Four Decades of Distance Learning Instruction in an Electrical Engineering Technology Program

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Abstract

Online instruction is no longer a new or seldom used modality. It has grown over the last few decades, reaching a pinnacle during the recent pandemic. Different institutions and different programs chose different approaches for the online delivery of courses, adopting either synchronous or asynchronous deliveries for online students, and hybrid delivery for mixed groups of campus and online students attending the classes in a live or synchronous manner. This paper's main goal is to present the history of 40 years of distance learning in an Electrical Engineering Technology program and how the delivery mode progressed over time. While the building blocks were fully in place at the beginning of the 2020 pandemic, the paper discusses the solutions to the problems encountered during the shift to fully online delivery and the lessons learned from this experience. The paper also presents the solutions for specific curriculum constraints, assessment considerations, and the relationship between course delivery and enrollment at a time when schools are competing for enrollment while facing a shrinking pool of potential students.

Introduction

Online instruction was introduced in the last few decades either to accommodate students with timing or location constraints, or to enhance traditional instruction with the resources offered by the advances in technology. It has been said that telecommunications and transportation are in a technological race, and whichever will win will make the other one obsolete. But with teleporting technology nowhere close to being adopted, the idea of "moving the work to the workers instead of moving the workers to work" was taking over way ahead of the crisis imposed by the recent world pandemic [1]. College instruction in particular was well-suited for such a transition, and to introduce alternative instruction models to the traditional face-to-face approach. Over time, different venues for remote delivery of instruction materials were developed, with the variety created due to different needs, available resources, and/or educational goals. In some cases the online component was added to complement or enhance the traditional face-to-face instruction, with some virtual resources added to the course materials that students can access outside of the class. These added resources could be recorded videos, documents, or online links, as well as extra virtual meetings on top of the regular face-to-face meetings. Various options for video conferencing, such as Webex, Zoom, Microsoft Teams, or GoToMeeting, became ubiquitous in the later years, and these solutions were adopted regularly for work, instruction, and even for individual needs. This approach of incorporating online components into traditional classes has been largely investigated by researchers, with the flipped classroom setting being one of the methods introduced [2-4]. Blended learning and E-learning are other terms that describe the mix of online components into traditional instruction [5-7].

Some literature refers to hybrid courses as a mix of face-to-face and online instruction [8-9]. The terms are not always used in the same way by different researchers, and it is important to clearly understand in each context what the terms actually mean. However, the focus of this presentation is mostly on how the students participate in the class, meaning either in person, live but virtually, or offline. From this point of view, the instruction will be categorized as face-to-face (or campus), synchronous (live virtual), or asynchronous (offline virtual). One other category that we add to this list is hybrid instruction, which in our interpretation is the course delivery to a combined group of campus and synchronously attending students. Rather than separating the two groups and having either campus or online synchronous versions of the course, the two groups are joined together into a single hybrid class, with a single instructor delivering the course to the joined group. The hybrid mode also offers the chance for the two student groups to get to know and interact with each other. Different literature uses the term Blended Synchronous Learning Environment (BSLE) or "Here or There" (HOT) instruction for this scenario of face-to-face courses that also accommodate remote access from different locations [10-11]. We found these course settings to be the ones with the closest resemblance to what in our institution is called hybrid course delivery.

Pioneering online teaching

Old Dominion University (ODU) was a pioneer in terms of online instruction and digital learning and the Engineering Technology (ET) Department, which the Electrical Engineering Technology (EET) Program is a part of, was participating in this process from the very beginning. The reasons for this lie mostly with the large student population and their various backgrounds. The Hampton Roads area in Virginia, where ODU is located, is a major military Navy as well as naval shipbuilding site. Thus, a large number of our students are active or retired military, and this population requires traveling on short notice and often being in remote places or on ships. To serve this student population ODU and EET in particular started in the mid-1980s to offer support for courses delivered at a distance, especially on US Navy ships deployed around the globe [12]. That first approach of distance learning (DL) was a version of asynchronous course delivery, based on portable media for delivering the courses to the students, initially using VHS and later using CD-ROM course recordings. Students were able to study the course materials at their own pace and make arrangements with the instructors for the completion of assignments and examinations. This option was implemented for a series of courses, mostly upper division courses, and not for the whole curriculum. The model served well the military students, who were able to complete the lower division portion of the curriculum while they were stationed in the area. Once these students were deployed, they would be able to continue with some upper division courses and stay on track for graduation. With the advancements in technology, more flexibility became available for distance learning, which facilitated a more timely delivery of the courses for the military student population and at the same time started to attract new student population, in particular returning students, who were at different stages in their careers and in their lives, and had to balance schedule between work, family, and study. In 1994, ODU invested

in satellite technology for course delivery and TELETECHNET was developed in partnership with the Virginia Community College System (VCCS) [12]. This facilitated broadcast instruction via satellite, a form of interactive television. Outgoing audio and video were broadcast via satellite, and audio from the students was returned via a telephone bridge system. The EET program was fully on board with this course delivery with faculty engaging in the new format of teaching. That is to say that the experience with virtual learning for our program, as well as for the whole ODU, began before web-based course-management systems such as WebCT, Blackboard, or Canvas were available. Courses were delivered synchronously, and from the very beginning of the distance learning delivery, both campus and distance learning students were grouped together in hybrid classes. The assessment of the courses for accreditation reasons was always performed for the combined groups, and did not separate the campus and online students, since both groups were exposed to the same instruction and were taking the same tests. Testing for DL students was usually performed with proctored tests at the student site, since ODU made arrangements with local community colleges, libraries, or other institutions that can administer tests and provide proctors. However, laboratory classes always raised more issues for distance learning due to their hands-on component. The labs were often offered separately, for campus and distance learners, and not in hybrid mode. Assessment was conducted and the results were compared for the two groups with the results showing similar results or even better results for the distance learners than for the campus group [13]. For a digital electronics lab, to ensure consistency across the campus and online groups, the same labs were assigned to both groups - partially simulation and partially hardware. Campus students used the campus laboratories, but distance learners were expected to develop agreements with local community colleges or engineering companies to gain access to similar lab equipment. To assist with these arrangements, the EET program would have made recommendations for the partner community colleges in the student's area of residence. Working students often had access to equipment through their employers. For a power and machinery lab, due to the larger and more specialized equipment, the campus lab experiments were videotaped for the distance learning group, with the instructor operating the equipment, and the students being asked to observe and make the measurements and needed calculations. This study, performed in the early 2000s, shows that over 15 years of DL and hybrid course delivery, the assessment results show better performance of the DL students compared with campus students. The instructor performing the assessment made the suggestion that this may be due to the DL students being more mature and motivated, more experienced due to work experience, and maybe due to a lighter course load since most of the DL students were part-time students [13]. Similar results between the two groups were noticed moving forward as well.

Pre-pandemic Period

The satellite-based course delivery was discontinued in the Fall of 2014, and everything that had been previously broadcasted started to be delivered online using Webex. ODU Online was

established, and they oversaw a dedicated building from where the courses were delivered with continuous technical support for faculty teaching, as well as the recruitment of DL students from all the United States, and the seamless transfer of students from the VCCS or out of state through articulation agreements. ODU also invested in three regional centers in the Hampton Roads area, in close proximity to the main campus in Norfolk. These centers, Peninsula (in Hampton), Tri-Cities (in Portsmouth), and Virginia Beach (in Virginia Beach), have a large number of rooms set up with DL capabilities, such that synchronous courses can be initiated from these classrooms or students can come to these rooms to attend live courses that were initiated from the main campus, for example. In early 2010, ODU Distance Learning wished to expand courses that would not require live attendance. Departments and faculty were encouraged to develop asynchronous courses, fully online without face-to-face interaction. While the other programs in the ET department developed part of their courses in the asynchronous format, the EET faculty group decided to stay with the synchronous/hybrid format, providing a very limited offering of courses in the asynchronous format. These asynchronous courses were mostly for the active military students without access to the Internet, or for some summer offerings of certain laboratory courses. The synchronous mode courses, also referred to as hybrid, were at this time available for all online lectures and most of the online laboratories, and were delivered live by an instructor from an ODU classroom and transmitted via Zoom, (via Webex prior to 2021), to any remote student, and to the three regional higher education centers. Students may attend the live broadcast from a classroom on either the main ODU campus in Norfolk or at one of the higher education centers. Students may also stream the broadcast live on their computer, phone, or tablet. All broadcasts are automatically recorded and stored in the course's web conference and video archive page on the ODUGlobal website (formerly ODU Online). The archives are available to all students within 24 hours of the broadcast, most of the time within a few hours. Communication with the instructor and students during live broadcasts is accomplished using two-way video and audio. All these facilities are coordinated by the DL technical support personnel and are transparent to the instructor. At the beginning of each semester, instructors are welcomed by a DL technical support person and asked about what accommodations are needed for the class. They are also reminded that their focus should be on teaching and the technical aspects of the course delivery are to be left for the technical support. Pictures in Figure 1 show the setting for DL course delivery on the main campus in Norfolk, Gornto Building. The instructor may use a panel to select the input for the display, which can be a computer screen with document view, an overhead camera for writing on paper, or a camera on a whiteboard positioned on the wall behind the instructor's desk (not shown in Figure 1). A tablet also allows the instructor to write on the documents displayed on the screen and save the annotated document for the course archive. There are several large monitors around the room, in front of the room for campus students to see, and in the back of the room for the instructor's view. The monitors also show the cameras of the DL students, such that the instructor can see both campus students and DL students and be able to notice if any of them have a comment. The campus students have microphones to use for questions and comments, such that DL students can also

hear and interact if they wish. DL students may at any time turn on their microphones and ask questions or interact with the other class participants.

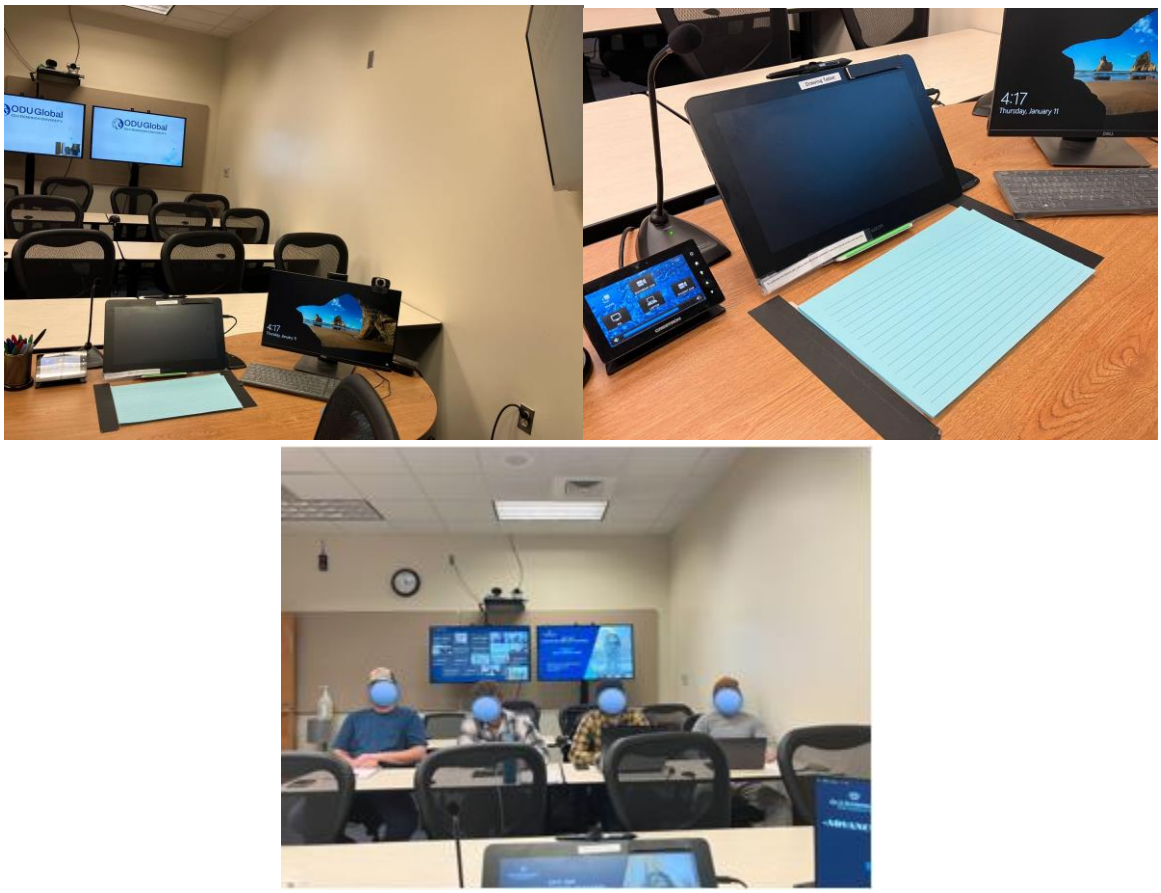

Figure 1. Synchronous Instruction Room

In the EET program, prior to the Spring 2020 semester when the Covid-19 pandemic imposed a shutdown, the majority of the curriculum was offered on campus as well as the synchronous distance learning mode, with the majority of classes being offered as hybrid, for joined groups. ODU Online promoted the EET program as a program for completion, and not a fully online degree program, since the campus option was still in place and not all courses were available online. The only courses that were not offered in online format were the lower division labs, electrical circuits and electronics. No effort was made at that time to offer these labs online because of the partnerships our program had with local and state community colleges. DL students were able to complete these classes in actual labs at institutions near their location and transfer the credits toward their ODU degree.

It is important to note that for all the courses that were offered in hybrid mode the size of the classes was no larger than 40 students, with most of them in the 20-30 students range. This class

size was appropriate for the hybrid setting, manageable for the instructor, and at the same time it offered a sense of community among the students as they got to know and interact with each other. The setting requires more effort from the instructor since the attention has to be distributed between presentation, making sure the transition between PowerPoint documents and document camera for example goes smoothly, as well as students present in the class and students connected remotely. DL students are always encouraged to speak up when they have questions, rather than posting their comments, since that will help the instructor to answer in a timely manner. Technical support personnel are always present and ready to assist if necessary, regardless of the timing of the course, so the instructor has little stress about the technical aspects and can focus on teaching. If students have technical issues, they can also contact the university's Information Technology Services (ITS) and receive assistance in a timely manner. The technical staff are also in charge of managing the recordings of the lectures, posting them in Canvas, or the previously employed Blackboard learning platform. The course managing platforms Canvas and previously Blackboard, were implemented university-wide, regardless of the delivery mode of the course, so for either campus only, synchronous or asynchronous courses. In the case of synchronous courses, the lecture recordings for current semesters as well as archives for previous semesters are available on the ODUGlobal (former ODU Online) website. Additionally, the lecture recordings are available to the course participants in either Canvas or Blackboard under Media Gallery. If needed, the instructor can add additional recordings in the same section. The Canvas and Blackboard platforms were also very helpful in assisting with the quizzes and exams. This feature was adopted during the pandemic, as most of the faculty turned to exams delivered in the course management system rather than in person or through proctors. This feature continued to be used after the pandemic by most EET faculty since it provides a unified testing environment for both campus and online students. The exams in Canvas or Blackboard offer flexibility in terms of types of exams, either whole exam deployed at once or question by question, with either multiple choice answers or file upload option for written solutions, for timed exams or take-home version, for the same tests offered to the whole class or tests differentiated per groups. Other features of the course management platforms that are very useful in the hybrid setting of a course are discussions and collaborations settings, which offer the opportunity for all students to get in touch to discuss the course topics or to work together on assignments. These settings allow for campus and online students to get to know each other and help especially the online students to get a sense of inclusion. Additionally, the Course Collaboration Tool in Canvas for example, offers the possibility to add additional meetings, which may be office hours type of meetings.

With the option of either campus or online, especially for the hybrid setting, there is a tendency for some students to migrate from campus to online for reasons of personal convenience. While some students perform well in those settings, there is a percentage of students who say they do better in face-to-face settings and that they need to come to campus to be engaged in the class. The way students attend the classes, especially for those that are local and have the option of

either campus or online, was controlled through the registration process. Different sections of a course were created with respect to the way the students declared their location. There are sections for on-campus students, for local online students, for within the state online students, and for online students residing outside of the state. Registration to the local online sections was most of the time offered by approval only, such that the local students were encouraged to attend campus sections. If a student can demonstrate a work related schedule conflict, or any other type of constraint that limits their participation in person, they may receive approval for registration in the local online sections.

EET faculty were fully engaged in adapting the pedagogy to the new student body, and in introducing teaching techniques to assist both campus and DL students in a similar fashion [14]. The hands-on nature of the engineering field raised special constraints for online delivery, but solutions were found, with EET faculty pioneering the online delivery of microprocessor-based courses [15-17].

The hybrid mode of course delivery became the preferred mode prior to the pandemic shutdown. From the faculty's point of view, it was an efficient way to manage the resources, classrooms, and instructors, and a good way to perform course assessment regardless of the way students attended the class. It also offered the instructors the possibility to have live feedback from the two groups. From the student perspective, the hybrid setting was also preferred because it offered the option of live course delivery, which has always been preferred to asynchronous classes, while also providing the flexibility of not having to travel for classes, saving time and money. Access to after-the-fact lecture recordings allows for the making up of a missed lecture, or simply to review material for enhanced understanding. These are all additional benefits of the synchronously offered hybrid classes.

The Pandemic - Fully Online Curriculum

The pandemic time might have reminded science-fiction fans of the 1957 book by Isaac Asimov, The Naked Sun, and of the Solarian society in which people never meet in person but by holography [18]. The isolation imposed by the pandemic placed a huge burden on people's emotional and social state, both of which will be studied for years to come. But from the technological point of view, it turns out we were prepared for the transition to remote activity for a wide variety of sectors. For academia, the shutdown imposed by the Covid-19 pandemic required a sudden transition to fully online course delivery. This was very disruptive for most of the institutions and academic programs, but at ODU, and especially for the EET program, the transition was smooth. This was largely a result of the infrastructure being in place and the course settings being already adjusted for online delivery. The only change for the majority of classes was allowing for the campus students to join the class remotely, with that setting being already in place for the DL students. Since this happened in the middle of the Spring 2020

semester it could have been very disruptive, but the courses were already set for online delivery and the transition went quickly and smoothly. Faculty could have continued to teach from the special online rooms on campus, but in most cases with the addition of a document camera, they were able to teach from home and join the classes remotely along with the students. It was only for the few lower division lab courses that were previously not offered in the online format that an alternative solution was needed. The immediate solution was to modify the laboratories for completion using simulation software, and while this solution was quick and practical, the faculty were dissatisfied with the missing hands-on component. Over the next year, the faculty decided to employ the NI myDAQ hardware for online laboratories, and the department acquired 50 packages to support the online students. Students can borrow for free the myDAQ packages from the department, complete the course, and return them at the end of the semester. With the added hands-on component of the online labs, currently all the laboratory courses in the program are offered with both campus and online sections. The myDAQ packages include the actual myDAQ, breadboard, jump wire kit, protoboard, and in some cases the needed electronic components, all contained in a sturdy case. The needed software is available to students through the university at no additional cost other than the standard laboratory fee. The same package is to be used for all the circuits and electronics laboratories in the curriculum, and students are only responsible for the electronic components needed for each lab, that is if they are not provided as mentioned above. In the event that the students need to procure electronic components, the instructor provides the parts list. Often students decide to buy their own myDAQ package as they find it a good investment for their career needs.

Online Course Delivery and Student Enrollment

Before the pandemic, the trend of an increasing number of students choosing online registration became apparent, resulting in a decline in campus registrations. This trend was noticed nationwide, and literature discusses this trend as a consequence of the advances in technology, the flexibility of distance learning, and the shift of the young generation's approach to technology and learning style. ODU was no exception, and it was in fact a front runner in developing distance learning, which led to the increase of the distance learning population. During the shutdown, more students took over part-time or full-time jobs, and they had the flexibility to do both work and study, saving time and money due to the online course delivery. Once the campus reopened the trend continued and for some time it seemed difficult to bring students back to face-to-face classes. As long as they do well in classes with this mode, their preference is to rather share their schedule between work and study than spend the time traveling. Of course, this mode does not fit all, and there is a significant group of students that find the face-to-face instruction best fit for them. Often the traditional student simply wishes to return to campus for reasons of social activity and personal independence. In EET however, a large group of students is non-traditional, either military or returning students, and students at different stages in their lives for whom the flexibility of the online instruction is essential for

being able to attend school and obtain a degree while also working either full or part-time. These are students who already have significant work experience and they find the degree in engineering technology to be their best option for advancing their careers. Some student testimonials about the synchronous/hybrid course delivery are included below:

- *"As a long distance, online student it has been very helpful to attend synchronous, hybrid classes. Attending a real-time class helped me be more motivated and scheduled with my work. Not only that but knowing that I was getting almost the same support as the in-person students greatly boosted my confidence. I feel that creating a distinct disconnect between online and in-person students could make distance learning students like me feel more disconnected from the campus community. Through attending synchronous, hybrid classes, I was able to have the best possible experience given my distance from campus; this wouldn't have been the case with a strictly asynchronous structure."*

- *"Having the option of synchronous classes and in campus classes is very helpful for us. Students are able to watch the recording once the lecture is uploaded and go back to review the content, students will also have a more flexible schedule where they don't have to commute for a class and can learn online. This system (hybrid) at ODU is very helpful for all the students."*

- *"I went from full-time commuter to full-time synchronous, because of having to relocate for my job. If ODU did not offer the hybrid courses, it would have taken me another 2 years to graduate, or I would have had to transfer to another university and start all over. The way the course work is offered allows the maximum participation for all types of students and allows content to be reviewed in a manner that is flexible for all types of backgrounds."*

- *"It's easier to interact and ask questions to the professor when taking the course in a synchronous format. Some community college courses I took before attending ODU were in an asynchronous format, and I found it much more difficult when compared to the hybrid/synchronous format."*

- *"I appreciate the hybrid delivery of the courses very much. Having access to the professor in real time to ask questions is invaluable. Having access to the archive allows me the time to review more challenging sections of the course, ensuring my success in those areas."*

Data presented in Table 1 shows the total registrations for the EET program for the Fall semesters of several years, both before and after the pandemic. The table shows the numbers for individual sections, relative to the student's location. The numbers show that the distribution between campus and online turned around for the time period considered, with 76.78% campus registrations in 2016 versus 69.1% online registrations in 2022.

Table 1: EET Student Enrollment

Semester	Campus			Online local			Online in state (not local)			Online out of state			total
	LD	UD	total	LD	UD	total	LD	UD	total	LD	UD	total	
Fall 2016	140	184	324	0	43	43	0	36	36	0	19	19	
	324=76.78%			43=10.19%			55=13.03%						422
	Campus 76.78%			Online 23.22%									
Fall 2018	123	139	262	0	54	54	0	40	40	0	11	11	
	262=71.39%			54=14.71%			51=13.90%						367
	Campus 71.39%			Online 28.61%									
Fall 2019	125	116	241	1	31	32	8	56	64	3	14	17	
	241=68.08%			32=9.04%			81=22.88%						354
	Campus 68.08%			Online 31.92%									
Fall 2020	59	69	128	49	68	117	21	70	91	7	14	21	
	128=35.86%			117=32.77%			112 = 31.37%						357
	Campus 35.86%			Online 64.14%									
Fall 2022	48	45	93	21	49	70	26	56	82	27	29	56	
	93=30.90%			70=23.25%			138=45.85%						301
	Campus 30.90%			Online 69.10%									

Note: LD= lower division; UD=upper division

Data shows that the percentages of local students registering online grew very much after the campus reopened, the reason for this being that the majority of students took jobs and the online instruction fits better their schedule. It is also to note that the registrations of non-local students, both in-state and out-of-state, grew very much in the later years, an indication of the fact that the flexibility of the course delivery attracts a broader student population.

Table 2 shows the total ET student count for academic years 2012 through 2022, FTE (full time equivalent). Data for campus and online is recorded, based on how students declare themselves, with lower and upper division recorded separately also. This decade set of data shows the same trend, of online group taking over as the larger one relative to the campus population. The data also shows larger numbers for the upper division, which in the engineering technology programs case means that a large portion of the student population joined the program by transferring from community colleges and began taking classes at the junior level.

Table 2: ET Student Headcount

FTE Term : Fall + Spring + Summer	College of Engineering , Engineering Technology										
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
On Campus	268.50	282.64	239.07	229.42	203.92	192.23	198.27	178.12	43.17	100.90	123.47
Off Campus	154.61	159.10	193.07	189.59	177.08	200.43	204.87	227.57	346.66	257.88	237.83
Total	423.11	441.74	432.14	419.01	381.00	392.67	403.14	405.69	389.82	358.78	361.30

FTE Term : Fall + Spring + Summer	College of Engineering , Engineering Technology, Face-to-Face										
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Lower Division	97.19	106.13	93.43	92.53	95.39	77.53	83.43	77.52	21.50	44.93	62.27
Upper Division	161.66	159.37	139.07	132.58	101.42	106.33	108.83	94.37	32.60	52.37	56.17
Total	258.85	265.51	232.50	225.12	196.82	183.86	192.27	171.89	54.10	97.30	118.43

FTE Term : Fall + Spring + Summer	College of Engineering , Engineering Technology, Online										
	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23
Lower Division	0.03	2.02	15.22	7.30	4.50	29.98	32.52	45.48	104.07	65.35	69.36
Upper Division	108.03	114.75	184.42	186.59	179.68	178.83	178.35	188.32	231.66	196.13	173.51
Total	108.07	116.77	199.64	193.89	184.18	208.81	210.87	233.80	335.72	261.48	242.87

Note: FTE= Full time equivalent

We find that the registration data are most relevant in showing the shift in the way students choose to attend classes, with more students transitioning from campus to online attendance. Records of retention and graduation data that separate campus and online students were not available at this time, but academic advisors assisting students with registration and throughout their academic process were noticing that graduation and retention are not affected by the campus or online status of the students. Graduation rate is mostly affected by the working status of the students, with those working either part or full time usually taking longer time to complete the degree, as they usually register for only a few courses per semester or they may take gap semesters. When it comes to students staying in the program or changing majors, advisors also noticed that this affects mostly freshman or sophomore students, who are still searching for their preferred career pathway. EET program has a large percentage of transfer students, as well as of returning students, and these groups rarely change majors as they have a better understanding of their career choice, or they have the maturity to stay on track to complete the degree choice they made.

Conclusions

This paper presents the history of nearly 40 years of distance learning (DL) delivery experience in an Electrical Engineering Technology program. The DL delivery was initiated primarily to serve the active military population. However, over time this modality grew to serve a larger population of DL students than campus students. The revolution in technology, including the access to broadband internet and video conferencing, makes online attendance to classes a preferred choice for students of all ages. As a result, it has become more feasible to work and attend school in parallel. Moreover, the access to education through online instruction makes the school more accessible to non-traditional students, with students in their 30s or even 40s returning to classes to complete degrees to advance their existing careers. With the overall number of prospective students decreasing in the short term, schools are competing for enrollments, and offering a variety of options and flexibility in instruction delivery may well become a significant factor in student recruitment and retention.

References

1. Nilles, J. M. (1976). *Telecommunications-transportation tradeoff: Options for tomorrow*. John Wiley & Sons, Inc.

2. Uzunboylu, H., & Karagozlu, D. (2015). Flipped classroom: A review of recent literature. *World Journal on Educational Technology*, *7*(2), 142-147.

3. Zainuddin, Z., & Halili, S. H. (2016). Flipped classroom research and trends from different fields of study. *International review of research in open and distributed learning*, *17*(3), 313-340.

4. Ayala, O., Popescu, O.& Jovanovic, V. (2017). Flipped Classroom as Blended Learning in a Fluid Mechanics Course in Engineering Technology. *Proceedings of the 2017 ASEE Annual Conference.*

5. Alammary, A., Sheard, J., & Carbone, A. (2014). Blended learning in higher education: Three different design approaches. *Australasian Journal of Educational Technology*, *30*(4).

6. Tayebinik, M., & Puteh, M. (2013). Blended Learning or E-learning?. *arXiv preprint arXiv:1306.4085*.

7. Graham, C. R. (2006). Blended learning systems. *The handbook of blended learning: Global perspectives, local designs*, *1*, 3-21.

8. Bilbeisi, K. M., & Minsky, B. (2014). Teaching online versus teaching hybrid and in-class. *International Journal for Innovation Education and Research*, *2*(9), 1-9.

9. Kurthen, H., & Smith, G. G. (2005). Hybrid Online face-to-face teaching. *International Journal of Learning*, *12*(5), 237-245.

10. Wang, Q., Huang, C., & Quek, C. L. (2018). Students' perspectives on the design and implementation of a blended synchronous learning environment. *Australasian Journal of Educational Technology*, *34*(1).

11. Szeto, E. (2014). A comparison of online/face-to-face students' and instructor's experiences: Examining blended synchronous learning effects. *Procedia-Social and Behavioral Sciences, 116,* 4250-4254. https://www.sciencedirect.com/science/article/pii/S1877042814009434

12. https://online.odu.edu/about-us/our-experience

13. Hackworth, J. & Jones, R. (2004). Assessment Methods for Comparison of On-Campus and Distance Learning Laboratory Courses in an Engineering Technology Program. *Proceedings of the 2004 ASEE Annual Conference.*

14. Jovanovic, V., Popescu, O., Ayala, O., Tomovic, M. & Verma, A. (2016). Embedding Online Based Learning Strategies into the Engineering Technology Curriculum. *Proceedings of the 2016 ASEE Annual Conference.*

15. Hsiung, S., Ritz, J. M., & Jones, R. (2010). Design and Evaluation of a Microcontroller Training System for Hands-on Distance and Campus-Based Classes. *Journal of Industrial Technology*, *26*(3).

16. Hsiung, S. C., & Deal III, W. F. (2013). Distance Learning: Teaching hands-on skills at a distance. *Technology and Engineering Teacher*, *72*(5), 36.

17. Hsiung, S. C., Ritz, J. M., Yaprak, E., & Jao, F. (2014). *Delivery of hands-on technical courses through real- time distance learning. Proceedings of the 2014 ASEE Annual Conference.*

18. I. Asimov, The Naked Sun, second edition, Bantham Books, Random House, Inc., New York, 2011.