THE OHIO STATE UNIVERSITY

College of Engineering

Undergraduate Education & Student Services

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March 23, 2020

Randy Smith, Vice Provost for Academic Programs
Office of Academic Affairs

Re: Certificate of Completion, Workforce Development Training Programs

Dear Randy,

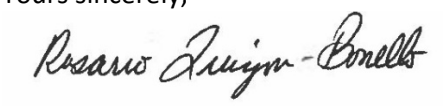
Attached are two Workforce Development Training programs that were submitted by the College of Engineering Professional and Distance Education Programs. The proposals were presented during the College Committee on Academic Affairs (CCAA) meeting conducted via CarmenZoom on March 20, 2020.

1. **Coding Boot Camp**
   A twenty-four week program that combines front-end and back-end web development, big-picture training, both theory and application, and exposes participants to both individual and group-based challenges in order to teach the importance of teamwork.

2. **MATLAB Programming for Engineers**
   The program, to be completed within fourteen weeks, will provide working engineers with the in-depth knowledge of the MATLAB programming language and built-in numerical analysis capabilities needed to solve real engineering problems.

This letter is to inform you that CCAA unanimously approved both programs.

Yours sincerely,



Rosario Quinzon-Bonello M.Ed.
Assistant Dean for Curriculum and Assessment
College of Engineering

College of Engineering

Proposal for a non-credit, 24-week In-Person Program

"Coding Boot Camp"

February 25, 2020

OAA Certificate Program Category: (4) Workforce Development Certificate of Completion Programs

Description
The Coding Boot Camp is a 24-week program that combines front-end and back-end web development, as well as big-picture training to participants. The rigorous and fast-paced program covers both theory and application, and exposes participants to both individual and group-based challenges in order to teach the importance of teamwork. Areas of focus include browser-based technology, databases, server-side deployment, quality assurance and testing, and more.

Participants must attend and complete the 24-week program in order to obtain the certificate of completion. The course will be taught in-person at The Ohio State University. The boot camp is a partnership with the College of Engineering, Trilogy Education Services, and the Computer Science Engineering department and administered through the Professional and Distance Education Programs Office.

A review of this proposed partnership with Trilogy Education Services by the Computer Science department and the college and is available in Appendix A. Approval from the Computer Science department to proceed with the program is in Appendix B.

Stand-alone Program and Maximum Credit Overlap between Academic Certificate and Other Academic Programs
This is a non-credit, in person course and will be a stand-alone program.

Maximum Credit Overlap with Degree Program
N/A

Minimum Acceptable Grade to Apply
N/A

Transfer Credit
N/A

EM Credit
N/A

Outcomes-based
Upon completion of the course students will be able to:

Phase 1: Foundation - Weeks 1-8
The first phase, Foundation, equips you with the fundamental concepts of web development, covering HTML, CSS, and JavaScript, as well as command line fundamentals and API consumption.

Participants will learn:

- HTML, CSS, and JavaScript
- Creating a web page from scratch
- Mastering terminal commands
- DOM manipulation
- jQuery
- Consuming RESTful APIs
- Parsing JSON to extract meaningful data
- Using AJAX to update data on a website

Phase 2: Technical - Weeks 9-16
In the second phase, Technical, you learn the skills necessary to engineer a full stack web application, working with servers, databases, and other back end technologies, and connecting them to the front end.

- Writing Node.js server code to serve static web pages
- Querying large amounts of data and answering questions from a MySQL database
- Understanding and using Joins, Where's, and Counts strategically

Phase 3: Performance - Weeks 17-24
The last phase, Performance, has a dual meaning in that you acquire skills to optimize your web applications for speed and efficiency as well as prepare yourself for the transition to a career in web development.

- Utilizing NoSQL databases, such as MongoDB, as an alternative to MySQL
- Improving the performance of applications
- Converting traditional applications into progressive web applications (PWAs)
- Creating single-page applications with React
- Computer Science applied to JavaScript (data structures, algorithms)
- Create scalable web apps, APIs, and Services
- Take a deep dive into core Java and Object Oriented Programming
- Build a foundation in common build tools for Java projects, such as Maven

Curriculum and Credits
The non-credit course will include these topics:

Computer Science applied to JavaScript • Design Patterns • Data Structures • Algorithms • Big O Notation **Browser Based Technologies** • HTML • CSS • JavaScript • jQuery • Responsive Design • Bootstrap • Handlebars • Local Storage, Session Storage, IndexedDB • React.js **Deployment** • Heroku • Git **Databases** • MySQL • MongoDB **Locally Popular MVC Framework** • C#/ASP.NET • Python/Django • Java/Spring • PHP/Laravel	**Server-Side Development** • Express • User Authentication • Sequelize • MERN Stack (MongoDB, Express.js, React.js, Node.js) **Quality and Performance** • Unit Testing • Google Lighthouse • Webpack • PWAs (Progressive Web Apps) • Lazy Loading • Service Workers **Accessibility** • Semantic HTML **Agile Development** • Kanban, Project Management • Issues • User Stories • Sprints • Standup • Retros

Admission
No college degree is required but participants must be able to pass an entrance exam to enroll.

Arranged/Individual Study Courses
None.

Minimum Grades and GPA to Complete Program
Students must obtain a passing grade on all quizzes, assessments and final project to receive the

certificate of completion.

Recorded in the Student Information System (SIS)
No

Regular OSU Tuition and Fee Assessment
No, this is a non-credit program. Fee will be $10,995

Eligibility for Federal Pell Grant and Direct Student Loans
No

Diploma Issued
No.

Type of Completion Document Issued
A certificate of completion is awarded after a participant successfully completes the in-person 24-week program.

Proposal Contact Information

Bob Mick
Director
Professional & Distance Education Programs
Mick.15@osu.edu
614-292-0393

A Review of the Proposed Partnership between The Ohio State University and Trilogy Education Services

Principal Author:
Thomas E. Bihari, Ph.D., Associate Professor of Practice
Department of Computer Science and Engineering, The Ohio State University

Contributors:
Ginger Breon, CIO - College of Engineering
Bob Mick, Director - Professional & Distance Education Programs, COE
Jeremy Morris, Ph.D., Assistant Professor of Practice - Computer Science and Engineering
Julia Armstrong, PMP, CSM, Coordinator & Instructor - Software Engineering Capstones;
Director - OHI/O Informal Learning Program, CSE

February 16, 2020

1 Introduction

Trilogy Education Services is proposing a partnership with The Ohio State University (OSU) to deliver OSU-branded technology "bootcamps" in the Columbus Metropolitan Area (see Appendix for proposal). Trilogy was founded in 2015 and was acquired by 2U in 2019. Trilogy currently has similar partnerships with ~40 other universities in the USA, plus several in Canada, Mexico, Germany, and Australia. See the appendix for the complete list of Partner universities (UP).

Trilogy provides bootcamp programs in: Web Development, Data Analytics and Visualization, UX/UI Design, Cybersecurity, and FinTech. Individual partner universities may offer any or all of the programs.

OSU and Trilogy are considering a partnership. As currently envisioned, the Web Development course would be the initial offering in 2020, with the potential to continue to offer this course and/or one or more of the other bootcamps in the future. While there is an expectation and desire that the program would move forward long term, there would be no long-term commitment.

The proposed plan is for the partnership to be managed through the Professional & Distance Education Programs component of the OSU College of Engineering (COE), with the Department of Computer Science and Engineering (CSE) involved appropriately.

The OSU CSE Department has been asked to review several aspects of this potential partnership, to assist in decision-making. This report summarizes our findings.

2 Scope

We were asked to:

1. Review the Trilogy curriculum for the Web Development program.
2. Compare this program's curriculum and cost with competitors' offerings.
3. Solicit feedback from Trilogy partner universities that currently offer this program.
4. Examine data on program success – e.g., graduation rates, job placement rates.

Aspects that are **not** in the scope of this exercise include, but are not limited to:

1. Financial benefits and risks.
2. Legal risks.
3. Organizational structure and execution of the program.
4. Infrastructure and logistic support for the program (e.g., classroom, internet access, parking).
5. Impacts to the OSU "brand" or reputation.

3 Process

From mid-January through mid-February 2020, we:

1. Reviewed publicly available data for a number of competitors, on their offerings, costs, and success evaluations.
2. Met with Trilogy representatives to review the Web Development curriculum, and subsequently reviewed example materials provided by Trilogy.
3. Interviewed representatives of three of Trilogy's current partner universities: Vanderbilt, Case Western Reserve, and Columbia.
4. Interviewed a local representative of Chase, to assess the desirability of an offering and to receive feedback their experience with a competitor. (We have reached out to other local companies, and may speak with them in the future.)
5. Interviewed a local representative of Apprenti, a national apprenticeship program management organization that works with local employers and bootcamp providers.

These activities were intended to provide "directional" information, not a comprehensive view. While none of the interviewees requested confidentiality, it should not be construed that the interviewees represented the official positions of their organizations, or that they desired their comments to be publicized in raw form.

Our understanding, based on the results of these efforts, is summarized below.

4 Course Structure

Overall, Trilogy's model is one of standardization in curriculum, hiring processes, and course delivery, across all partner universities. Partner universities are able to make small adjustments, in collaboration with Trilogy.

Trilogy offers several full- and part-time options. OSU is considering a 24-week, part-time option. Classes would be held on two weeknights (typically Tuesday and Thursday) for three hours each night,

plus a four-hour class on Saturdays, for a total of 10 classroom hours per week. Instructors hold office hours before or after class. An additional 10 hours per week of "homework" is expected.

A typical class contains 30 students, one instructor, and three-four teaching assistants (TAs) who assist in class. Additional assistance is provided as needed by remote tutors, for one to two hours per week.

The classes would take place on OSU campus. The course materials and necessary environments are provided by Trilogy "in the cloud", so an Internet connection would be necessary, but no OSU servers or other technology infrastructure would be needed.

5 Web Development Curriculum

Trilogy uses a common curriculum for all offerings of the course across all partner university sites. Trilogy contends that this provides a strong curriculum that responds to feedback from all sites. The partner universities we interviewed agreed with this contention. Universities approve the curriculum and are free to suggest or require minor customizations, some of which may be incorporated into the common curriculum. The partners we interviewed indicated that customization, and the need for customization, was rare.

Trilogy provided an overview of the curriculum to OSU (T. Bihari, J. Morris, G. Breon and R. Mick), and subsequently provide additional materials (e.g., lesson plans, exercises), including access to their GitHub curriculum repository. A brief review was done on the provided materials.

The curriculum and pedagogy concentrate on hands-on work and exercises "building things". Small teams of two-three students work on projects. Teams are formed by evaluating individual student capabilities. Trilogy has found that assigning students to teams based on similar level of capability works well, allowing "strong" teams to move forward quickly, and providing additional support to teams that are more challenged.

Lesson plans are detailed and heavily scripted, indicating the specific points to cover, how to cover them, and the number of minutes.

The Trilogy curriculum is not designed to be deep-dive into Computer Science (CS), as compared to the curriculum for a CS BS degree. The curriculum contains a small section at the end of the course on "Advanced CS", which Trilogy admits is not truly advanced, touching some topics (data structures and algorithms). Trilogy does not contend that this course is in any way a competitor to a CS BS degree.

Overall, Trilogy's curriculum, at an outline level, is similar to the curriculum outlines of similar courses provided by competitors. The interviewed partner universities seemed satisfied with the curriculum, and indicated that they heard few student complaints.

6 Instructors

Trilogy hires about 10% of applicants for instructor positions. They expect instructors to have five to ten years of technical experience in the areas covered by the course, and two years teaching experience.

Trilogy contends, and the partner universities concur, that instructor issues are rare. Columbia has had 56 instructors since their partnership started, and five are no longer teaching (two were removed).

Trilogy submits candidates to the partner university for approval. Supporting materials include a one-hour video of the instructor performing in a mock classroom setting, in which competency in the subject matter, teaching skill and engagement are exercised.

7 Feedback Loop

Students provide feedback to Trilogy each week via a fine-grained, online survey on their concerns and engagement. Trilogy analyzes the surveys in "real time" and makes adjustments to correct issues (e.g., mentoring an instructor, providing additional tutoring to a student).

Trilogy does not provide access to the "real time" feedback data directly to the partner universities, but summaries can be provided on a weekly basis.

When handling issues, Trilogy is first line of contact. Partner universities are made aware, and occasionally might be involved (rare). The Columbia coordinator attends each cohort's orientation, shows slides of contact information, and lets students know he is there if needed.

Overall, the partner universities seemed satisfied with the feedback loop. The interviewees indicated that it is important that a university point of contact be actively engaged with Trilogy on a frequent basis.

8 Student Acceptance and Variability

Potential students have a wide variety of backgrounds. Trilogy evaluates students before acceptance help ensure students are likely to succeed. This evaluation takes the form of a questionnaire and a test. Partner universities may set a threshold on the test (e.g., D or better).

Another filter for the potential students is the cost. Students who choose to invest in the program tend to be "serious" about putting in the significant effort it takes complete the course.

For accepted students, Trilogy monitors student performance and obtains feedback frequently, and makes adjustments, as noted above. Access to a free tutor (remote, one-two hours/week) is available if students require help.

9 Evaluation of Student Success

There are organizations that "audit" the outcomes of bootcamp programs (e.g., CIRR (https://cirr.org/)).

Trilogy does not use an independent auditor. Trilogy provides a "180-day Report" to each partner university, with data on their students 180 days after graduation. Some data points:

Graduation rate:

- Trilogy graduation rate is 87% overall.
- Vanderbilt first cohort (2019): 47 enrolled; graduated 43 (91%).
- These numbers are similar to competitors' results (https://cirr.org/data).

Student satisfaction:

- Columbia: Seven to ten students out of ~1000 total have asked for refunds since program began.
- Case WR: Two to three student complaints out of ~400 students total in three years.

Job Placement Rates:

Trilogy does not provide overall job placement data. They indicate two general reasons:

- Student goals differ. Some students already have jobs and just want to improve their skills.
- Only partial data is available. Students are not required to "report back" to Trilogy after graduation. About 41% of Trilogy students take advantage of the Trilogy-provided career assistance program that is available to students after graduation. Job placement data for other students is not known.

Data from interviewed partner universities:

- Columbia: First 2 cohorts (2018): 72 students total, 55-60% were looking for new jobs; all obtained them.
- Vanderbilt: 180-day Report for first coding cohort (2019): 21 students were seeking new positions; 19 obtained new employment. All graduates of the program are employed.

Example data from a local bootcamp:

Tech Elevator has been offering programs in Java and .Net in Columbus for several years. For the Columbus Tech Elevator site for H2 2018 (https://cirr.org/data):

- 95 graduates
- 98% employed in-field (88% full-time)
- 99% of students graduated on time
- $60K median pay

Overall, we heard no significant concerns from interviewed Trilogy partner universities regarding student success.

10 Program Management and Expectations for CSE Department Involvement

Professional & Distance Education Programs leadership in the OSU College of Engineering will be the main point of contact for the partnership, ensuring OSU and COE presence is made available to students. They will monitor the program and provide information to the CSE Department as requested.

Other data points:

- Columbia's relationship is managed through their School of Engineering. There is no direct CS department-level involvement. The Columbia program coordinator goes to each orientation, shows slides, and lets students know he is there if needed.
- Case Western Reserve's relationship is managed at the University level. There is no direct CS department-level involvement. Typically, some individual senior faculty members interview instructor candidates and/or review curriculum.
- In both of these cases, the interviewees indicated that that the constraint was lack of CS faculty release time to participate.
- The Chase interviewee indicated that OSU CSE Department involvement would be valuable, both to the partnership and to the department.

11 Cost

The cost for the proposed program ($10K - $13K) is generally in line with competitors. See Appendix for examples.

12 Other

- Possible confusion or concern about the relationship between University CS BS degree and Trilogy Bootcamp Certificate. This was an initial concern for us, but interviewees indicated that it was not a significant problem. One interviewee indicated that students occasionally expressed concern about not being able to use other University resources (e.g., library), but the concern was minimal.
- Case Western Reserve students have expressed some informal interest in taking the bootcamps for credit. CWRU is considering developing a credit-bearing certificate/curriculum with Trilogy.

13 Conclusion

In summary, based on the efforts outlined above, we found no significant red flags. Our interviewees indicated that a partnership with Trilogy must be managed actively and transparently, as with any partnership. Interviewees indicated they are generally satisfied with their partnership with Trilogy, and in general concurred with Trilogy assertions.

14 Appendix

14.1 Current Trilogy Partners

Harvard University - Boston, MA	Columbia University - New York, NY
Rutgers University - Jersey City, NJ	University of New Hampshire - Portsmouth/Nashua, NH
University of Pennsylvania - Philadelphia, PA	George Washington University-Washington, DC
Georgia Tech University - Atlanta GA	University of North Carolina, Chapel Hill - Chapel Hill, NC
University of North Carolina, Charlotte - Charlotte, NC	University of Richmond - Richmond, VA
Vanderbilt University - Nashville, TN	University of Miami - Miami, FL
University of Central Florida - Orlando, FL	Rice University - Houston, TX
Southern Methodist University - Dallas, TX	University of Arizona - Gilbert/Chandler, AZ
University of Denver - Denver, CO	University of Texas, Austin - Austin, TX & Houston, TX
University of Texas, San Antonio – San Antonio, TX	University of Utah - Salt Lake City/Sandy, UT
Northwestern University - Chicago, IL	University of Minnesota - Minneapolis, MN
Case Western Reserve University -Cleveland, OH	University of Kansas - Overland Park, KS
University of Wisconsin - Madison, WI	Washington University in St. Louis - St. Louis, MO
Michigan State University - Detroit, MI	University of California Berkeley - Berkeley, Belmont & San Francisco, CA
University of Washington - Seattle, WA	University of California Davis - Sacramento, CA
University of California Irvine - Irvine, CA	University of California Riverside - Riverside, CA
University of California San Diego-San Diego, CA	University of California Los Angeles - LA, CA
University of Oregon - Portland, OR	University of Southern California - LA, CA
University of Toronto - Toronto, Canada	University of Sydney - Sydney, Australia

Monash University - Melbourne, Australia	The Monterrey Institute of Technology - Monterrey, Mexico
European School of Management and Technology (ESMT) - Berlin, Germany	

14.2 Competitors and Similar Bootcamps

14.2.1 Literature Search

The following table lists some example competitors and similar bootcamps (nationally), from the CIRR audit reports (https://cirr.org/data). There are many more.

Program	Company URL	Program	Cost
Bloc Web Development	https://www.bloc.io	9 months approx, online	$7,500
Bottega Salt Lake City	https://bottega.tech	Python and React.js (600 hours ~12 weeks - full time onsite or remote), 600 hours ~36 weeks - part time remote); Front-End Dev	$12,000 full time, $7,500 part time
Codesmith Los Angeles Full-Stack Web Development	https://www.codesmith.io	12 weeks full time onsite, part time remote	$18,800
Fullstack Academy Chicago	http://www.fullstackacademy.com	1 month remote plus 2.5 month onsite	$14,000 to $16,000
Fullstack Academy Grace Hopper New York City (women only)	http://www.fullstackacademy.com	3 months onsite	$19,000
Hack Reactor @ Galvanize Austin	https://www.hackreactor.com/	12-13 weeks onsite / remote, full / part time	many options
Tech Elevator Columbus Full-Stack Software Development	https://www.techelevator.com	14 weeks onsite full time	$15,500

14.2.2 Tech Elevator

Tech Elevator offers classes in Java and .Net in the Columbus market, and so does not overlap the Trilogy offering significantly. It publishes statistics overall and by site (https://www.techelevator.com/outcomes).

Overall for 2018 across all sites: 95% graduation rate; 94% job placement rate; $58K average starting salary.

For the Columbus Tech Elevator site for H2 2018 (https://cirr.org/data): 95 graduates; 98% employed in-field (88% full-time); 99% of students graduated on time; $60K median pay.

14.3 Trilogy Proposal

The Ohio State UniversityTrilogy Edu

End of Document

Appendix B

From: Sivilotti, Paul
To: Mick, Robert; Wenger, Rephael
Subject: RE: Draft of Trilogy report
Date: Friday, February 21, 2020 2:00:34 PM

Hi Bob—

The CSE undergrad studies committee approved the partnership, in principle, with Trilogy for the formation of the coding bootcamp. An important component of that approval is ongoing quality review by CSE of the bootcamp offering(s).

The committee's approval gives Rafe and Tamal a mandate to work with you in negotiating logistics and financial arrangements for a successful partnership.

Are you planning to submit this as a certificate program to CCAA?

Best wishes,
--paul

From: Mick, Robert
Sent: Friday, February 21, 2020 9:00 AM
To: Sivilotti, Paul <paolo@cse.ohio-state.edu>; Wenger, Rephael <wenger.4@osu.edu>
Subject: RE: Draft of Trilogy report

Hello,

This is great news from Tom. I am wondering though, will I actually receive something official from either of you? I'm finishing the proposal to submit to CCAA but I didn't know if I should be wait until I receive something from either of you?

Thank you,
Bob

From: Bihari, Thomas <bihari.5@osu.edu>
Sent: Thursday, February 20, 2020 7:48 AM
To: Breon, Ginger L. <breon.5@osu.edu>; Mick, Robert <mick.15@osu.edu>
Cc: Sivilotti, Paul <paolo@cse.ohio-state.edu>
Subject: RE: Draft of Trilogy report

It was a great discussion and the motion to move forward was approved. The committee should be making it official.

Best regards.

Tom