Entrepreneurial Learning in a Secure e-Commerce Course through Creating Competitive Real-World Sites

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ABSTRACT: In Spring 2013, the Secure e-Commerce course curriculum was revised to have both undergraduate and graduate teams creating functional real-world sites while trying to compromise the security of the other team during and after the development process. Outcomes from the course included a now functional e-commerce site currently generating revenue for the ACM chapter at the University of North Texas. This paper presents the results of the process of active, entrepreneurial learning in e-commerce from a pedagogical, motivational, and functional standpoint, with notes toward future course design and implementation.

1 INTRODUCTION

As a now well established subject area in computer science and business curricula, e-commerce education has evolved rapidly. Active, experiential learning using industry tools has taken an important role [Ngai, 2005], as well as ‘service’ or ‘community’ based education with students working in conjunction with established businesses [Tabor, 2005]. For a thorough history of the development of e-commerce courses, see [Abrahams & Singh, 2010]. We present a novel approach that guides students in two competing teams through the entire entrepreneurial approach to creating a secure online business [Garlick, 2013].

1.1 Course details

CSCE 4560 / 5560 Secure Electronic Commerce is a blended undergraduate / graduate course at the University of North Texas. In the Spring of 2013, 21 undergraduate students and 13 graduate students enrolled. The class was divided into graduate and undergraduate teams, who then chose group membership within their team as detailed in Section 2.2. The goal for the course was to move beyond the typical case studies or ‘service learning’ of providing services to businesses in the community and create e-commerce sites from the ground up. This necessitates the selection of product, platform and infrastructure, security provisions, business and graphic assets and the essential entrepreneurship quality of learning how to implement solutions to problems as necessary. In this way, the course was designed to give students the necessary skills to implement a secure e-commerce site with exposure to marketing, entrepreneurship, advertising, business, fulfillment, software development, and payment gateways - with an over-arching focus on security.

1.2 Security

Students were encouraged to actively probe the defenses of the opposing team’s site during the development process, with a few caveats: First, if a security breach was possible, nothing destructive should be done until the final presentation, and then only as a demonstration that could be reversed. Secondly, although other possibilities were discussed, only application-layer attacks were permitted. Exploiting weaknesses in the shopping cart software and database were promoted over DDOS or other network level attacks. Cross-site scripting, SQL injection, and several other attack vectors were presented. Lastly, social engineering was encouraged to promote an awareness of creating a secure development environment and team.

2 CLASS FORMAT

2.1 Entrepreneurial learning

Course content was presented in the order it would be needed for site development via real-world examples from live sites the instructor is involved with through outside consulting. Examples of the administrative side of shopping carts, phpMyAdmin, Google Analytics and Adwords, and Amazon feeds were shown as demonstration. Purchasing domains and SSL certificates was also covered. The instructor purchased hosting services and security certificates.
as needed since there were restrictions on using school equipment, but expenses were minimal.

2.2 Student groups

Students from each team (undergraduate and graduate) chose to join one of the following groups:

Project Management – a single student from each team, an effective project manager was critical to the process (as discussed in Section 3.4). He or she was held responsible for group progress, organizing meetings, and implementing project-tracking and collaboration software.

Security – the largest group in each team, security team group members were responsible for ensuring the security of their site throughout the development process as well as probing the other team’s site for security holes.

Payment – the payment group was responsible for incorporating the payment gateway in the site. This team was also responsible for researching and implementing Bitcoin and Paypal as payment methods.

Database / Backup – responsibilities for this group included setting up and securing the site’s database and scheduling regular backups. This team was also tasked with restoring the site in the event of a security breach.

Business – The business group was tasked with search engine optimization, advertising, email marketing campaigns, Google Analytics, and setting up an Adwords account for potential pay-per-click advertising.

Graphics – This group created all site graphics, product images, logos and templates.

Cart Software – The shopping cart group loaded products into the cart, implemented custom attributes, managed the shopping cart software, and customized code necessary for the implementation of each site.

Overlapping group requests at the start of the semester necessitated a few students being placed in their second choice group, but the members of each group quickly took to their roles, shared contact information and established independent meeting times. Workdays were also provided during class times for inter-group coordination.

2.3 Sites chosen

Students spent the initial class sessions researching e-commerce platforms and selecting a site to create. The undergraduates chose to sell t-shirts and other merchandise for the ACM chapter in the department. Their selected platform was Drupal Commerce.

The graduate team developed a site for selling drone photography services to augment an autonomous UAV research project in the Electrical Engineering department. Their chosen platform was WooCommerce for WordPress.

3 RESULTS

3.1 Evaluation methods of student work

There were no exams or homework assignments in the class, and performance was judged based on milestone presentations at mid-semester and during the traditional final exam period. These were oral presentations and students were told to focus on presenting their contribution to the project and to strive for completion over adding additional features. Students were made aware they would be evaluated on measurable results contributed to the site, and not just research of potential solutions.

Each group within the team presented during the milestones, and grades were assigned based on individual performance. Feedback on individual student performance from the project manager was also significantly taken into account when assigning grades.

3.2 Site status

Overall course results were encouraging, particularly among the undergraduate team, which completed the site and received their first order before the class had concluded. The project manager for the undergraduate team was highly organized and efficient, leading to effective teamwork and progress.

The graduate team created a visually appealing site with significant front-end programming work to determine service availability based on user location. The site was not quite functional by the time the class completed, however.

Due primarily to the unfinished status of the graduate site, no students took over development and management once the course was complete. The undergraduate site was turned over to the ACM chapter where it continues to operate and earn revenue for the chapter.

3.3 Security related outcomes

As part of the final presentations from each team, security groups presented the results of attempting to compromise their cohort’s site. Undergraduates were
given a 2x grade modifier for successful attacks on the graduate site.

Although both teams used security tools to scan the other site for vulnerabilities and attempted to use known exploits against PHP and MySQL, no application exploits were successfully used against either team. This was attributed largely to the use of popular platforms with large community involvement in patching vulnerabilities. Both teams were security conscious throughout the development process, and the security groups were responsible for implementing defensive measures including monitoring for intrusions and unauthorized modifications.

The only successful attack was a social engineering exploit committed against the instructor during the first week of the project. The undergraduate team successfully convinced the instructor that a fake Gmail account belonged to the project manager of the graduate team, and initial login details from the hosting provider were sent there. The only factor mitigating the instructor’s embarrassment was the unheeded advice by the graduate team to change their login credentials frequently. It was a learning experience for everyone.

3.4 Course comments from students

Students completed the standard course evaluation form at the conclusion of the semester. Reaction to the course format and content was largely positive. A few comments noted that the overall size of the undergraduate team led to groups too large for effective collaboration. In the future, limiting the size of teams to facilitate communication and workload will be addressed. Having about 2 people per group (security, cart, etc.) seemed to be the ideal size. A few students preferred the traditional model of an instructor choosing the platform and giving step-by-step guidelines, but most seemed to find their role and perform well on the team.

Anecdotally, the reaction from the students at the end of the semester was very positive, with two students indicating their desire to create e-commerce sites for organizations they were associated with. The course material seemed effective at spurring the entrepreneurial spirit among some students. The existing sites also create an opportunity for students to create side jobs with managing and fulfilling orders.

Several students indicated that they appreciated the real-world nature of the course, and were more motivated to learn the material by actually having to put the skills into practice.

As mentioned previously, selection of an effective project manager was critical to the process. As with most group projects, team cohesiveness and delegation is essential. Having someone that can lead a team on both technical and personal details is critical.

3.5 Pedagogical notes

The unique nature of the course led to several initial observations. With no exams or homework, the course is essential plagiarism-proof. Students were encouraged to use existing modules for their platform of choice when available, but a significant amount of customization had to be done to each site. As each project was new, code, graphics and security had to be implemented from scratch.

The traditional approach of presenting a topic and subsequently testing students on the subject was turned on its head. Often during the creation of a site, an unanticipated problem would come up and the learning paradigm switched to identifying the problem, followed by researching and implementing a solution – a much more entrepreneurial approach.

3.6 Conclusions and Future Implementations

If the course is taught in the same format in the future, projects would be arranged prior to the class, possibly with community and business input to minimize setup time and expense, and provide direction for the design of the site, products, and fulfillment. Partnering with students from the Murphy Center for Entrepreneurship at UNT and co-listing a course to provide additional support for product creation, integration and fulfillment is also a possibility. Even with large teams, designing, implementing and securing the sites was more than enough work for the Computer Science students without worrying about designing t-shirts to sell online. Without sacrificing the entrepreneurship component, outsourcing some of the implementation of product fulfillment would be considered in the future.

4 REFERENCES


