

**CYBERBADGES: WEB PLATFORM FOR CYBERSECURITY TRAINING**  
**THE POTENTIAL OF GAMIFICATION IN TECHNOLOGY TRAINING**

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By  
Daniel McNamara

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Technical Project Team Members  
Brandt Welch, Humza Mohammed, Joe Gumprich, John Fultz, Leonard Ramsey, Riley Hevener

On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

Signed: \_\_\_\_\_ Date: \_\_\_\_\_

Approved: \_\_\_\_\_ Date: \_\_\_\_\_  
Catherine D. Baritaud, STS Division, Department of Engineering and Society

Approved: \_\_\_\_\_ Date: \_\_\_\_\_  
Aaron Bloomfield, Department of Computer Science

Cyber security and technological literacy are necessary skills in the modern professional landscape. The internet is ubiquitous and nearly unavoidable in everyday life for most Americans, but alarmingly few are aware of the potential consequences of internet use. Current educational institutions often fail to effectively teach basic cybersecurity knowledge and skills. Many companies require employees to complete cyber security training, but these trainings are often outdated and ineffective. CyberBadges aims to re-think cyber security training by designing a system that is painless and fun, but still useful and educational.

The Science, Technology, and Society (STS) portion of the Prospectus reviews the benefits and drawbacks of gamification in online training. Gamification is the application and implementation of elements from games such as point-scoring and leaderboards in non-recreational areas such as academics. CyberBadges and gamification both aim to provide enjoyable and effective learning experiences for users. The CyberBadge project does not include the implementation of the trainings and modules, but it provides a platform for employers or managers to create trainings and modules that may include a gamification elements and interactive storytelling.

CyberBadges is an open source Django site that will be developed as a part of the University of Virginia Computer Science Service Learning Practicum (SLP) to be delivered at the end of the 2017-18 school year. The members of the SLP CyberBadge team consists of third and fourth year Computer Science students Daniel McNamara, Brandt Welch, Humza Mohammed, Joe Gumprich, John Fultz, Leonard Ramsey, and Riley Hevener. The client for the project is Professor Ryan Wright of the McIntyre Commerce School at the University of Virginia. The technical advisor for the team is Professor Aaron Bloomfield of the Computer Science department at the University of Virginia.

The timetable of the technical project is split into two-week iterations that continue throughout the school year. At the beginning of the project, tasks and specifications were entered as issues on GitHub and assigned a point value, which represents the relative amount of time expected to complete the task, and urgency. At the beginning of each two week period, issues are assigned to team members and completed over the course of the iteration. Tasks can be added and edited throughout the project as specifications and expectations change and evolve.

### **CYBERBADGES: WEB PLATFORM FOR CYBERSECURITY TRAINING**

CyberBadges aims to provide a framework that facilitates the development of cybersecurity training courses for Virginia state employees. The basic framework of CyberBadges can also easily be repurposed to support many different types of training beyond cyber security. The CyberBadges Django site provides a versatile platform on which a company or school can implement their own training modules in a number of subjects.

The site's functionality includes multiple user types, tracking statistics such as time spent on modules, and a verification tool which allows employers to assign trainings to specific employees. The system requires three user types: state employees, content creators, and managers. State employees extend the built-in Django user and can create an account, complete trainings, and view their statistics (hours in training, certificates, etc.). Content creators extend the "state employee" user type and can create accounts, add/edit modules and trainings, and test modules in a user view. Managers extend the functionality of the built-in Django admin user, which allows them to view and edit user information, and can do everything that the content creators can do, manage user accounts, and run reports for various statistics on the site. The

nature of these reports is not yet determined, but will likely include statistics such as the average amount of time users spend on a specific training or the average numbers of attempts for a user to complete an assessment.

The final design of the site is not finalized, but the team developed wireframes to plan the basic layout without needing to add functionality. One of the wireframes is depicted below in Figure 1.

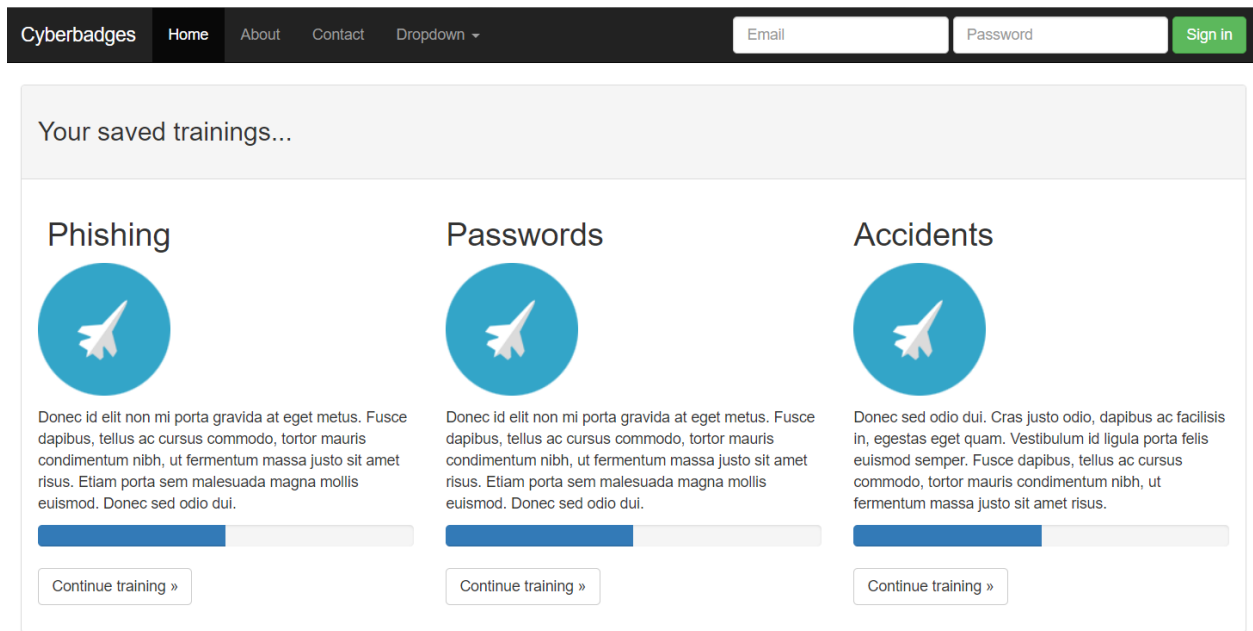


Figure 1: Wireframe Homepage: One potential basic design for the homepage of CyberBadges, designed with JetStrap. Training modules are prominently displayed along with progress bars. (Hevener, 2017)

The site in figure one features a clean and simple interface with a menu bar and multiple trainings. The trainings displayed in Figure 1 are placeholders and will not be included in the final site. Instead, “content creator” type users will be able to create these trainings and write the title and description that displays on the homepage. The training descriptions also include a progress bar, which is an example of a light gamification element. Visual representations of progress motivate users and give them a notion of the amount of time required to complete the

training. CyberBadge aims to include several visual features such as this that allows content creators to provide a more interactive and interesting training experience.

The paper for the technical project will be a technical description of the process of designing and coding the website. Currently, the project is still early in the design process, so the technical section in the final paper will be much more in-depth once the website is fully functional.

## **THE POTENTIAL OF GAMIFICATION IN TECHNOLOGY TRAINING**

A novel new idea in education and training is ‘gamification.’ Studies show that trainings that borrow characteristics from games are more effective than their more traditional counterparts (Cohen, 2011). Gamified learning uses a number of methods, such as leaderboards and experience points, to incentivize learning and make it enjoyable. Aspects such as Jeopardy-based assessments, leaderboards, and experience points make education effective and fun (Boopathi, Sreejith & Bithin, 2015). Another type of gamification is the use of fiction and narrative to make an enjoyable learning experience (Armstrong & Landers, 2017). Implementing fiction and interactive storytelling, while creatively demanding, makes education more engaging and personal for the users (Baldwin & Ching, 2017).

Although gamification is an intriguing concept, effective training focuses on objectives first. The overarching goal of training is to educate the user on important topics for their work or school, so other aspects, such as approach and appearance, must follow the basic goals of the training (Patricui & Furtuna, 2010). Gamification is not the primary objective when designing a training exercise; it is meant to enhance the training experience. Game-like aspects are blended

into the training aspects in order to create a seamless experience. Users should not feel that the training is gimmicky or pandering in nature.

Gamified learning shows promise, but still faces problems. The question remains: how can gamified learning be seamlessly implemented into technology education and training?

Gamification fails when it stands out as a gimmick. Poorly implemented gamification aspects can make the educational aspects even more tedious, as they are hidden behind a half-hearted attempt at fun or humor. Critics of gamification in education cite oversimplification of material and reliance on “extrinsic motivation” as a downfall (Hung, 2017).

## **GAMIFICATION IN ACTION: AN EXAMPLE**

Gamification implementation can follow any number of models and feature any combination of elements. It is highly flexible and deeply customizable by the content creator. CyberBadge aims to provide a framework that easily allows content creators to use gamification elements when designing their training modules. In order to determine the design of these elements, the team will look to examples of gamification in education and training. An example of a gamified system for a class at the University of Virginia is the Gamercard system used in

Professor Mark Sherriff's Computer Game Design class. Gamercard, shown below in Figure 2, features several elements taken directly from video games.

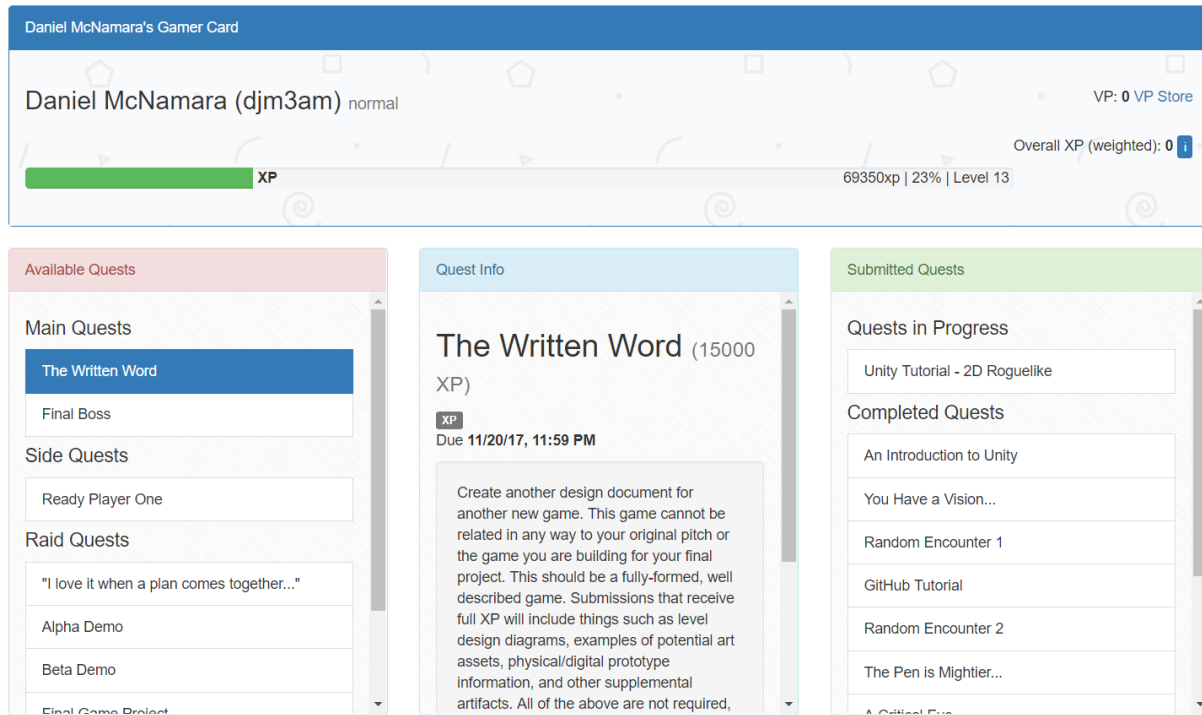


Figure 2: Gamercard: This screenshot depicts the system used to handle assignments and grading for Computer Game Design. It features an experience bar, quests list, and quest descriptions (Sherriff, 2015).

The student's experience level, which corresponds with grade, is prominently displayed along with a bar that displays progress. The idea behind this is that an experience bar with levels gives a more tangible feeling of progress than a letter grade. Normal grading relies on percentages which can rise and fall depending on performance; Gamercard's experience level can only increase, which can be more encouraging for students after receiving a low grade. Quests, which represent assignments and exams, are assigned an experience reward which

corresponds with their weight and given a description. The gamification elements in Gamercard combine to create a novel and fun learning experience.

The design of Gamercard is more simplistic than CyberBadge, but both sites share a similar goal. CyberBadge may look to emulate some of the elements in Gamercard, such as experience level or a point system. The main difference is that CyberBadge, unlike Gamercard, is not accompanied by an in-person lecture.

## **IS GAMIFIED ONLINE TRAINING THE FUTURE?**

Gamification elements are generally effective, but different students have different learning needs. Some gamification and visualization concepts may be highly effective for one user, but confusing and disinteresting to another (Olsson & Collin, 2015). While this issue is not unique to gamification, it is an important critique to consider when designing a gamified system.

As it applies specifically to cybersecurity training, there are a number of ways that gamification elements can be applied. Interactive storytelling of real-life cyberattacks and hacks would give users an idea of the gravity and importance of cybersecurity while remaining relevant and interesting. Another method that may make the material more appealing is to take an attacker-centric approach (Adams & Makramalla, 2015). This could take the form of either another interactive narrative or a series of minigames. Putting users in the minds of attackers might help them to grasp cybersecurity methods because they will understand the motives and methods behind attacks.

Although the CyberBadge project does not directly create the material for the prospective gamified training, it is important that the final design incorporate systems and tools that allow



content creators to create tailored learning experiences. After the basic functionality of the site is completed, the team will work to create tools such as progress bars and video players for interactive narratives that content creators can use to create an enjoyable and informative learning experience.

Most writing on gamification focuses on the implementation of gamification elements in classroom environments. This paper will aim to delve into the possibilities of an online training system that uses gamification in order to create an informative and enjoyable experience. The success of gamified training depends almost entirely on user response. Because of this, the final paper will use the “social construction of technology” (SCOT) theory to investigate the relationship between gamified training and the users. The paper will focus on the relationship between the relevant groups of employers, who will create the trainings, and employees, who will complete the trainings. The overall goal of the paper will be to determine the potential benefits and drawbacks of gamification in an online-only training environment for cybersecurity skills through research and literature review.

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