

Comparing the Impacts of COVID-19 for Online and On-campus Students: A Case in Software Engineering

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ABSTRACT

Arizona State University offers a bachelor's degree in Software Engineering in both online and on-campus (ground) modalities. Online students in the program tend to be older with a mix of professional experience and prior academic work (usually community college courses), though during COVID we noticed an uptick in the number of traditional first-time incoming college students enrolling online. The program recently underwent its second cycle of ABET review, successfully earning accreditation for another 6-year cycle. The self-study for this review cycle occurred during the academic year 2020-21 when the University, like everyone, was utilizing various tools to continue its educational mission while conforming to health safety protocols. For on-campus students this meant a switch to online education for a period, then to mixed-mode (smaller in-person classes, synchronous broadcast via Zoom, alternating attendance days) delivery. For online students, there was no change in program delivery, as ASUOnline utilizes an asynchronous model using pre-recorded material with online forums, Slack, and Zoom. While all students, ground and online, encountered challenges that greatly affected learning, our analysis of outcomes data showed multiple outcomes were significantly impacted by COVID, and the impacts were heavily moderated by modality.

The software engineering program at ASU is relatively new (starting implementation Fall 2011), and includes an online variant (implemented starting in Fall 2013) that has grown rapidly since its inception. The program was the first software engineering program to earn ABET accreditation in both online and on-campus modalities (2015-2016), and recently underwent its second ABET review. The on-campus (ground) program has generally remained relatively flat in enrollment during the second cycle, with enrollment reaching 261 undergraduate students at the time of our ABET self-study report. The online program has encountered significant accelerated growth, almost doubling in size from 655 students to 1,233 in a four-year period. The programs are identical in terms program objectives and outcomes and also in terms of the course requirements; students in both programs share the exact same major map. The notable differences in delivery are that the online program courses run 7.5 weeks (versus a traditional 15-week semester for ground) and the delivery modality is asynchronous, meaning online students are given pre-recorded lectures, readings and resources that must be consumed in a regular cadence (weekly) but do not have a specific online class meeting time.

Table 1. ABET-1 and ABET-7 Student Program Outcomes

<i>ABET-1 An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics</i>
<i>ABET-7 An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.</i>

The Covid-19 pandemic hit early in the Spring 2020 semester. ASU's response to the pandemic was rapid and massive. For ground and online programs like software engineering, the response included synchronous modalities like Zoom, but also leveraged the assets pre-existing for the online program. Delivery to online students largely

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remained the same, with accommodations made for student hardship. Ground delivery was modified to allow for in-person delivery if students chose to attend (with social distancing and masking) with synchronous delivery on Zoom. Few students, if any, chose to attend in person, most all students attended online during Spring 2020. In the academic year 2020-2021 ASU operated under “hybrid” policies, where students attended class with social distancing every other class session, effectively partitioning classrooms in half for the twice-weekly class meetings. Liberal accommodations were allowed for students at high risk or requesting an at-home accommodation due to anxiety, home-care responsibilities, or other reasons.

The software engineering program conducted an ABET self-study and site visit during these two academic years. The ABET preparation team noted poor performance² in ABET-1 in academic year 2019-2020 (28% non-attainment, our threshold was no more than 25%) and further a somewhat significant delta between ground and online cohorts (.49 difference in weighted average). The difference was more significant with ABET-7 in 2020-2021, with a .82 weighted average difference as well as an overall low average for the ground cohort). Our hypothesis is that on-campus students were ill-prepared for the pandemic due to an inability to formulate new learning strategies and assimilate new knowledge outside the traditional classroom – in other words, the deficiency in ABET-7 accurately represented the ground student cohort.

The Undergraduate Assessment Committee assigned watch items on these two program outcomes, but in subsequent review cycles (yearly) the program outcome results returned to “normal”. The faculty hypothesize a COVID “blip” occurred, but has not seen sustained negative results. A cursory review of the computing and software engineering education literature did not yield studies where an ABET assessment process was used as the primary means to assess student progress during the intense COVID cycle. Our experience raises the following questions:

1. Are there studies in engineering education where ABET self-study assessment processes were utilized as a means to determine the impact of the pandemic on students?
2. Did engineering educators implement some alternative form of assessment because ABET assessment processes were inadequate? If so, what does this say about the value of ABET assessments?
3. Do computing and engineering educators see lasting effects of the pandemic? The literature suggests so, but what studies are tracking in terms of program outcomes?
4. For the growing number of engineering programs offered in both ground and online modalities, does an adverse event like the pandemic speak to assumptions about preparation of some types of outcomes, particularly those like ABET-7 that deal with the development of long-term personal leaning skills?

² We intend to present the full data if presenting at the ASEE PSW meeting