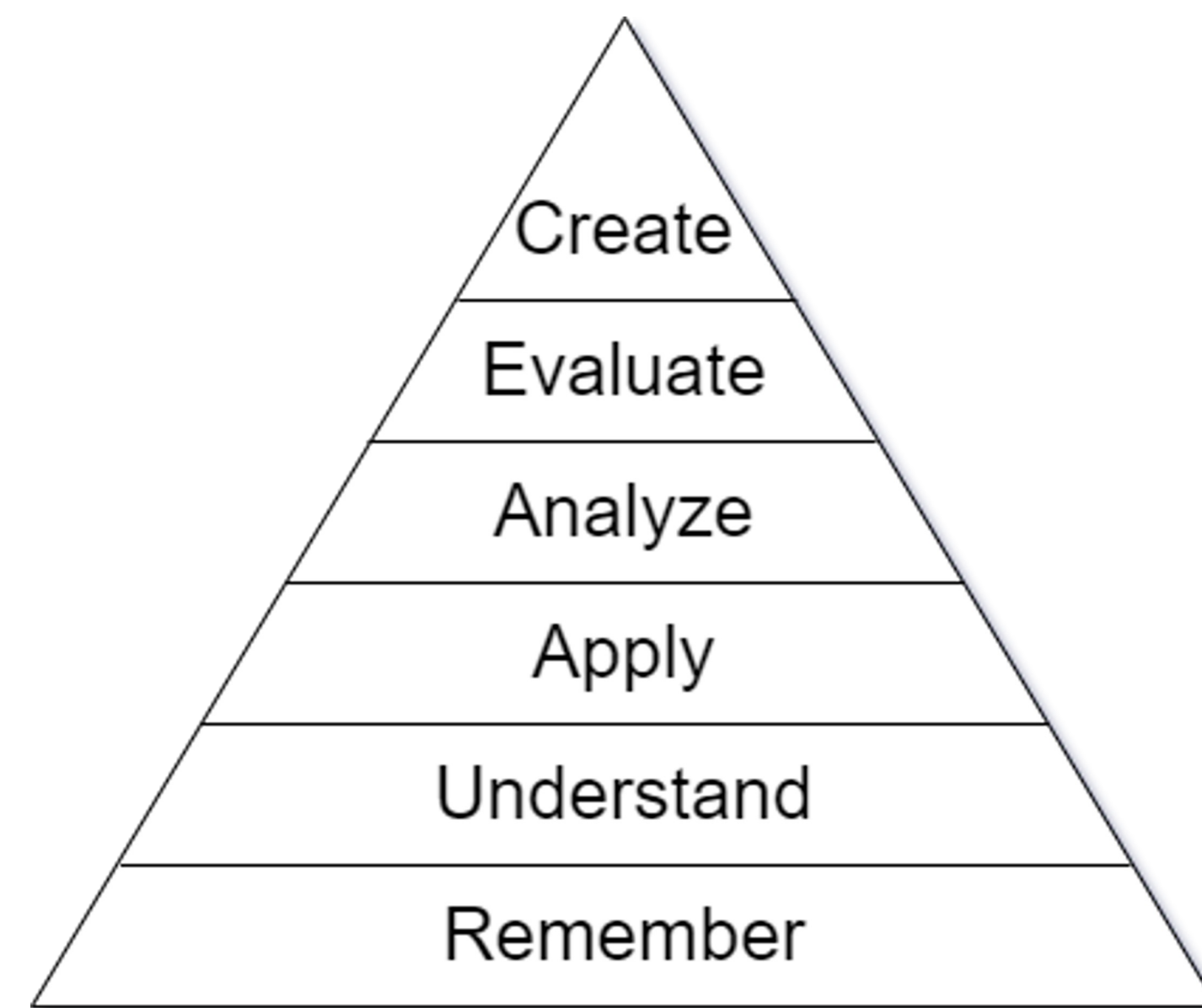
BLOOM'S TAXONOMY

A framework for classifying levels of knowledge to develop progressive assessments at each level.

We are using this to develop instructional tools based on assessment of important concepts in cybersecurity.

- **Remember:** To recognize or recall knowledge from memory.
- **Understand:** To construct meaning from material when presented via different formatted messages or activities.
- **Apply:** Carrying out or using a procedure through executing, or implementing.
- **Analyze:** Differentiate, organize, and attribute components and functionality of a concept.
- **Evaluate:** Making judgements based on criteria and standards.
- **Create:** Putting elements together, and/or reorganizing them into a new pattern, to form a coherent/functional whole.

Bloom's Taxonomy levels



CYBERSECURITY CONCEPT INVENTORY

Parekh et al (2018) developed a list of top concepts that should be taught in cybersecurity courses including:

- Identify vulnerabilities and failures
- Identify attacks against CIA triad and authentication
- Identify potential targets and attackers
- Given a breach, explain how to recover from it

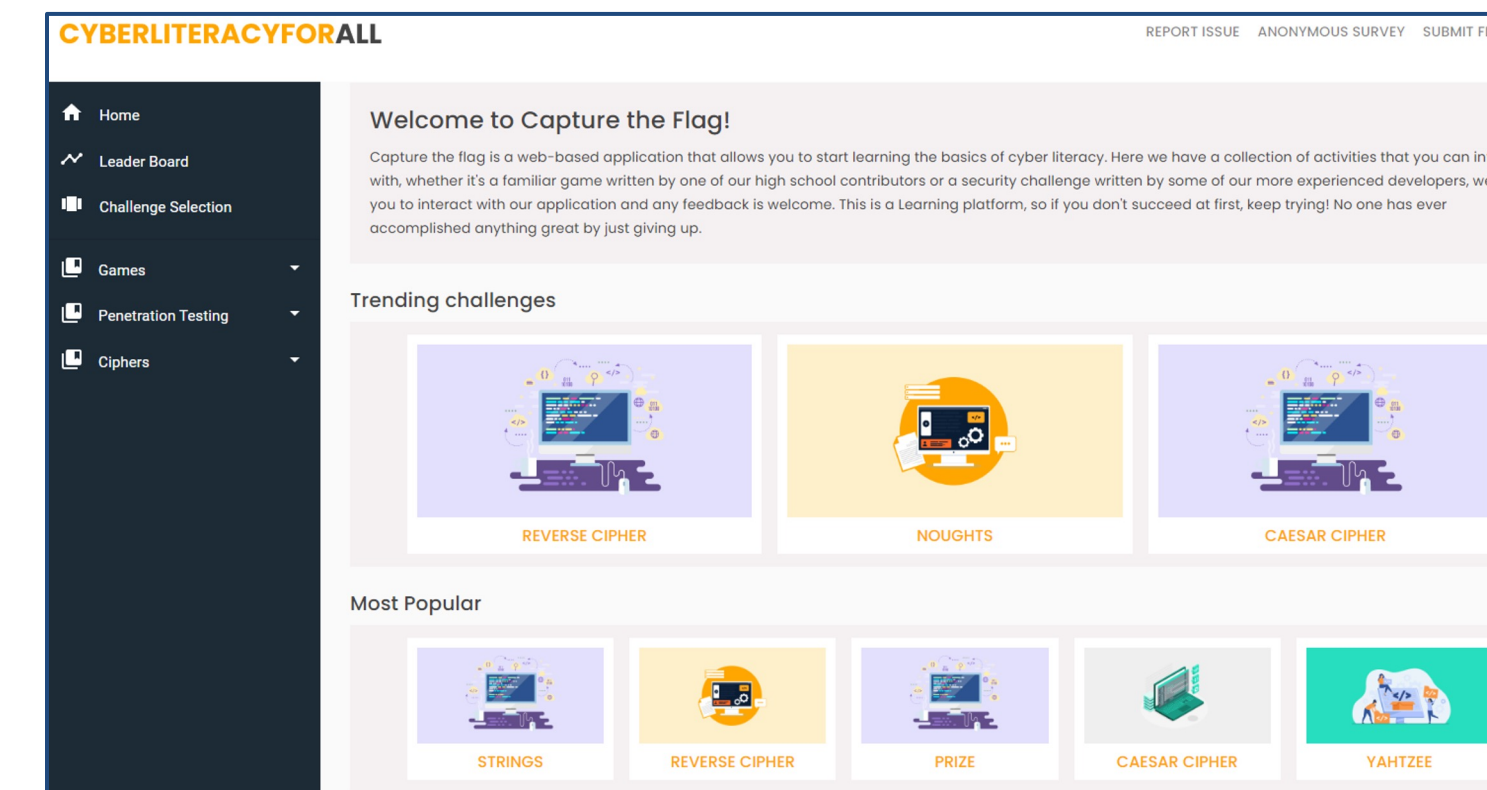
Industry Recommendations

Existing recommendations from industry sources on important cybersecurity skills and knowledge:

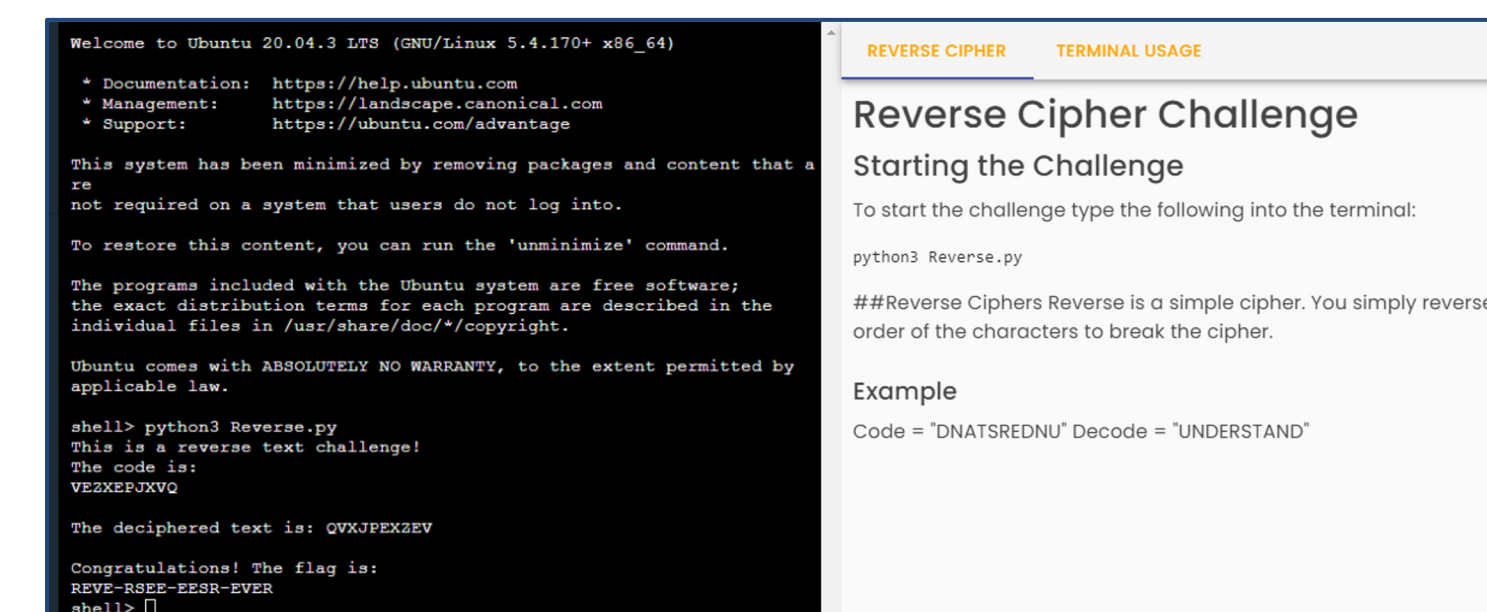
- NICE Framework (NIST)
- Cybersecurity Curricula 2017 (ACM, IEEE, others)

CYBERLITERACYFORALL

The cyberliteracyforall (CLFA) web application delivers cyber literacy and security basic concepts in the form of hands-on activities.



The CLFA web app provides a variety of activities, from familiar games written by high school contributors, to security challenges written by more experienced developers



Pictured above is the CLFA challenge structure which is comprised of the following:

- **Interactive Terminal:** The left side of each challenge is an interactive terminal interfacing with an Ubuntu instance.
- **Challenge Lesson:** The right side houses the challenge documentation. This documentation aims to satisfy several objectives.
 - Teach the user basic digital principles needed to understand the challenge
 - Teach the user basic usage of tools needed to complete the challenge
 - Deliver challenge instructions

FUTURE DIRECTIONS

The main goals of this work moving forward are:

- Cross-validating CCI concepts with industry recommendations
- Develop learning materials for CCI concepts (Parekh et al, 2018)
- Use Bloom's Taxonomy to guide development of assessments (Anderson et al, 2001)
- Design lessons that teach to the assessment while following established instructional design principles for multimedia learning (Mayer & Fiorella, 2022)

ACKNOWLEDGEMENTS

The authors are grateful for funding from the Griffiss Institute under contract No. SA10012021MM0336. The authors would also like to thank the staff at cyberliteracyforall.com.

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