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Hyflex for Successful Student Veteran Engineering Education: Say it Like You Mean It

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Abstract

There has been increased attention on producing engineers that are technically proficient while having many professional skills such as organization, time management, communication, and leadership. Across organization types, especially academia, veterans are admired by their peers for their professionalism and communication skills. Student veterans have trained and taken online classes in diverse and remote environments. They are accustomed to learning under ideal and less than ideal circumstances. The combined traits of increased professionalization, prior experience with online learning, and persistence position student veterans to perform as well or better than their traditional college-aged peers during the COVID-19 crisis. In a study of the effectiveness of Hyflex (Hybrid Flexible) learning conducted in the School of Engineering at The Citadel, forced-choice and free text survey responses showed that student veterans match with and differ from traditional college-aged students in important ways. Results from this study can be used to guide best practices in the Hyflex educational model, in order to better serve the student veteran demographic and all students. In particular, student veteran responses coalesce around a focus on effectiveness and time management concerns, as many have families and other external obligations. As a result, student veterans simultaneously want more Hyflex educational options going forward, however they want Hyflex implementation strategies to be refined and executed better in the future with more long-term planning.

Active duty and student veterans can serve vital roles in the engineering classroom, modeling appropriate communication strategies for traditional students as well as connecting their global knowledge with the course content, enriching all students' understanding. Faculty and traditional students can benefit from this unique demographic if they are aware of their skills and experiences. This paper presents some of the issues and concerns of active duty and veterans pursuing an engineering degree compared to their traditional student counterparts when institutions pivot to alternative instructional delivery, specifically Hyflex.

Background

In spring 2020, COVID rapidly transformed higher education practices which, for many institutions, resulted in the adoption of a Hyflex lecture model. Planning for fall 2020 began in April. With unknown COVID restrictions and rules for fall 2020, The Citadel pursued a means to allow for simultaneous teaching face-to-face, synchronous learning for those available, and asynchronous learning options for those quarantined or not available for the other two modes. Best practices and health professional opinions steered to mandatory mask-wearing on campus and social distancing as minimal requirements. Early considerations also included face shields and gloves.

During the summer of 2020, campus leadership made the decision to return to campus in the fall and maximize the face-to-face experience as much as possible. Limitations included classroom size which resulted in approximately half capacity due to social distancing requirements. Most large section classes (20 or more) were divided into two sub-sections. Each subsection then alternated from face-to-face and livestreaming synchronously through Zoom during the semester. For faculty who had accommodations, they taught purely online synchronously so they and students could simulate the actual student schedule as much as possible. Even though there was a learning curve for all, the new Hyflex teaching model generated new opportunities for faculty development and instructional evaluation. The Hyflex model allowed more students to experience a blend of receiving instruction in the traditional classroom setting of face-to-face (but wearing masks and socially distanced), and experience a livestream lesson where they could participate with the in person class via Zoom. For students in quarantine, the face-to-face instruction was not available on their assigned alternate days, so the livestream version was the only way to participate in class.

Of course there was some resistance to change and new technology for students and faculty alike. Instructors were not fully prepared for a rapid transition to remote instruction. By June 2020, leadership determined that training was needed prior to the fall 2020 semester for faculty and students regarding quality online / remote learning in case no face-to-face instruction was possible for the fall term. The Citadel required one module of instruction for all faculty and three additional modules for accommodated faculty teaching completely remotely during the fall semester. Additional training modules were developed as needs and skill gaps were identified. Department chairs were granted access to all of their department courses on the Learning Management System (LMS) to assist faculty [1].

The Citadel opted to employ a SWIVL [2] robot in each classroom. The SWIVL sits on a tripod or desk and follows the instructor automatically. It connects to a marker to record audio and track the instructor's movement and uses an iPad on the rotating base for recording/ streaming the video through a designated app. The SWIVL offers a universal response to the need of preparing for many delivery options within one integrated system. Classroom setup is easy for most instructors, and they have the ability to start/stop recording and upload recordings to their LMS for asynchronous students. Faculty can hear and see remote students during the class while also employing recorded instruction for those who missed class or for future remote/online offerings. This allows the instructor to use the traditional lecture format, transmitting information from one to many, while mitigating the 'disconnection' of the physical classroom, student, and teacher.

By mid-summer, The Citadel purchased enough SWIVLs for each classroom and an iPad for each faculty member. Some School of Engineering instructors piloted the SWIVL robot during summer courses. When faculty returned for the fall, the benefits of SWIVL were already known and evolving on campus. The SWIVL allows normal whiteboard presentation of content, questioning of students face-to-face or synchronously on Zoom, use of color markers on the boards, and verbal communication while wearing a mask. Perhaps the most overlooked requirement was the need to repeat student questions and answers to ensure the marker/

microphone around the instructor's neck captured the student dialogue. This mirrors the need to repeat as a best practice used in most large classroom settings to ensure everyone hears the question and answer, especially if the instructor is using a microphone.

Hyflex Instruction and SWIVL-based Lecture Capture

In Hyflex course design, students can choose to attend face-to-face, synchronous class sessions or complete course learning activities online without physically attending class. Hyflex instructional models were generally regarded in instructional research as a new standard that offered distinct advantages over traditional teacher-centered classrooms before their proliferation from the COVID pandemic [3]. Hyflex teaching requires extensive organization to facilitate before class, during class, and after class learning [3],[4]. This resulting arrangement allows for collaboration, multiple forms of communication, and high and low-stakes grading opportunities—all of which have been identified to be aligned with best teaching practices. Phased learning requires intensive organization and time from instructors, [3],[5]. In one study of Hyflex instruction, researchers regarded Hyflex as a "flipped, micro-Massive Open Online Course (MOOC) environment," highlighting the active participation of the students in speaking, writing, and listening [6]. In the same study, researchers acknowledged Hyflex teaching requires instructors to modify and tune course content for an online delivery environment and recommended more frequent student assessments to promote active engagement. In another study, Singh and Arya praised before-class learning as key to eventual content mastery. They identified the practice of providing students with pre-lecture material, slides, and videos 24 hours in advance as a meaningful predictive factor of successful student learning [5].

Employment of the SWIVL and Hyflex instruction prompted the following research questions:

1. Can the SWIVL and Hyflex instruction facilitate student learning during a pandemic? How effective are they for first time use?

2. Will active duty and veteran students be receptive to these rapid changes?

Active Duty and Veterans

The Citadel has a traditional student population of cadets who live on campus. The College is a well-known military friendly school and attracts a fair number of active duty and veteran students due to its proximity to several military installations. Faculty have noted and commented on the motivation, initiative, and abilities of these students compared to the traditional students. Active duty and student veterans typically enter college in age from 22-42 and possess maturity beyond the traditional 18-22 year old students. Some have completed courses online or acquired online educational experience as part of education and training courses obtained during military service. As a result, a fair number enter college classified as sophomores or even juniors and miss some of the orientations usually seen in freshman year.

Student veterans are a distinct demographic of older transfer students, and their reasons to major in engineering are very similar. Frequent observations include the following: the choice of institution is affected by proximity to a desired location, family considerations to include spouse employment, cost and reputation in engineering. Many start their engineering degree at a relatively inexpensive local technical or community college or immediately use their GI Bill benefit to attend a four-year school. Student veterans with families may need to balance their academic and family lives, causing them to make choices about attending full time, part-time, or with a reduced course load. Some may need to pursue employment or internship opportunities or graduate sooner and enter the workforce. Some may even be reservists with training or deployment obligations. Some student veterans attended college immediately after high school but left due to poor academic performance and joined the service [7]. Back in college, they are much more focused and academically successful.

Veteran students report the following transitional difficulties upon leaving the military [7]:

- Translating military skills into a new profession
- Switching focus away from their military experience
- Military skills do not transfer to college credits
- Difficulty using the GI Bill (late payment of benefits)
- Being an older student with differing interests
- Living off campus
- Alienation or isolation

For many student veterans who never attended college, the transitional difficulties cited above add to the academic rigor if they have had no exposure to higher education. The COVID pandemic could easily exacerbate these challenges for student veterans.

Survey Data from Traditional Students and Active Duty / Veteran Students

After employing the SWIVL and teaching in Hyflex modality, the authors wanted to measure its effectiveness and developed a survey instrument. In the survey, students identified their year and whether or not they were a veteran or active duty. The survey asked students to rate the effectiveness of different instructional delivery methods as a percentage from 0 to 125%, using face to face instruction (pre-COVID) as the baseline (100% effective). None of the students surveyed specified what ‘Other’ instructional delivery they experienced, and very few answered this question. Only five students used a percentage over 100%, and these five data points were across all the instructional modalities, so no single delivery method was biased with ratings over 100%. Active Duty and veterans did not quantify this mode. Additional survey questions focused on four areas concerning the SWIVL-Hyflex instruction: initial reflection, distractors, reducing distractions, and recording availability. A standard 5-point Likert scale was used to assess their level of disagreement (1) to agreement (5). Active duty and veteran (ADV) students tended to agree with the traditional students on the survey, but some of the differences are worth noting. Questions not discussed in this paper showed no difference between traditional students and

ADV and addressed their comfort level in class vs. livestream and whether or not they were in a class that was recorded. The sample size for this survey was 102 traditional students and 12 ADV students. These ADV students ages were 25-38 years old, with 11 males and 1 female representing all major service branches. All students surveyed provided a percentage for each mode, resulting in a rating from each student for each instructional modality. Each student's experience with the instructional modalities varied with some experiencing few lessons and some experiencing 20 or more lessons in the remaining spring 2020 and fall 2020 terms.

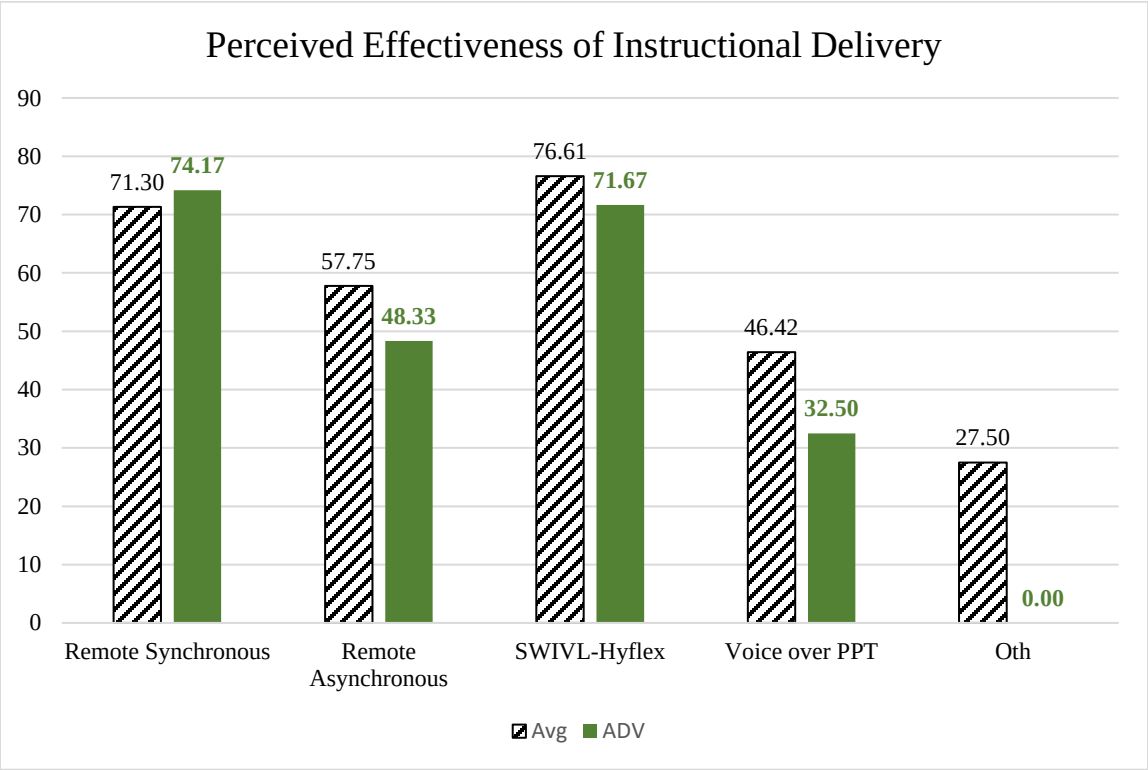

Figure 1: Perceived Effectiveness of Instructional Delivery

Figure 1 compares the traditional student average with the ADV average. In general, students found the SWIVL-Hyflex modality the most effective, about 5 points higher than Remote Synchronous. However, ADV assessed Remote Synchronous slightly more effective, approximately 2.5 points. A paired T-test was not conducted due to small sample sizes and the desire to continue this longitudinal study. These values are within the 5% error and may be inconclusive to determine a superior instructional modality. However, both of the asynchronous modes (remote and voice-over-PowerPoint) were considered to be noticeably inferior. During COVID, many of the ADV's shared in parental duties as local schools phased in face-to-face instruction. Many ADVs expressed frustration over switching from face to livestream every other lesson, i.e. face-to-face on Monday and Friday, livestream on Wed with the reverse scheduled for the following week. Many of the ADVs surveyed had significant college level coursework completed while they were in the military, and some of it was online. They were

mature, and self-directed learners and may have personal demands that made fully, remote synchronous more appealing.

In the first area of interest, instructor interaction, Figure 2 compares traditional to ADV students, specifically to capture their initial thoughts and reflections of the SWIVL-Hyflex instructional delivery. In the first question, ADVs were significantly higher than traditional students on their fall 2020 grade expectations (4.80 vs. 3.79). ADVs knew their class standing better than traditional students. It is also noteworthy that grades in fall 2020 were slightly higher than fall 2019 overall as students had fewer opportunities to travel and leave campus. However, traditional students still felt they should have had better final grades.

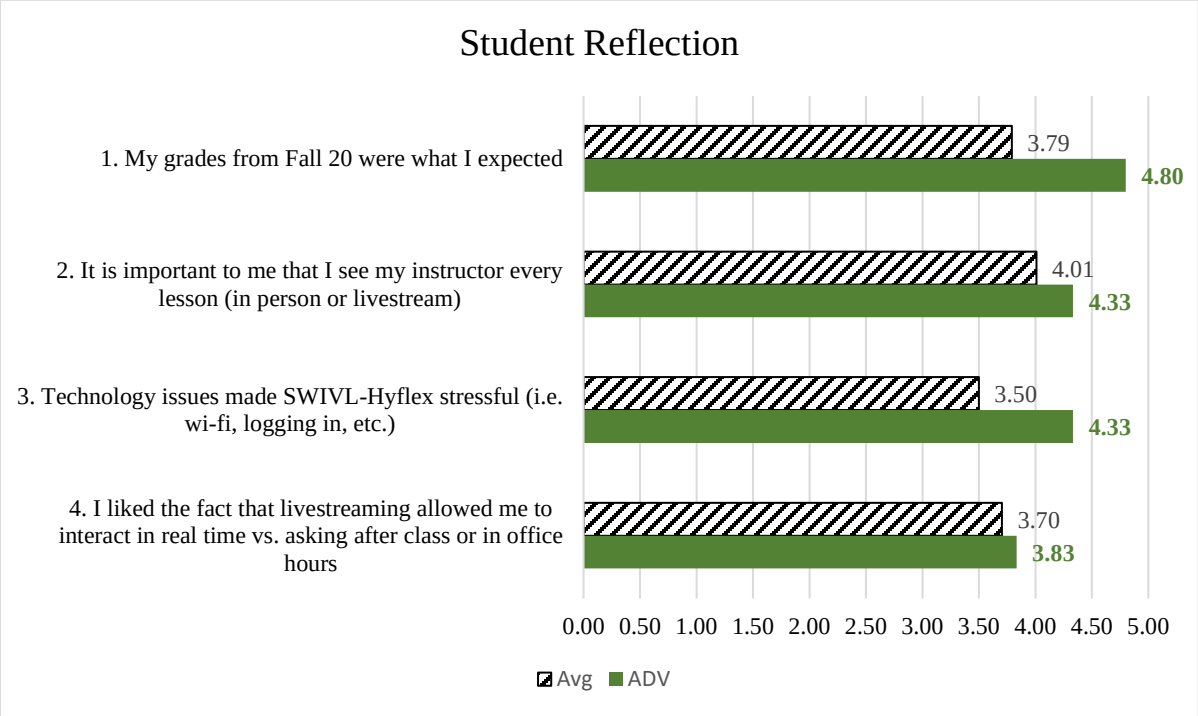

Figure 2: Student Reflection of Hyflex

Students were also asked how important it was to see their instructors every lesson and the ability to receive immediate answers to questions. It was important that they had the opportunity whether it be in person or livestream. Figure 2 shows that ADVs rated this topic higher (4.33 vs. 4.01). The last question in this category showed that ADVs and traditional students generally agreed (3.83 vs. 3.70) that they liked how livestreaming allowed them to ask questions and interact immediately, rather than seeking the instructor out of class. Question 3 showed a large difference between ADVs and traditional students (4.33 vs. 3.50) when it came to technology problems. Many ADVs livestreamed from home or on campus (if required) in empty classrooms or the library. Some had connectivity issues during livestreaming sessions. This is in contrast to the traditional students who were on campus with strong Wi-Fi, but even they had some

streaming difficulty because they often had email, social media sites, and music or videos playing while they livestreamed a synchronous class.

Figure 3 shows the nature of distractors when students livestreamed. In the category of distractions, both cohorts agreed (4.00 and 3.88) they were easily tempted during livestreaming sessions to do other things than focus on the lesson. Because students are required to keep their cameras on and instructors adjusted Zoom settings to not allow private chats, other students were not the cause of the distractions. Additionally, the institution directed all traditional students of proper places to livestream (dorm rooms, library, and empty classrooms) and unacceptable places (athletic team rooms, outside of a building). ADVs who had a class to livestream immediately before or after a face-to-face class used the commonly accepted places to livestream as many live 20+ minutes from campus. When sharing a common place to livestream with traditional students, they disagreed that the academic area was a better location than their home (2.17 vs. 3.06).

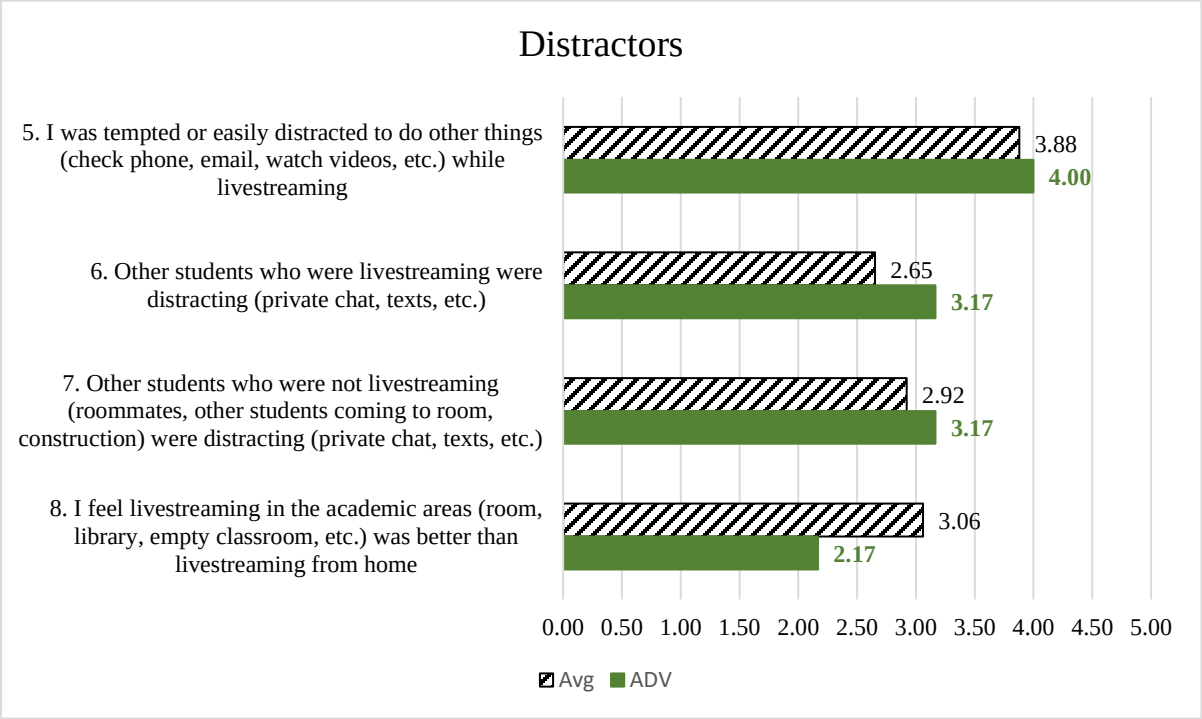

Figure 3: Sources of Distraction

Figure 4 shows how students assessed their ability to overcome the distractions at different times in the semester: the first few weeks, midterm, and end of term. Both ADVs and traditional students generally had the same assessment at these different times. They could overcome distractions and focus on the lesson while livestreaming with better progression as the semester passed. ADVs rated themselves as 3.67, 3.83, and 3.83 while traditional student ratings were 3.71, 3.80, and 3.83, respectively at these points. To meet the additional challenges of

livestreaming, both ADV and traditional students adjusted their class behavior. Both traditional students and ADVs were able to focus and avoid distractions equally.

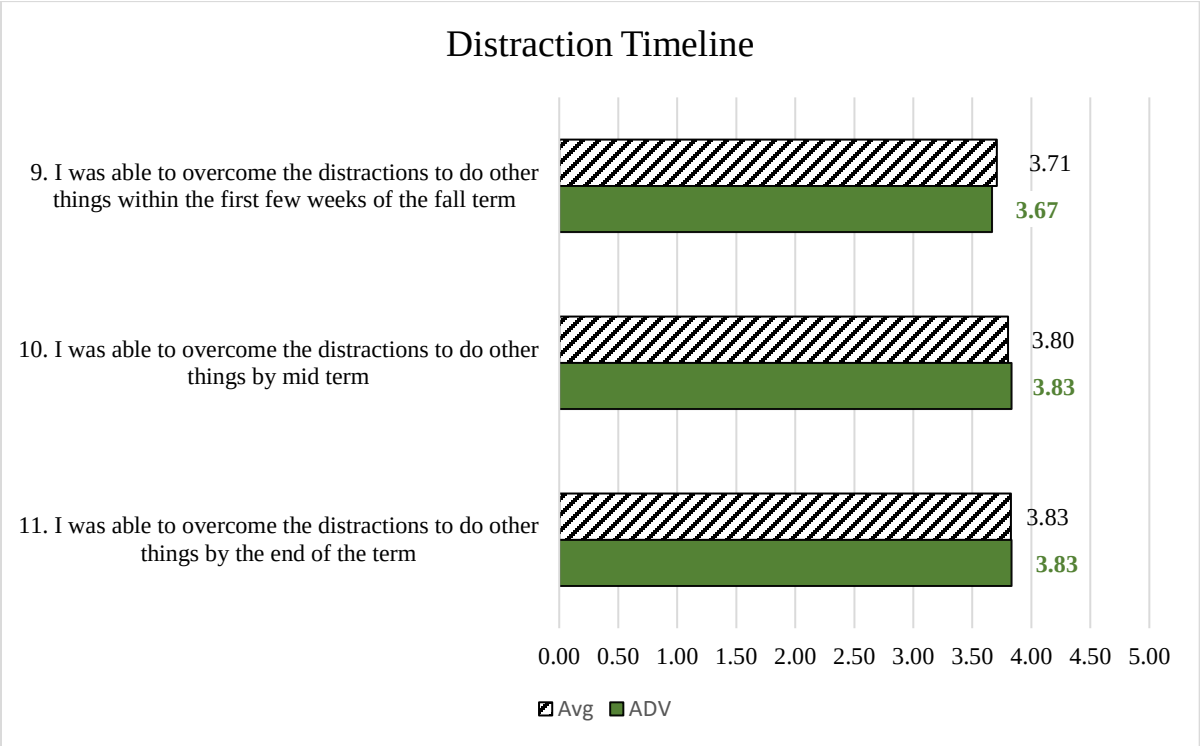

Figure 4: Ability to Overcome Distractions

Very few students, if any, did not have any Hyflex instruction in fall 2020. Students knew every lesson was being recorded when an instructor set up the SWIVL and iPad. At the beginning of each lesson, instructors started the SWIVL and iPad, even if the section was not split into alternating days of face-to-face and livestream. A missing student could indicate a late student or one in quarantine and being prepared for either outcome was necessary. Instructor notification of students in quarantine was not always timely, so most instructors erred on the side of caution. The integration of the SWIVL with the LMS allowed for recordings to be housed on the cloud. Instructors had the option of making these cloud recordings available if any student were absent. Some instructors used video editing software to remove extraneous material from the lesson and could easily post the edited video to the LMS. Once the SWIVL and iPad are started, recordings begin immediately and often capture instructors' hands as they finish the setup. In Figure 5, ADVs found the recordings less useful than the traditional students (3.67 vs. 4.17) if they missed a lesson or needed to see it again. ADVs were more critical of the quality of the recordings than the traditional students, finding the recordings difficult to read (4.50 vs. 3.76) but could still get useful enough information from them. The highest rating in the entire survey was that both ADVs and traditional students felt every instructor who records should allow students to view the recorded lesson (4.83 vs. 4.54, respectively). Student comments revealed that access to the recordings helped to reinforce the material, especially if they missed a lesson or did not

understand it during the live lesson. Students' comments indicated that requests for recordings was to watch the video when needed and was not driven by the desire to be passive learners.

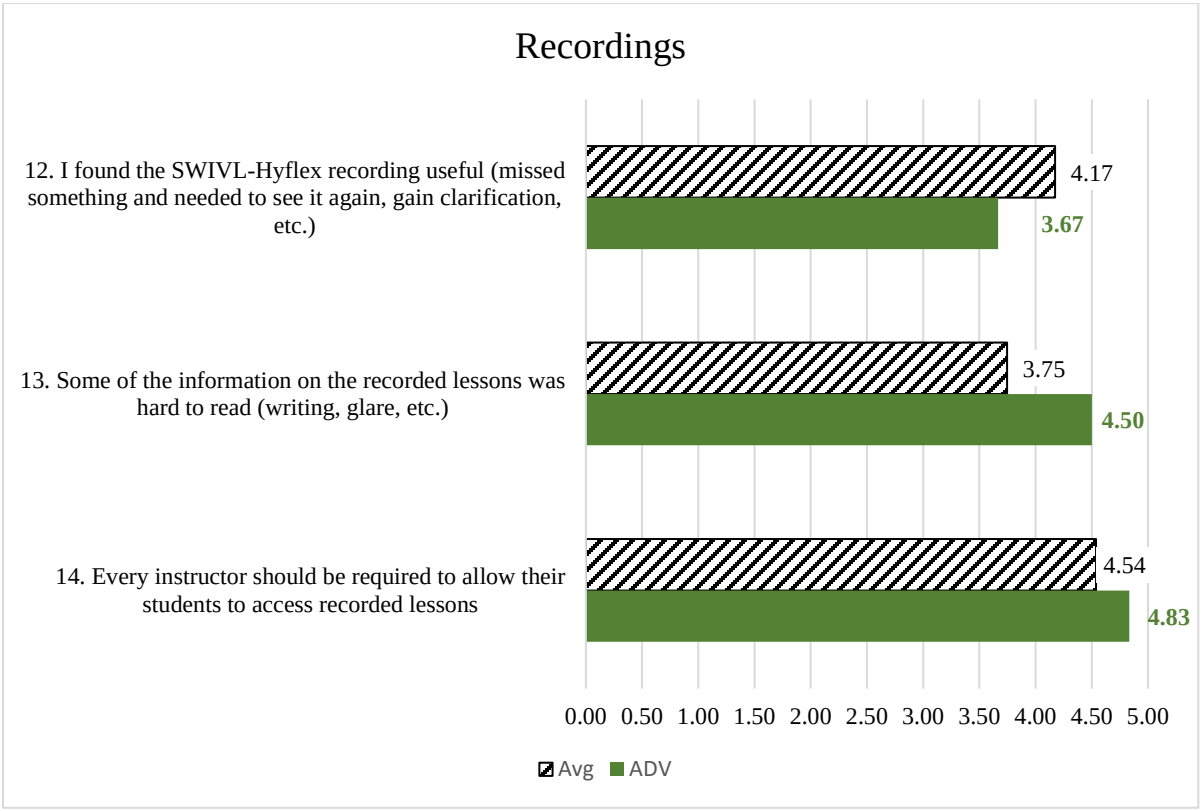

Figure 5: Availability of Recordings

These surveys show that both ADVs and traditional students value instructor interaction, the identification and reduction of distractors while livestreaming, and the value of recordings to review material again.

A thorough analysis of free text responses shows 47% of students surveyed enjoyed being able to select and control their learning environment during Hyflex-taught courses. Some positive feedback from ADVs include:

- It still allowed for some face-to-face communication.
- It is better than Powerpoints or pre-recorded lessons. Allows for safe learning.
- All the slides documents are available after class is over. Scheduling [is better] if missing lecture.
- Ability to rewatch lessons.

Approximately 30% of the surveyed students cited technical difficulties, audio lags, blurry visuals, and wifi issues as challenges. Other constructive feedback, specifically from ADVs include:

- Only two of my teachers posted lectures to canvas. Defeats one of the main purposes.
- Hard to read white boards and tech issues (sound and disconnects).
- Notes on board hard to read.
- It is distracting and difficult to hear students' questions.

Summary of Findings

Veteran and active-duty students bring persistence and mental toughness for academic work stemming from their goal-oriented work ethic in the military [8],[9]. In addition, their world experience provides a different and critically broad experience, which contrasts with the traditional student cohort who may not have traveled outside of the state. Further, veteran students have spent years working with diverse groups and have the skills and experiences to lead small teams.

The first research question considered if the SWIVL and Hyflex instruction facilitates student learning during a pandemic Although not perfect, the SWIVL and Hyflex instruction were positive factors for student learning during a pandemic. Student perceptions of this instructional delivery were very positive for both traditional and ADV students. Students were accepting of this delivery method and assessed it approximately 71-76% as effective as traditional face-to-face instruction, and significantly higher than any asynchronous modes. This is commendable considering the number of faculty who had little experience in remote instruction. However, it does require some faculty training and persistence. Research in Hyflex learning suggests that this persistence and resiliency is an important trait for delivering effective instruction during a pandemic [10] - [12].

The second research question concerned active duty and veteran students' reception to rapid changes in instructional delivery. The ADVs could work through distractions like any of the traditional students. Much of their frustration was the result of synchronizing their schedules to have days on campus and days off campus. They were comfortable learning remotely as long as they had interaction and access to the instructors. Many of the ADV students had taken correspondence courses or online courses while in the military, so they knew how to manage their time and be self-directed learners. ADVs were receptive to the changes in instructional delivery but Hyflex should be flexible enough to accommodate their schedules as their personal and family lives were impacted by the pandemic as well. Hyflex models were already being commended within pedagogical research as the new normal before the Covid pandemic. Hyflex approaches offer advantages to student learning and retention that are not present in traditional teacher-centered classrooms [3].

Conclusion

Developing a better understanding of the ADV students' motivations and concerns highlights a few issues of importance to the engineering education community as it transitioned to a variety of instructional delivery modes. Proper preparation at all levels from instructor up to institution facilitates learning in less than ideal conditions. Remote instruction can be difficult, especially for students and instructors who are experiencing it for the first time. Integrating technology and awareness of student needs (interaction, availability, distractions they may or may not control)

can improve Hyflex instruction. Though ADV students clearly saw value in Swivl-based instruction, some experienced streaming difficulty due to multiple messaging and media applications open at once while simultaneously attempting to livestream class. Streaming interruptions highlight both a need to limit access to other apps during class and the need to build capacity for greater access and higher connection speeds. Higher education may never be the same, and our students are aware of this with one responding to the survey with "I think e-learning will revolutionize classroom learning" and another noting "SWIVL is better than regular classes". COVID has provided opportunities to improve education, and instructors and institutions should employ these best practices when possible to improve our own collective resiliency. The ability to reach more students remotely represents an opportunity to grow engineering students, especially active duty and veterans, to meet the increasing demand of engineers.

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