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Challenges and Opportunities during COVID: A Community College Perspective

In this Community College Corner, Christian Servin and Cara Tang team up to offer thoughts on the challenges, opportunities, and lessons learned (so far!) for computing education during the global Coronavirus pandemic. We offer thoughts from the perspective of faculty leaders at our respective community colleges in El Paso, Texas, and Portland, Oregon, both located in the United States of America.

The COVID-19 crisis has brought numerous collateral challenges for every individual in the world. In education this has imposed on students the need to assimilate both soft and technical skills into the new "classroom." For educators it has necessitated redesigning dissemination techniques of courses and learning techniques and tools that permit this process. For leadership/administrators, concerns involve accreditation as well as mission, objectives, and strategies in higher education.

For the first months of the crisis, the most palpable solution was the migration to online teaching. Although many institutions have offered online courses in computing for decades, for others this might be an abrupt change for students, faculty, and the institution's infrastructure. What solutions are adopted could change, literally, from one day to another. The so-called "new normal" comprises a set of interesting emerging teaching techniques, a massive form of collaboration, and of course an open exposure window of latent but ubiquitous challenges that educators have been facing for decades.

The init() into this New Phase

Community colleges have long been serving a broad and heterogeneous demographic of students: from early college high school students to returning/transfer students to retirees looking for a second career; from military and international students to working parents who would like to continue their studies. Community colleges assist primarily in the regional workforce and help extensively in the economic development of their city regions as well as facilitating transferability to major universities. Despite the expected drop in enrollment for the 2020-2021 academic year (projected at approximately 15%) [5], computing job positions still have high demand, and computing programs at community colleges are adapting to the COVID environment to continue meeting this need.

Portland Community College (PCC) [12] is the largest post-secondary institution in Oregon, serving nearly 73,000 students at four campuses in the Portland metropolitan area. When COVID-19 struck, PCC was in the last week of classes for the winter quarter. Instructors were encouraged, but not required, to hold final exams online. Starting with the spring quarter, PCC moved to 100% remote operations, with most programs remaining 100% remote through summer. A few programs (health-related programs requiring the use of on-campus equipment, such as Medical

Lab Technology) started offering limited on-campus meetings in the second half of the summer, and more programs were planned for limited on-campus instruction in the fall. However, these plans were cancelled when a couple students in the on-campus summer programs came down with COVID and cases started rising unexpectedly in the state. In August 2020 PCC made the announcement that it would operate 100% remote for the fall and winter terms (through March 2021) with no on-campus classes, and no in-person access to on-campus resources such as the library or computing labs.

El Paso Community College (EPCC) [8] offers more than 130 academic programs and more than 350 personal enrichment/continuing education courses, with current enrollment close to 29,000 students in academic, workforce training, and continuing education programs. EPCC serves the borderland community that is composed of El Paso, Texas, Ciudad Juarez, Mexico, and Las Cruces, New Mexico. On March 21, 2020, the U.S. Customs and Border Protection (CBP) agency announced a restriction on non-essential travelers across the U.S.-Canada-Mexico borders. El Paso counts many individuals who commute back and forth every day to their homes or jobs on both sides of the U.S.-Mexico border. This restriction brought a significant constraint with international students and instructors/staff who live in Ciudad Juarez, Mexico, and commute every day to the college. After spring break in March, the college migrated to online courses.

Community Colleges: Distinctive Challenges and Solutions

Community colleges provide workforce education as well as college transfer academic programs. Within the computing disciplines, an Information Technology (IT) program typically prepares students for the workforce and a Computer Science (CS) program typically prepares students for transfer, and these programs may have overlapping courses or content. In addition to degrees, community colleges offer a variety of certificates, ranging from entry-level to advanced, even covering content that may be found in the upper division at a four-year school. In the mission of serving the community, community colleges provide diverse modalities such as early morning, day, and night classes, weekend classes, mini semesters, and hybrid and online learning.

Many community colleges have a large non-resident population, and may not offer student housing at all, as in the case of PCC. Not having to deal with challenges of student housing on campus during COVID is one less issue PCC has had to deal with, but that may be offset by other challenges that result from the 100% commuter student body. Beyond the move to online/remote instruction, perhaps the biggest issue affecting both students and faculty during COVID at PCC is not having access to the resources on campus. Computing programs at PCC are supported by labs equipped with computers containing all the software needed in the various computing courses. In addition, student tutors staff the labs and help with questions from other students on some of the coursework. While many students have their own computers to work on, the loss of this on-campus resource has had a huge impact on those students who do not have their own computer, or do not have a computer with sufficient resources for the coursework (such as needing to run multiple VMs). This group of students, while not a majority of students, is a significant minority of students, and ironically, one of the key groups of students that community colleges are intended to serve as a lower-cost alternative to most four-year schools. The support from peers in the learning process, whether student tutors or fellow classmates, is also significantly reduced without the campus as a meeting place.

Outside of computing program resources, students also do not have access to other on-campus programs, such as the Panther Food Pantries on each campus where students can get free food. (Based on a survey, 60% of PCC students face food insecurity, and 10% are extremely food insecure.) PCC has struggled to offer students equivalent services in the environment of remote operations due to COVID. A few programs that have helped include mailing food gift cards to eligible students; education grant and loan programs that can be used to cover a variety of expenses from books to food to car repair; and laptop loaner programs. Nonetheless, some students have trouble concentrating on schoolwork in the current environment, and faculty face the corresponding challenge of engaging students.

El Paso Community College created a fund for students based on allocation from the US Department of Education and the economic stimulus Coronavirus Aid, Relief, and Economic Security (CARES) Act to assist students in covering college expenses. The fund varies by student, with a $750 limit, and intends to help students who have experienced financial hardship due to the disruption of campus operations in the wake of the COVID-19 pandemic.

EPCC has also been addressing equity challenges relevant to several aspects of teaching modes after March 13, 2020. One effort is online tutoring for all majors. In addition to the virtual peer-led team learning in computer science, different tutoring programs migrated to an online format

with extensive virtual hours that run from 6:00 a.m. – 1:00 a.m., Monday to Sunday to serve community college students. A particular challenge that emerged in the computer science courses was the need to keep consistency in rigor and competence in programming labs and the elaboration of strategies to maintain academic integrity. Nevertheless, the adaptation of well-known online learning platforms helped to reduce this challenge.

Furthermore, the continuous tech support to students taking CS 1 for the first time exacerbated this persistent challenge for faculty. Although the Academic Computing Services and the IT Department at EPCC provide computers to students and faculty who require them, many enrolled students have a different operating system, compiler, virtual machine, and other settings, creating a continuous tech support challenge for instruction. Also, nearby Fort Bliss, the largest installation of US Army Forces Command in the United States, is a community from which many EPCC students come. Military students stationed in El Paso represent a student population group that surged in computer science courses during these past semesters.

Online Learning extends Face to Face Challenges

The online component has been an option for a long time now at many different types of colleges and universities, allowing students with one or two jobs, families, or other responsibilities to have the opportunity to attend college. One of the prominent elements of community colleges is the distance learning departments that provide students flexibility on work schedules, days, and programs for training. For many years, these departments have provided the infrastructure and support for Learning Management Software (LMS) and offered professional development, including training and certifications for faculty. Colleges may require review of online course content and training for online faculty using Quality Matters, a quality assurance system for online courses [13].

In pre-pandemic times, many educators acquired skills and mastery of online teaching for popular courses, core curriculum courses, and other courses with content and teaching pedagogy that could be migrated online. Due to the recent required challenges, there is an emerging need for all courses to migrate to an online format. This is a challenge especially for STEM courses, including Career and Technical Educational (CTE) courses, which often have on-site equipment used in the learning process. For the months of the pandemic, all courses were forced to go online, which brought deep concerns additionally about certain aspects that were invisible but ubiquitous in a regular face-to-face classroom for both students and educators.

The CIS department at PCC had online versions of all courses except two: a hardware trouble-shooting course and a data communications course that involved working with physical cables and equipment. Moving to 100% online for the spring and summer, and now fall and winter as well, caused reevaluation of the in-person components of these courses, and the decision was made to develop online versions of both courses. As the workforce has moved to virtual machines for working with nearly all aspects of computing, the two courses at PCC are being updated to this model, allowing them to be offered online. At the same time, the in-person courses will be offered again when the campus reopens, with the now added bonus of working with physical equipment in the lab, and students will be able to choose their preferred modality.

During summer 2020, EPCC implemented a Safe Campus Taskforce charged with identifying solutions for establishing best practices for essential employees working on-site and for the CTE instruction. Most of the computing programs at EPCC migrated to an online format. There are selected courses that require a limited amount of face-to-face component requirements, particularly the ones that belong under the workforce education area. Faculty and administrators developed strategies to disseminate the skills needed in a hybrid mechanism. Similarly, the peer-led team learning program in computer science moved to virtual synchronous learning sessions using video conferencing tools, permitting complementary education available for CS students.

COVID Recess: An Opportunity for Curricular Updates

Most educators from both two- and four-year institutions changed their instruction, office hours, and other duties to a home virtual office after March 2020. This circumstance caused educators to reconsider how curriculum is delivered, how skills and dispositions are evaluated, and how competency is assessed in the new, fully online environment. This offers an opportunity to update curricula and align them with curricular guidelines such as those from ACM and other professional bodies. Of particular interest to community college educators are the curriculum guidelines produced by the ACM CCECC (Committee for Computing Education in Community Colleges), which consist of competencies for various computing disciplines. The most recent: Cybersecurity Curricular Guidance for Associate-Degree Programs [2], provides an outstanding number of competencies for cybersecurity programs. Also, the Computer Science Curricular Guidance for Associate-Degree Transfer Programs with Infused Cybersecurity [1], which is based on ACM's CS2013 curriculum guidelines provides an infusion with contemporary cybersecurity content. Finally, the Information Technology Competency Model of Core Learning Outcomes and Assessment for Associate-Degree Curriculum [3] and the most recent Information Technology Curricular Guidance for Transfer Programs [4], incorporate academic and industry competencies to define core IT learning outcomes and the accompanying assessment rubrics, which should be common to all associate-degree IT programs.

These curricular guidelines were designed to assist educators who are in the process of developing, modifying, or revamping programs in their home institutions. Since many educators are in the process of these changes, the CCECC guidance documents are a resource to incorporate and align learning outcomes and competencies to recognized guidelines. It is worth mentioning that these guidelines inherited and are based on workforce frameworks, recommendations from subject matter experts in both academe and industry, and align with accreditation and other national and international

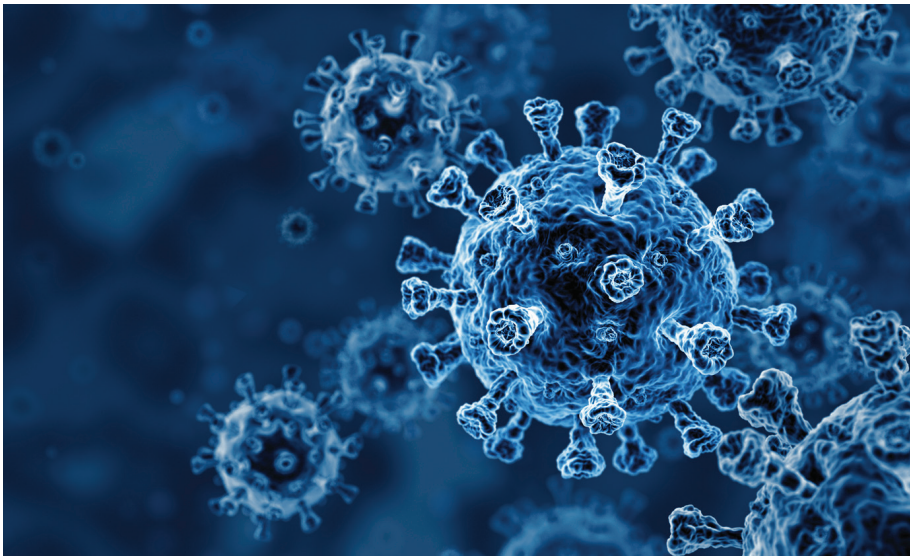
frameworks such as ABET and the NICE Cybersecurity Workforce Framework.

The migration from face to face to an online environment limits certain well-known traditional formative assessments and instruments that are used under a supervised environment. For some time, community colleges and junior colleges have recognized the highlighted opportunity to incorporate Competency-Based Education (CBE) into their programs [14]. Programs such as nursing and other health programs, CTE, and computing areas are migrating into CBE format to provide the opportunity to demonstrate mastery of academic and workforce requirements. These options provide flexibility on time and money to students in the process of completing their degrees. Having CBE programs in place opens the opportunity for educators to collaborate in pedagogical techniques and articulation agreements between institutions. Another opportunity incorporates Instructional Designers (ID) into CBE courses since ID has been working with Massive Open Online Courses (MOOCs) for decades and understand educational models and aspects that are critical to consider in the dissemination of material. In addition, instructional designers incorporate important as well as legal aspects into our teaching and coursework such as ADA (American Disabilities Act), trade-offs between summative and formative assessments, retention, and transferability.

Towards Hacking Old Challenges with new Perspectives()

Many of the challenges faced due to COVID are not new, but take on new urgency, characteristics, dimensions, and context. Likewise, solutions to challenges pre-COVID may have deficiencies in the new era, and new or different solutions may be needed. A few of these challenges are discussed here.

The Prominence of Professional Development. Even though some educators have been offering online courses for many years now, these educators sometimes lack proficiency in educational tools and dissemination mechanisms, including features in learning



management systems (LMS) and video conferencing tools. After spring break 2020, institutions became proactive in addressing these gaps in technology. The emergence of boot camps, distance learning institutes, webinars, and professional development on these topics became popular throughout the spring and summer. Faculty were inundated with emails touting offers of free resources and training. Education technology companies such as Codio and ZyBooks, Turing's Craft, and others provided free licensing to support computing educators across the globe cope with the learning curve of incorporating educational tools into their classrooms. Google and Zoom have provided an extensive set of products and tools that permit educators and students to manage education in a virtual manner, establishing collaboration and meetings between students and educators [9,16].

Specialized Courses Need Hands-on. Some courses require a face-to-face component to use specialized equipment or to evaluate skills and competencies. At EPCC, in spring 2020 (just before the COVID-19 crisis) 84% of the courses were offered in a face-to-face modality, 14.9% were online, and only 1% were hybrid. For fall 2020, most of courses were planned to be online; however, CTE, lab, clinical, and Continuing Education classes, including selected computing courses, e.g., courses for Cisco Academy, have a hybrid component. The CIS department at PCC serves a little over a thousand students each term, with about 30% of course sections typically offered on campus and 70% offered online. For fall 2020, 100% of CIS courses will be offered either online or "remote," with "remote" being the designation for courses that would normally be offered on campus. These remote courses may have a synchronous online meeting component with the same attendance requirement as courses offered on campus. This differs from online courses at PCC which are usually run asynchronously with at most an optional synchronous portion.

Special Education and Accessibility Requires Attention. Although colleges are moving forward to online teaching by using videos, conferencing technology, chats, and other tools, it does not mean these tools are adaptable to all students. Community colleges are known to provide resources for students with a wide variety of disabilities, including visual and hearing impediments, cognitive and learning issues, as well as others. Accommodations can include interpreters, note-takers, distraction-free environments, extra time, or other environments adapted according to their disability. During the transition to online teaching, many educators reflected and recognized elements in their course materials that did not follow a universal design theory. Although computing educators do not necessarily have a background in accessibility, all educational materials should support universal accessibility as much as possible when they are designed, implemented, and disseminated in courses.

In other words, the course materials must comply with American Disabilities Act (ADA) regulations of accessibility standards [6,15]. In addition to accessibility, many higher education institutions have special education courses and modalities that require face-to-face interaction. These may include any kind of therapy, such as physical, occupational, or speech therapy, and can be limited by technology.

Standards, Plagiarism and Academic Dishonesty. Although educational researchers found that students who took online classes were less likely to cheat as compared with the students who took face-to-face courses [10,11], keeping the academic integrity in a "virtual classroom" remains an open problem for online teaching. For computing courses, such as computer science/programming, there is enough available material online such as Wikipedia, blogs and forums, and of course YouTube, where most traditional course material can be found expeditiously. An LMS has mechanisms to permit blocking a browser or having a camera available when a student is taking a test for example, but these features can often be bypassed and further, they raise concerns among students of being stressed or uncomfortable. Considering these factors, educators can take this as an opportunity to redesign evaluation instruments, and perhaps transform most of the summative assessments to a more formative-based model that includes a competency-based or project-based approach. The main drawback of the latter approach is the massive increase in evaluating work for the educator.

A major challenge that community college educators are facing recently is the increase of course caps. This has increased the concerns of many educators to keep a standard on the quality material that is being offered versus the time to evaluate assessments according to an evaluation rubric. The majority of community college instructors do not have teaching assistants, and the entire responsibility falls under the instructor to satisfy not only the course requirements but to keep articulation agreements in place by following standards and alignments with major institutions. This combination of factors has raised equity concerns with educators who are facing this new normal in education. This is an opportunity for educators and administrators to work along with higher education authorities in the development of educational policy.

Conclusion

Experts in public health claim that it will be difficult to eradicate COVID-19, but with a combination of collaboration between health authorities and other entities we can move forward [7]. Similarly in education, we have challenges to face and overcome, but we can also see the opportunities to address many of the old and new issues of the current era, such as improving equity, establishing collaboration between different entities in education, and combining solutions that can impact our students positively. Despite the unfortunate events of the pandemic, there are positive emerging areas that can help to improve education.

We have learned that despite the majority of our students taking online classes, we have students who strongly prefer the face-to-face experience and benefit from courses held on campus with the computing resources, tutoring, and students with disabilities services available in on-campus labs. While community colleges are implementing appropriate safety guidelines including social distancing, maximum allowable group size, personal protective equipment (PPE), and other measures, there are still challenges in adaptability and in dissemination strategies to create remote versions for courses that require skills or competencies evaluation or equipment use and that have never been taught online before.

Finally, it is always a good opportunity to revisit partnerships and articulation agreements between two- and four-year institutions. We can use this situation to exercise our ability to identify equity gaps across education that affect access, affordability, quality, and success to our communities. ❖

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