Synchronous Cohort-Based International Education

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Bryan Polivka is currently the Senior Director for Shorelight Education, focused on instructional design and learning architecture for Field Degrees. He is a creative, strategy-focused education executive who has designed new products and services and provided strategic direction and business results for a wide array of organizations.

As principal consultant for PolivkaVox LLC, he has helped schools, universities, corporations, and non-profits by providing both strategy and strategically positioned product. His higher education clients have included online, graduate, two-year, and four-year colleges and universities. As Divisional Vice President and Chief Learning Officer with Laureate Education, Mr. Polivka led the creation of degree programs and courses that fueled student growth from 1,500 to 35,000 at Walden University. He and his teams have built online, hybrid, and distance programs for and with Harvard, Wharton, Johns Hopkins, Notre Dame, SMU, Babson, UMass Amherst, UT Austin, Southern Cal, Carnegie-Mellon, the University of Liverpool, and Universidad del Valle de Mexico. Among his awards are the Most Significant Achievement by an Individual from the US Distance Learning Association, and a national Emmy for a documentary he both wrote and produced.

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Abstract

Many universities are striving to reach a broader audience of students by expanding into the international market, especially for graduate degree programs. The two dominant types of educational offerings to international students are (1) online degree programs or (2) establishment of an international branch campus. Both approaches present significant challenges, specifically, low persistence and completion rates in online courses and difficulty staffing international branch campuses with high-quality faculty members. To address these problems, we have developed a novel mode of distance education that offers a high-quality learning environment for students and quality instruction from instructors who remain on the home campus. We describe the implementation, operation, and assessment of the Live Platform used in our Field Degree Program to demonstrate the effectiveness of this new mode of synchronous cohort-based international education.

1 Introduction

Universities in the United States, Europe, and Australia have for many years attracted international students to their residential programs. Students have engaged in these programs through bilateral student exchanges, government-sponsored programs, as self-paying students, or in funded graduate degree programs. In recent years, universities have aimed to expand their reach in the international market to target students who do not typically come to residential programs. This pursuit has been driven by the desire for additional revenue and broader international recognition, as well as to diversify against the decline in the local demand for higher education [1, 2, 3].

Reasons why students may want to remain in their home country but still obtain a degree from a university in the US, Europe, or Australia are varied: In some cases they are working adults who want to keep their current employment and who see an advanced degree from an international university as a way to upskill. In some cases, students are tied to their home country or city due to family commitments (children, aging parents, etc.). To capture this market of students, universities have pursued the following approaches:

- International branch campuses: This model requires a physical campus to be set up in a location abroad. The main benefit of this approach is a physical presence on site, which may attract and help retain students. The main drawback is the high capital investment as well the difficulty with sourcing high-quality faculty members to teach on site. Examples of international branch campuses are: NYU Abu Dhabi, NYU Shanghai, Georgetown University in
Qatar, Northwestern University in Qatar, American University in Cairo, Georgia Tech Lorraine, Temple University Japan, Saint Louis University Madrid, Duke Kunshan University, etc. [4].

- Online degree programs: Online education typically is based on the asynchronous delivery of pre-recorded and other static content. The main benefit of this approach is that course content is presented and facilitated by highly qualified faculty members from the institution’s home campus. The drawbacks of this approach are difficulty in ensuring student success and extremely low completion rates. Student enrollments in online degree programs continue to rise, but the vast majority of online course registrations come from students already within the catchment areas of the university and the goal of reaching international students is not being realized [5].

Both existing models of international education have significant drawbacks. The high capital costs to set up international branch campuses make this approach prohibitive for all but a few well-endowed, private universities. Over time, faculty sent by the home campus tend to be replaced by local faculty, undermining credibility. The asynchrony in online programs has created a perception of lower quality of instruction and learning. This perception has led to low overall adoption of online programs and saturation [6] or decline [7] in this market. High attrition rates have various causes but are attributable in many cases to students’ incorrect assumption that higher convenience translates into an easier workload. Students who have self-selected into a lower-commitment environment are quick to drop out when the rigor of the program proves higher than expected [8].

In response to these challenges, we have developed an entirely new mode of international education, which provides a high-quality educational experience and can be implemented without large capital investments. This “Field Degree Program,” developed jointly by the University of Massachusetts Amherst and Shorelight Education, is a synchronous, cohort-based classroom experience for international students who want to pursue a graduate degree while remaining in their home country. Instructors teach from a studio on the UMass Amherst campus to students who are located together with their peers in classrooms abroad. The instruction is synchronous and allows for seamless two-way communication and active student engagement and thus provides an environment that is very similar to what students experience in a conventional residential program. By locating the studio on the main campus of the university, regular faculty members can be instructors and thus ensure that the quality of the program is identical to what is normally taught on campus. The cohort-based approach ensures that students can form a community, collaborate in the classroom, and persist in the program.

The technology is based on high-quality audio and video, interactive whiteboards, and a proprietary teaching and learning system that is augmented to support interactions during live lecture. For audio and video, the studio uses a large screen to let the instructor “look” into the classroom and see all the students. The instructor can see when students raise their hands (either physically or through the software). Interactive whiteboards enable the instructor to present and annotate slides. On the classroom side, students can see a persistent video feed of the instructor to ensure a continuous “presence” as well as all slides and whiteboard content at all times. Students can interact with the whiteboard from their side, present, and collaborate.

To-date, this mode of instruction has been used to teach four cohorts of students in the M.S. pro-
gram in Electrical and Computer Engineering and one cohort in a certificate in Teaching English to Speakers of Other Languages (TESOL). Assessment results of the program show very high persistence, high levels of interactions in the classroom, and achievement of learning outcomes. The first graduates completed the program in December 2018. Currently, the program is offered in two international locations and more locations are expected to come online in 2019.

The remainder of this paper is structured as follows. The Live Platform is described in detail in Section 3. We describe the experience from the perspective of the instructor, student, and operator in Section 4. Section 5 presents assessment results showing the effectiveness of our approach. Section 6 summarizes and concludes our paper.

2 Programmatic Overview

The synchronous, cohort-based mode of instruction presented in our work can be used for any number of different programs. In this paper, we describe our use of this teaching modality for the course-based Masters of Science in Electrical and Computer Engineering. This degree program consists of 10 3-credit courses and all of these credits are offered in a synchronous, cohort-based fashion.

2.1 Target Audience

The target audience for this program is international students who want to remain in their home country while obtaining a U.S.-based graduate degree. Typical reasons why these students do not want to take a residential program in the U.S. are:

- Current employment: Students who seek to upskill while retaining their current job cannot afford to take 1-2 years to study abroad.

- Family ties: Students who have responsibilities to their family (e.g., kids, aging parents) cannot fulfill these duties while studying abroad.

- Visa restrictions: Students who come from countries where getting visas to the U.S. is difficult might not be eligible for residential programs.

At the same time, getting an advanced degree from a U.S.-based institution is still of high value to some of these students:

- Career opportunities in multinational firms: Students can advance their careers based on educational credentials from a known, international university.

- Potential eligibility for the U.S. workforce: Students who study one year on a U.S. campus can become eligible for joining the U.S. labor market (see 1+1 option in Section 2.4).
2.2 Program Curriculum

The course schedule for the M.S. in ECE degree program is shown in Figure 1. There are eight courses spread over four semesters plus two capstone project courses, which are offered in the second and fourth semester. The entire program duration is four semesters, which is approximately 16 months, as a full semester is offered during the summer.

This program meets the same requirements as the residential M.S. in ECE offered on the UMass Amherst campus. The admission and degree completion requirements are identical, and the degree that is issued to students who complete the program is indistinguishable between the residential program and the Field Degree Program.

2.3 Program Rollout and Student Recruiting

Our synchronous cohort-based program in ECE has been offered since Fall 2017. There have been student intakes in Fall 2017, Spring 2018, Fall 2018, and Spring 2019. The program has been offered to students in Shanghai from the beginning and since Spring 2019 also in Beijing. The classrooms for the program are hosted at Shanghai Jiao Tong University and at Beijing Jiao Tong University.

Recruiting and admission to the program are conducted by Shorelight Education based on admission criteria defined by the University of Massachusetts Amherst. Prospective students are recruited through a variety of channels. The program employs a robust digital marketing strategy to drive international students to the program website, where students go through an online application process supported by a virtual team of enrollment advisors. The program also leverages a network of international student counselors and advisors to attract applicants, as well as institutional partnerships with local universities to promote the program to its undergraduate seniors and
alumni. The recruitment team also visits local universities to conduct informational sessions and attends industry conferences and events to recruit working professionals into the program.

As the Field Degree Program’s curriculum and assessments are identical to those of the U.S. based residential program, admissions requirements are the same for both programs, with the exception of the requirement for Graduate Record Examinations (GRE). The Field Degree Program does not require a GRE score since this standardized test would present a significant hurdle for prospective students who are working professionals and do not have current GRE test results.

Application deadlines for each intake are typically a few weeks later than the residential program as students do not need to apply for a student visa as part of the enrollment process. Aside from aspects related to the unique delivery modality of the program, recruitment and admissions practices and standards adhere closely to the university’s policies for international students.

2.4 Program Options

There are two options that are offered in this program:

- 1+1 option: For students who want to combine the synchronous cohort-based instruction with a residential experience, there is an option to complete two semesters in their home country using the Live Platform, followed by two semesters on the Amherst campus in the residential program. Thus, the “1+1” option enables students to get benefits from both aspects of the program: more time in their home country near family and work, as well as a residential experience. Students who study for 12 months or longer in the residential program are also eligible for Optional Practical Training (OPT) and can thereby join the U.S. workforce.

- Certificates: Another option that students may pursue is that of obtaining a graduate certificate as either a stackable stepping stone in this program or as an additional credential from the M.S. program. The certificates offered in this program require five courses from Figure 1, including the foundations course and the two project courses. Depending on the selection of the other courses, certificates may be obtained in Computer Networking, Computer Systems Security, Embedded Systems, or Internet of Things.

In our current Field Degree Program, about 50% of the students choose the 1+1 option and practically all students also complete a graduate certificate.

3 Live Platform Implementation

The setup for the Live Platform consists of two components:

- Studio: The studio, which is located on the campus of UMass Amherst, hosts the instructor who teaches to the classrooms.

- Classrooms: The classrooms, which are located at international sites, host the cohorts of students.
The technology that is implemented in both the studio and classrooms enables the seamless interactions between instructors and students.

### 3.1 Studio

The studio is designed to be intuitive for anyone accustomed to classroom teaching. The instructors can see the students on a large screen, as shown in Figure 2. Instructors can teach from a lectern, standing in front of a wide-screen PowerPoint slide presentation, which can be annotated with a pen, or at a large interactive whiteboard. The layout is such that faculty new to the environment do not need to adjust their presentation style to the technology, rather the technology is designed to support and augment the teaching methods with which they are deeply familiar. They simply move from the lectern to slides to whiteboard as they wish. Additional support technologies are available at each position.

At the lectern (Figure 2), instructors can use an overhead document camera or plug in a laptop or any other device in order to display it “live” to students. A proprietary electronic hand raise feature, when initiated by a student logged in on a laptop, gives the instructor an indicator of who has a question and provides the instructor with thumbnail information about that student. When the instructor acknowledges the raised hand by clicking the student icon, cameras automatically steer and zoom in on that student.

At the PowerPoint display (Figure 3), instructors can use tools to poll the class by sending prepared or spontaneous questions to the student laptops. Results are collected and displayed graphically.
and automatically, as shown in Figure 3. Another feature allows faculty to facilitate small group work in the classroom by sending out a question for discussion to student laptops. One student in each group can then send a group answer, attributing it by name to all the students who worked together on the question.

From the interactive whiteboard (Figure 4), instructors can present prepared diagrams or other images, which students can then annotate. Additional tools allow instructors to encircle and move text or images from one part of the screen to another, or enlarge or reduce the size of their own drawings or handwritten text. The instructor can also turn to a new page, a fresh white screen, without erasing or losing any of the existing annotations. When this happens, classroom whiteboards follow along. All PowerPoint annotations and whiteboard writing are saved and supplied to students electronically within minutes of the conclusion of each class session.

From all three positions, the instructor sees the students by looking at a large-screen screen (Figure 2), designed specifically for this purpose. Classrooms can be selected and cameras steered at any time by the instructor, or the instructor may choose to let the proprietary software choose the shots. The system uses a combination of logic, algorithms, automation, and human intervention to present a student who is speaking to the instructor.

3.2 Classroom

The classroom technology has been designed very specifically to generate a student experience that feels like the instructor is in the room with them. Three large-screen projectors take up much of the wall space at the front of the classroom, as shown in Figure 5. In the center is the instructor, always visible and always life size. To the left of this screen is another, with the exact same PowerPoint presentation being used by the instructor. Annotations show up here in pristine resolution, almost instantly. To the right of the instructor, students see the same interactive whiteboard as in the
Figure 4: Shared digital whiteboard in Live Platform classroom.

Figure 5: Student view in Live Platform classroom.
studio. Students may write on the whiteboard when called on or at any time, and their additions are seen immediately in the studio, as shown in Figure 4. Even though the instructor is limited to the center screen, his or her ability to control the entire three-screen experience from one side of the room to the other contributes to a sense of presence and control that a single screen could never establish.

High-quality, two-way audio is always on for the duration of the lesson, never muted, so that students can interrupt the instructor or vice versa, carrying on classroom interaction as easily as in a traditional classroom. Multiple microphones allow students in any part of the room to be heard by the instructor even when whispering, which provides a level of intimacy with students not possible in a standard classroom. This has helped to contribute to levels of interaction that are higher in the technical environment than in the standard classroom.

An additional feature of the classroom technology is a connected electronic pen-and-paper technology, which allows students to write on physical paper at their desks, images which can be seen instantly in the studio and projected back to the data screen. This third-party technology requires the use of a special pen and paper printed with a faint microdot pattern. Any number of students can write or draw simultaneously, and as they write each of their pages are seen in an array in the studio. Instructors can then choose any page to enlarge and comment upon. This technology is effective for small group activities that require either drawings or advanced mathematical equations rather than text-based answers. It can also be used for written exam papers.

### 3.3 Platform Interactions

The Live Platform allows for the following types of interactions between the studio and classroom. These were the basis of the development of the platform and form the nucleus of the instructional design:

1. **Slides with annotation.** The instructor displays a PowerPoint slide set on a large screen, annotates as desired.

2. **Whiteboard.** The instructor writes and draws on a whiteboard. Students add and edit at any time.

3. **Video playback.** The instructor plays a video from a laptop or other connected device.

4. **Document camera.** The instructor displays small objects or documents for students.

5. **Orchestrated conversation.** The instructor engages individual students in sequence. The electronic Hand Raise function can facilitate this interaction.

6. **Group discussion and report back.** The instructor encourages group discussion, with anyone speaking up at will. Small groups discuss a problem or question and report back electronically, whether through text or drawing.

7. **Student presentation.** Student or group of students present from their own laptops, instructor watches and comments.
8. Polling. Instructor initiates an electronic multiple-choice survey question answered by students, then displays the results.

9. Guest via video-conference. Instructor introduces a guest, who appears via the teleconference link and instructs interactively.

10. Guest in studio. Instructor introduces a guest in the studio who presents, co-presents, or is interviewed.

11. Connected device. Instructor uses a laptop or other device to present information or data.


While not all instructors use all of these interactions during their courses, the rich set of possible interactions ensures that the Live Platform provides a high-quality teaching and learning environment despite huge geographic distances between studio and classrooms.

4 Instructional Experience

After four completed semesters, which include the repeated teaching of all courses in the M.S. program, we have gained substantial experience with this new mode of instruction.

4.1 Instructor Perspective

In most aspects, the in-class experience from an instructor perspective mimics live teaching interaction in a classroom and, in some aspects, is superior to classroom teaching. All lecture materials for the Field Degree Program are professionally prepared from instructor notes and slides. An important aspect of each lecture is a series of interactive polls and short answer questions that are prepared before the lecture. Prior to the lecture, the instructor examines the lecture slides and interactive materials to determine lecture pacing. For most courses, a series of pre-lecture questions are presented to the students via a web interface. The responses to these questions are used as talking points during the lectures.

As described in Section 3.1, students can be viewed live by the instructor via a large video monitor during the lecture. Even with the large geographical distance between Amherst and China, interaction with students is immediate with no apparent lag in either video or audio. The instructor typically checks the functioning of the digital pens and whiteboards before appearing on screen to the students in the classroom. The instructor can mute the studio microphone before and after the lecture, or if necessary so they can privately interact with the studio technician.

The studio lecture experience is similar to traditional classroom teaching. Lectures often contain both lecture slides and written notes. Most instructors alternate between the two formats, using the digital pen to write annotations on both boards.

The poll and short answer functions are significant mechanisms that allow students to interact in the classroom. Students enter responses to these questions using computers in the classroom. The responses are collated and the results displayed in both the classroom and studio. These functions
provide significant value in several ways. First, students have time to discuss options with each other in the classroom and offer group opinions. Second, the instructor is given a few minutes to consider directions for the lecture after receiving interactive feedback. Early in lectures, polls and short answers can be used to assess student knowledge from previous lectures.

The instructor experience with the students is not limited to lectures. Many instructors use video-conference meetings with groups of students to enhance classroom learning. Students can present supplemental material and request feedback from an instructor during these sessions.

4.2 Student Perspective

The advanced technology available in the classroom gives students a unique learning perspective. The life-sized image of the instructor appears before them to create a tangible teaching presence in the classroom. Both whiteboard and PowerPoint projections provide presentation materials in an easy-to-understand format. The interactive whiteboard, pen-and-paper technology, and individual laptops allow students opportunities to interact with the instructor and provide real-time feedback to questions and short tasks. Technology aids in the student experience to encourage participation, feedback, and ideas.

An important aspect of the student experience is the frequent opportunities to have short in-class discussions with classmates on lecture material. These discussions often result in short responses provided by the students to the instructor. This approach provides real-time feedback and allows the students to remain engaged in the learning process. Students often review lecture materials before class and answer questions online after lectures. Participation in these exercises is included in course grading as is lecture attendance.

Students who take the project courses are guided through two semesters as they work in teams to create a prototype of an Internet of Things device. The structure of the project and level of faculty support matches on-campus projects (incl. budget for prototype system). Presentations are conducted in the classroom, typically assessed and graded by more than one faculty member as shown in Figure 6.

The cohort experience of sharing a classroom with peers has led to very good attendance in the program. Students seem to value their interactions with classmates and small group work. As a result, student persistence has been excellent (see Section 5.1).

4.3 Operations Perspective

The Field Degree Program and the Live Platform require some level of support from professionals beyond the instructor:

- Instructional design: Each course offered in the Field Degree Program is developed by a master instructor, typically a tenure-track faculty member, who is responsible for the quality of the course content. This faculty member works with an instructional designer to ensure
Figure 6: Students and faculty interacting on Live Platform platform for project presentation.

that new or adapted content makes full use of best teaching practices and platform interactions (see Section 3.3). This instructional design is a one-time time commitment before the first offering of the course (and occasional refreshing of the course content).

- Studio operation: The studio requires minimal support, defined as one studio operator (not a broadcast technical director or an engineer) for two simultaneous broadcasts.

- Classroom operation: In addition to software and hardware, the classrooms are supported by a trained, part-time or full-time facilitator. The job description for this position requires a bi-lingual person capable of managing start-up and shut-down of equipment, basic troubleshooting, organization and preparation of teaching materials such as printing and duplicating handouts, and basic facilitation of activities, such as helping students to organize into small groups for discussions. The position is supported by technical personnel who are not on-site at all times.

While the operational support for the Field Degree Program seems to be higher than what is necessary for a typical residential classroom, it is important to note that each instructor teaches to multiple classrooms at any one time. Thus, the overhead of instructional design and studio operations is amortized over multiple parallel offerings of the course.

5 Assessment

We present data from a program-level assessment showing student persistence and satisfaction, as well as data from an assessment of the Live Platform in comparison to a traditional class-
Figure 7: Student flow in Field Degree Program showing very high persistence. Student numbers are noted for each step.

5.1 Program-Level Assessment

Figure 7 shows the student flow through the Field Degree Program. The chart shows admissions, enrollments, and students who choose the 1+1 option to join the residential program (see Section 2.4). Students from the first cohort who have transferred to the residential program are expected to graduate at the end of Spring 2019 since no summer semester is offered in the residential program. Except for one student who delayed their studies due to medical reasons, no student has dropped the program.

The assessment of the Field Degree Program by students is shown in Tables 1 and 2. Table 1 shows the student responses to the question: “At this stage, how satisfied are you with the UMass Amherst program?” with a scale from 0 (Not at all Satisfied) to 10 (Extremely Satisfied). Scores of 6 and above are considered to indicate that students are satisfied. The result show very high satisfaction results throughout the program. For Summer 2018, there are no assessment scores for arrival since no cohort was admitted (see Figure 7 and no mid-semester scores due to an administrative oversight. The Spring 2019 mid-semester and semester-end scores are not yet available at the time of writing of this paper.

A finer-grained assessment of student satisfaction is shown in Table 2, which shows the Net Pro-
Table 1: Student satisfaction scores for Field Degree Program.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Satisfaction Arrival</th>
<th>Satisfaction Mid-Semester</th>
<th>Satisfaction Semester-End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2017</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Spring 2018</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Summer 2018</td>
<td>n/a</td>
<td>n/a</td>
<td>88%</td>
</tr>
<tr>
<td>Fall 2018</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Spring 2019</td>
<td>86%</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Table 2: Student net promoter scores for Field Degree Program.

<table>
<thead>
<tr>
<th>Semester</th>
<th>Net Promoter Score Arrival</th>
<th>Net Promoter Score Mid-Semester</th>
<th>Net Promoter Score Semester-End</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 2017</td>
<td>50</td>
<td>50</td>
<td>57</td>
</tr>
<tr>
<td>Spring 2018</td>
<td>40</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td>Summer 2018</td>
<td>n/a</td>
<td>n/a</td>
<td>13</td>
</tr>
<tr>
<td>Fall 2018</td>
<td>55</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Spring 2019</td>
<td>57</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Promoter Score (NPS). The NPS, which is an industry standard, is calculated in response to the question: “How likely is that you would recommend UMass Amherst to a friend or colleague?” with a scale from 0 (Not at all Likely) to 10 (Extremely Likely). Scores of 0–6 are viewed as detractors, 7–8 as passives, and 9–10 as promoters. The results in Table 2 are calculated with the following formula:

\[
NPS = \frac{\text{Number of Promoters} - \text{Number of Detractors}}{\text{Number of Respondents}} \times 100.
\]

The range of net promoter scores is from −100 to 100. Our results show very strong support for our Field Degree Program. The two low NPS in the Fall 2018 semester are due to very low response rates to the voluntary assessment.

Overall, these results show that students are satisfied with the program and, more importantly, persist in the program.

5.2 Live Platform Assessment

One of the main concerns with this novel mode of instruction is to ensure that the quality of instruction is at least as good as in a typical classroom environment. It is difficult to assess overall learning outcomes at this early stage of program implementation. However, one indication of instructional quality is the amount of interaction between the instructor and students, as supported by the literature on active learning [9, 10].

As discussed above, each course offered on the Live Platform has gone through extensive instructional design. One important aspect of this design is to intentionally include interactive components. The most commonly used types of interactions are “raise hand,” “poll,” and “short answer.” These interactions ask students to respond verbally, with multiple choice, or written open-ended...
Table 3: Interactions Designed into Courses. Courses marked with * are alternatives in the program. Graduate Project II is not listed since that course consists of individual consultations between instructor and student teams.

<table>
<thead>
<tr>
<th>Course</th>
<th>Raise hand</th>
<th>Poll</th>
<th>Short answer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundations in Computer Engineering</td>
<td>24</td>
<td>29</td>
<td>18</td>
<td>71</td>
</tr>
<tr>
<td>Computer Networks</td>
<td>59</td>
<td>11</td>
<td>56</td>
<td>126</td>
</tr>
<tr>
<td>Computer Architecture</td>
<td>34</td>
<td>22</td>
<td>118</td>
<td>174</td>
</tr>
<tr>
<td>Trustworthy Computing</td>
<td>45</td>
<td>0</td>
<td>42</td>
<td>87</td>
</tr>
<tr>
<td>Algorithms</td>
<td>49</td>
<td>11</td>
<td>38</td>
<td>98</td>
</tr>
<tr>
<td>Reconfigurable Computing*</td>
<td>83</td>
<td>3</td>
<td>67</td>
<td>153</td>
</tr>
<tr>
<td>Security Engineering*</td>
<td>59</td>
<td>1</td>
<td>17</td>
<td>77</td>
</tr>
<tr>
<td>Advanced System Software Design</td>
<td>120</td>
<td>39</td>
<td>36</td>
<td>196</td>
</tr>
<tr>
<td>Data Analytics</td>
<td>37</td>
<td>2</td>
<td>17</td>
<td>56</td>
</tr>
<tr>
<td>Graduate Project I</td>
<td>16</td>
<td>0</td>
<td>8</td>
<td>24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>526</td>
<td>118</td>
<td>417</td>
<td>1,061</td>
</tr>
</tbody>
</table>

The very high levels of interactivity that is designed into the courses for this program can be observed by comparing instruction in the Live Platform with a residential classroom. To illustrate this difference, we have chosen a random 10-minute interval of instruction that was taught by the same instructor teaching the same content. In both cases, the class was recorded for students so that they can review the material later if they choose to do so. The instructor was not aware that the recording would be used for this analysis. (Permission to perform and present this assessment was later obtained from the instructor.) Note that longer comparisons are difficult because of divergence in instructional speed.

The timeline of interactions is shown in Figure 8. The orange bars indicate times when the instructor is speaking, and the blue bars indicate times when students are speaking. Overall, it is apparent that student engagements in the Live Platform environment are more substantial (students speak for a longer time). Also, interactions are more evenly distributed (fewer very long blocks of instructor monologues). The data shown in Figure 8 are summarized in Table 4, which shows the quantitative differences in the balance between instructor and student engagement.

One reason for the higher level of student engagement in the Live Platform environment is, of course, due to the instructional design, which encourages the instructor to engage in planned interactions. Another is that the remoteness of students and the ability to hear all students equally well may encourage instructors to engage more often in interrogative approaches to learning, rather than limiting themselves to the easier, but possibly less substantive, interactions that might occur in a...
Figure 8: Timeline of interactions in traditional classroom and Live Platform environment for instruction of identical content by the same instructor over a 10-minute interval. Instructor speaking is shown in orange and student(s) speaking is shown in blue.

Table 4: Comparison of interactions in traditional classroom and Live Platform environment for instruction of identical content by the same instructor over a 10-minute interval.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Traditional classroom</th>
<th>Live Platform environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Instructor speaking total time</td>
<td>9:16</td>
<td>8:41</td>
</tr>
<tr>
<td>Instructor speaking average</td>
<td>0:33</td>
<td>0:26</td>
</tr>
<tr>
<td>Student speaking total time</td>
<td>0:44</td>
<td>1:19</td>
</tr>
<tr>
<td>Student speaking average</td>
<td>0:03</td>
<td>0:04</td>
</tr>
<tr>
<td>Number of switches in speaker</td>
<td>33</td>
<td>39</td>
</tr>
</tbody>
</table>

traditional classroom.

Overall, the initial, formative assessment of our Field Degree Program shows that we can achieve near-perfect student persistence, high student satisfaction, and high levels of interaction in the Live Platform environment.

6 Summary and Conclusions

We have presented a new mode of instruction that can connect students in remote classrooms to an instructor who teaches from a studio on the home campus. The various technologies in the studio and classrooms enable highly interactive, synchronous teaching and learning. The cohort-based experience by students enables classroom interactions and contributes to student engagement and retention. Our assessment shows that students stay in our program and are highly satisfied with their experience. Comparison to traditional classroom instruction shows that interactions are frequent, and possibly even more substantial, in the Live Platform environment. Thus, we consider this new mode of teaching using the Live Platform environment in our Field Degree Program a viable approach to providing synchronous cohort-based international education. This new mode of instruction can be a significant and effective alternative to establishing and managing remote
campuses and online degree programs, opening the door to expanding into international student markets for domestic degree programs.

References


