

Doing Before Graduating: Experiential Learning with Part-Time Internships and Grants

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Abstract

In a field where many entry-level jobs require one or two years of experience to qualify, students are finding it difficult to enter the technology field upon their graduation. This is especially true when they did not work while going to school, or did not participate in an internship prior to their graduation. Our Experiential Learning (EXL) program was created during the Spring 2021 semester, and focuses on two types of projects – Business Process Improvement (BPI) and Cyber Security (CySec). This effort has been popular with our students and industry participants resulting in 79 students completing the program across 25 projects through 20 different industry participants – some of who sponsor multiple projects. The EXL program has also been recognized by the state of Virginia as an important program for the future of the CySec workforce, resulting in two Commonwealth Cyber Initiative (CCI) Grants which provides the opportunity for student stipends and professional networking events with industry professionals and leaders. The industry participants are organizations (commercial, government, non-profits, etc.) that work with the faculty member to scope the project, challenge the students, and provide mentorship along their EXL journey. The students are undergraduates attending a Virginia higher education institution who desire hands-on experience, challenging work, and a resume-booster to stand out among their peers. All students are informed they should put their EXL project efforts as experience on the resume, which has helped many get jobs prior to their graduation – and some even received job offers directly following the completion of their project by the industry participants themselves. The BPI projects are run as a course elective through the student's degree program. BPI projects are focused on having students identify the organization's business challenges, recommend a technology solution to address that business challenge, and develop an implementation plan for the recommended solution. The CySec projects operate similarly and have an additional benefit – they are funded by the CCI grants resulting in student stipends towards their project work. Moreover, these industry participants are required to pay the students an additional \$12/hr. – to show their commitment to the CySec workforce development. Beginning Fall 2023, the program has started to focus on making additional impact to the field through setting the goal for each project team to publish their project work in practitioner journals. Already, one article focused in the area of international CySec cooperation has been accepted for publication in the ISACA Journal – which not only enhances the student participants' resumes, but also provides a valuable contribution to the field. Furthermore, the program has been mentioned as a success within the Department of Defense's (DoD) Press Release, specifically noting a BPI project focused on onboarding of clients to the DoD Cyber Crime Center's Vulnerability Disclosure Program. The program is gaining a lot of attention and momentum through its successes (publications, past performances, media mentions, and fundings), and has a lot of potential to scale and receive additional funding for all projects – BPI and CySec.

Introduction

In a traditional education environment, students typically receive instruction and knowledge through lectures, in-class assignments, class projects, homework assignments, case studies, and study guides – or some combination of these. Experiential Learning (EXL) programs are used to go beyond these and get students outside-the-classroom training and experience so that they receive initial hands-on training prior to their graduation.

Since the Spring 2021 semester, our team has created an EXL program that focuses on recruiting industry participants from different sectors (finance, retail, real estate, defense, etc.) and organizations (government, non-profit, for-profit) to scope real projects relating to Business Process Improvement (BPI) and Cyber Security (CySec). We then have students apply to the EXL program as they would with an internship to sharpen their resumes and highlight their core abilities and technical skills. The goal of the EXL program is to give high-performing students an opportunity to participate in real industry-sponsored projects prior to their graduation so that they can have an edge-up on their peers in terms of resume content, hands-on project experience, and networking opportunities. The skills students gain (e.g. running meetings, engaging clients, requirements management, business case development, applying their technical skills, and much more) from the EXL program can be invaluable in getting that first full-time job.

This effort has been popular with our students and industry participants resulting in 79 students completing the program across 25 projects through 20 different industry participants – some of which sponsor multiple projects. The EXL program has also been successful in being funded through six-figure grants by the state of Virginia's Commonwealth Cyber Initiative (CCI) which provides the opportunity for student stipends and sponsorships of professional networking events.

The objective of this paper is to share with the academic and practitioner communities the following: 1 – The two types of EXL programs we offer; 2 – How we recruit industry participants; 3 – How we work with the Industry Participants to scope the EXL project; 4 – How we recruit the students; 5 – Examples of our past EXL projects; 6 – The desired outcomes of EXL projects for students, industry participants, and the university; 7 – some lessons learned for our experiences; and 8 – The future of EXL program.

Business Process Improvement (BPI) Focused Projects

The first type of project our EXL program offers is focused on BPI projects. These projects are group based, where each team may consist of 2-4 EXL students depending on the project's scope, student's ability, student's interest, and the industry participant's agreement.

The BPI EXL projects are based on a particular business challenge initially defined by the industry participant. The EXL student team's role is to then model and quantify the business challenge to showcase that the identified business challenge is in fact a challenge that negatively impacts the industry participant's organization. This is followed by a comprehensive solutioning effort by the EXL student team to create a business case for a proposed solution to

address the business challenges. The proposed solution will need to showcase a technical solution (through analysis of alternatives of different technical solution options) that can be applied to solve or mitigate the business challenge; a model must be developed to show how the business process for the organization is impacted due to the recommended proposed solution; and include estimated quantification of the benefits. Moreover, the EXL student teams will need to show their client the impacts their recommended technical solution has on the current organization IT infrastructure and, if applicable, application's user interface for the different types of users (customers, employees, managers, administrators, etc.). While implementation of the solution may not be required due to the project's scope and or schedule, an implementation plan of the proposed solution is required to be developed and delivered to the client which includes the development / acquisition, testing, training, and deployment / transition plans. A list of the risks and risk responses of implementing the proposed solutions is also required in the turnover documentation to the client. Moreover, the EXL student teams need to keep track of their project throughout the semester through a project execution plan, which is a mini version of the industry-famous project management plan (PMP).

The BPI EXL program is run based on the semester schedule, which is 15 weeks. The first week is dedicated to project introductions, course introductions, and team-building activities. The next 10 weeks are then focused on actual project execution. During the 10 weeks of project execution, the student EXL teams are required to meet with both their EXL instructor and their client (the industry participant) on a weekly basis. This allows all parties to have weekly discussions to highlight the project's progress, communicate blockers / issues, present any deliverables due, receive feedback on deliverables, receive any requirement changes / change requests, and communicate the next week's planned efforts. To ensure these weekly discussions are fruitful, student teams spend 10-20 hours per week on their project efforts. The following two weeks are then focused on client presentations (one week focused on creating the presentation and delivering a draft presentation to the instructor for feedback; and the other to deliver the presentation and turnover documentation to the client). And the final two weeks of the effort are dedicated to finalizing the project's writeup and format it for submission to an academic or practitioner journal. It should be noted that students are working on both their client presentations and journal articles throughout the 10 weeks of project execution to keep the workload spread evenly throughout the semester. The EXL student teams have the option to submit a dedicated paper of their project to a journal, or team-up with other groups and submit their project as an example of the overall EXL program.

Currently, this opportunity is offered to students through a 3-credit course. While there is no current monetary compensation for the students in completing the project efforts, there are discussions taking place (through sponsorships and endowments) so that there can be monetary incentives in the near future for students participating in this EXL opportunity.

Cyber Security (CySec) Focused Projects

The second type of project our EXL program offers is focused on CySec projects, which are heavily supported by the grant funding awarded to our EXL program by CCI. These projects can be tackled individually, but most are group based where each team may consist of 2-4 EXL

students (called interns in this CySec-specific program) depending on the project's scope, student's ability, student's interest, and the industry participant's available funding. In the CySec EXL-focused program, projects have one simple requirement: be a CySec-focused project where the interns can enhance their skills in the CySec field so that they can contribute positively to the CySec workforce upon or prior to graduation.

The CySec EXL projects are unique in that the CCI Grant pays each intern a fixed amount for the effort (e.g. \$3,000 USD/semester). Some grants require that the industry participant also provide a supplemental contribution (e.g. industry participant matches the \$3,000 USD/semester). Furthermore, students at other higher education institutions may also participate in the CySec EXL program since it is funded from an external source and does not require the interns to enroll in any specific course at the university. If approved by the instructor, students within the university can dual enroll in the BPI EXL course to receive credit.

The CySec EXL program is also run per semester, but is formatted as a 12-week program. The first week is dedicated to project introductions, course introductions, and team-building activities. The next 10 weeks are then focused on actual project execution. During the 10-week project execution, the expectations for the CySec EXL projects are the same as the BPI EXL projects discussed in the prior section with one major difference: students are required to work 20 hours per week with the industry participant. Unlike the BPI EXL efforts, which is non-paid and through a course, the CySec EXL efforts allow the students to have more face-to-face time with the industry participant – many of which have on-site requirements. And the final week is dedicated for client presentations, journal article submission, and a special networking event with industry leaders and professionals sponsored by the CCI grant.

Recruiting the Industry Participants

None of our EXL projects can run without supportive industry participants and that is why recruiting industry participants can be a challenge. Our program recruits industry participants through our personal and professional networks first, followed by the networks of the university. More recently, we have received referrals from past industry participants which have proven very effective as it expands the diversity of the types of industries and sectors for our EXL portfolio. Moreover, we have a lot of repeat industry participation requests. When recruiting for industry participants, we look for participants that can: 1 – Dedicate a minimum of 3 hours a week to meeting with our students; 2 – Scope challenging, exciting, and impactful projects that are compliant with our EXL program; 3 – Be responsive to email communication; 4 – Guide and mentor students throughout the process, like a typical internship; and 5 – Provide the right amount of access and resources for the students to participate and complete the project. For CySec EXL projects funded by certain grants, we'll also look to ensure that the industry participant is able to contribute the minimum amount of pay to the interns based on the grant's requirements.

Scoping the Projects

For all EXL projects, the EXL instructor works with each industry participant to scope the projects so that they are complex enough to challenge the students, but not so complex that

they would not be able to complete the project effort within the EXL program's timeframe; and that the project effort is applicable to the students'/program's field of study. Moreover, the instructor will need to help the industry participant organize their project's requirements, schedules, and goals in such a way that it would make sense to the students since this may be the first time the industry participants are working with students or interns. These scoping efforts may take multiple iterations, but it's worth the time investment since the scope of the project drives the effort and impacts the success rate of all projects.

Recruiting the Students

For the BPI EXL program, students are informed the semester prior about the program and are encouraged to apply. Students are selected by the course instructor following their application submission and must meet the following three requirements: 1 – Students must have taken a technical course (Advanced SQL, Data Mining, Application Programming in JAVA or Python, Data Warehousing, or Data Analytics); 2 – Students must have a recommendation from that course's instructor; and 3 – Students must have received a B or better in the prerequisite course.

For the CySec EXL program, a job posting is made on the industry participant's organization website, and the link is sent to all applicable areas (the university, other universities, etc.). Applications are screened first by the instructor to see if they meet the minimum job requisition requirements, and qualified candidates are then screened by the industry participant. The industry participants then schedule interviews for candidates and proceeds as they normally do according to their Human Resources policies.

Examples of Past Projects

Over 25 projects have been completed so far, with more than 10 active projects as of this submission. Below are summaries of four recent projects:

- Project 1: The student team provided process improvement recommendations to assist the Department of Defense's Cyber Crime Center's (DC3) Vulnerability Disclosure Program (VDP) scale their onboarding processes for the future.
- Project 2: The student team developed a graphical framework (Process of Information Transfer – PIT) that streamlines the transfer of sensitive information to allies (both in private and public sector) for the US Cyber Command.
- Project 3: The student team provided a small-business organization with a structured plan for an onboarding buddy system that allows experienced employees to be paired with new hires in order to foster company culture, and provide an excellent onboarding experience
- Project 4: The student team provided a startup company with multiple deliverables contributing to optimizing business processes by enhancing channel engagement, developing a new CRM, and a dashboard to monitor the company's standing incorporating a degree of automation.

Outcomes of the Experiential Learning Efforts

The main outcome that we like to see in our EXL programs are the technical, business, and soft skills the students have learned during the semester-long effort. The skills attained are put onto

the students resumes which give them the “hand-on real-project experience” edge over their non-EXL peers. This has been acknowledged multiple times by our EXL students that receive job offers prior to graduation or soon after graduation. It not only enhances the students’ resumes, but also enhances the students’ confidence and content during the interview stages. On multiple occasions, the EXL student is hired full time by the industry participant following their EXL project completion.

Recently, publications in academic and practitioner journals have become an outcome goal for the EXL program. Publications yields the EXL program more credibility in its efforts and enhances our position when submitting for EXL-related grants. Moreover, the students can reference the publications on their resumes and interviews to highlight their impactful contributions to the field. The past performance and lessons learned are all documented for each project – not only for publication submissions, but also for future grant opportunities.

Sponsorships are also an outcome goal for the EXL program so that we can one day provide monetary incentives to all EXL student participants – not just the ones funded by grants. We’re working to see how our past industry participants will be part of those sponsorship activities.

Some Lessons Learned

Like with any other project effort, there is much to be learned from past mistakes and inefficiencies – in which we will share some here: 1 – the weekly meetings are great since they help create an agile environment where the students, faculty, and industry participant regularly meet for progress updates, feedback, change requests, comradery, and more. 2 – the EXL faculty member should keep in close contact with the industry participants and build the relationship so that it can yield other benefits like sponsorships, hiring events, guest lectures, etc. 3 – Set expectations early with both the students and industry participants so that all parties understand the goals, requirements, roles, and responsibilities of the EXL program. 4 – Don’t take on too many projects per semester even if you’re a seasoned program manager because these projects will have all entry-level folks, unlike a typical team where there is a mix of entry-level, mid-level, and senior-level folks to balance the workload. 5 – Utilize the university’s outreach, sponsorship, and alumni teams to help find industry participants which will allow the EXL projects to be more diverse and with more committed industry participants. 6 – Get to know the finance and research departments so that grant opportunities are sent to you and you receive the support necessary when a grant is awarded.

Path Forward

The EXL program began in Spring of 2021, and it has already accomplished quite a bit. Going forward, we would like to grow the EXL program to offer more class sections per semester to reach more of our students. We would also like to bring in more sponsorship support so that all students can receive monetary incentives for their project efforts. We will also continue to pursue additional grants and publication efforts to grow the program, its impact on the field, and its credibility.