INNOVATION

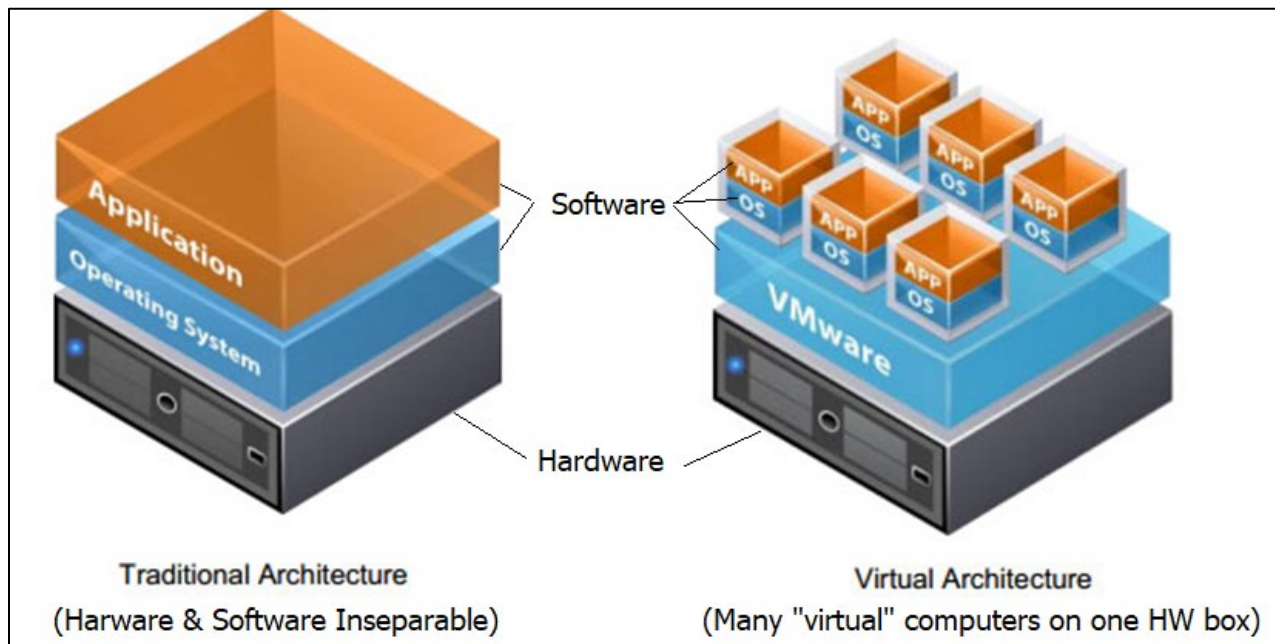## INCREASING REMOTE ACCESS TO TECH HEAVY CLASSES FOR ALL STUDENT POPULATIONS ON SIMPLE PERSONAL DEVICES

Figure 1: Difference between a traditional computer platform and a virtual computing platform.
Virtual computing can place many computers on a single hardware platform (Turner, 2014).

As technology has become a ubiquitous part of modern life, it has had a significant impact on course delivery in higher education. In almost every career, the understanding and application of technology represents an essential component of the educational experience, from learning how to navigate information to everything that is science, technology, engineering, arts, and mathematics (STEAM) (Rouhiainen, 2016). More recently, the

COVID-19 pandemic required institutions to pivot to 100 percent remote learning in a very short timeframe, creating even more issues around accessibility.

In this environment, one needs to have access to devices with high levels of power and capability to participate in the educational process. The personal expense incurred by students to attain this required accessibility too often serves as a barrier for underserved students. Therefore, advancements in the level of access must be urgently prioritized. A practical solution, which is beginning to penetrate the higher education field, is the use of virtualized computers. Commonly, a computer is assumed to be hardware that is inseparable from specific software, or operating system. On a virtual computer, the essential hardware and software are separable (see Figure 1).

Advanced technology classes, such as architecture, computer-aided modeling and design, graphics design, nursing, and others, require powerful computers with advanced graphics processing. Some examples of the required advanced computing and visualization include those shown below in Figure 2.

Currently, students can only access high performance computing (HPC) technology tools while they are on campus, as the hardware and software are expensive and too complex to install and maintain on students' personal devices. Even if a student's personal computer is sufficient, the instructor must typically help install the software, which is time consuming. In fact, some Computer Information Systems faculty have stopped teaching classes such as database design because they are spending more time helping to install the software on students' personal computers than teaching the course material. This reduces revenue potential and removes classes from course catalogs (Turner, 2019a).

Figure 2: Examples of applications requiring high-performance computing made accessible remotely via virtual desktop technology (Turner & Winn, 2017).

But what if students could take such classes remotely at home, at the library, or at a coffee shop on inexpensive devices such as a Chromebook, tablet, or smartphone, and never have to install or maintain the software? Virtualized computers allow this more convenient scenario by using a student's local device for its display, keyboard, and mouse, while all the heavy graphics and compute-intensive activity is done in the cloud or in the campus data center. In this scenario, underprivileged, single parent, and employed students who cannot get to campus have the same access to software and technology as students on campus and/or those who spend $2,500 on high-performance computers or laptops. Access to this

advanced computing power and a much broader range of educational experiences is possible and currently available at Schoolcraft College. Like Schoolcraft, other community colleges can increase the number of remote classes offered and improve the way they are delivered to make them completely accessible to most populations of students through local improvements to virtual computing (Turner, 2019a).

Distance learning is the fastest growing segment of business at Schoolcraft College. In fact, the number of distance learning classes increased forty-seven percent from fall 2016 through fall 2019 (Schoolcraft College, 2018; Schoolcraft College, 2019a). In addition, as of March 2020, driven by state mandated suspension of traditional face-to-face classes due to the COVID-19 threat, Schoolcraft transitioned over 1,100 course sections to online mode in only a few weeks. Given that remote learning via virtual desktop technology is relatively new in higher education, Schoolcraft's commitment to student facing virtual desktop technology since 2015 has enabled this type of course delivery method and provides Schoolcraft with a significant competitive advantage.

Improved Accessibility to Technology-Based Classes

The use of virtual computers, where the central processing unit (CPU), memory, and storage of the physical computer is no longer on personal devices, but rather in a campus data center or in the cloud, is currently standard at Schoolcraft. Students no longer need to own expensive hardware; they can access the college's powerful capability from anywhere Internet service is available. In order to deploy the high-powered equipment, a community college's student information system must have the ability to automatically identify in the classes in which a student is currently enrolled and to authorize access to the powerful virtual desktop depending on course requirements. This automated capability is not yet available to, or implemented at, higher education campuses at large, but has been prototyped by Schoolcraft IT—and it works. Moreover, this prototype can be brought into production on any virtual desktop-enabled campus and used to the advantage of all students who currently must come to campus for technology-intensive classes or to do homework. Therefore, for a relatively small incremental investment, after general deployment of virtual desktop technology, this option can be available to faculty who want to offer their class(es) to a much larger portion of the student population via an online format.

Virtual Desktop Technology: A Wise Strategic and Financial Choice

The implementation of virtual desktop technology aligns with strategic plans and trends at many community colleges, as they often include goals to increase student access to technology services. Virtual desktop computing can also create long-term financial advantages. First, the trend toward online and distance learning reduces the need for on-campus computer labs. Second, virtual computers take advantage of the available graphics and processors on typical personal devices. Third, virtual computers on campus enable students to transition to less expensive thin client devices, which replace personal computers (PCs), and virtual desktops are nearly 50-75 percent less expensive than the traditional desktop and laptop computers required for standard and HPC classes. Finally, and most significantly, is the impact of virtual desktop technology on access to all levels of educational hardware and software resources. It is not unusual for a typical mid-sized community college to support up to 1,000 separate applications required for a comprehensive course catalog and business infrastructure. It would be highly impractical to make all these apps as accessible to stakeholders (students, faculty, and staff) without virtual desktop technology. The sheer number of device types that can take advantage of this capability is growing at a rate that will make the virtual computing concept of any application, on any device, from anywhere, commonplace. In addition, providing virtual desktop technology on campus is the first step toward changing the course delivery paradigm for all student populations, with the biggest impact on underserved populations, and moving toward a more equitable, just, and accessible higher education environment.

Figure 3: Examples of personal computing platforms usable to remotely access any course via virtual desktop technology (Turner & Winn, 2017).

Improved Access to Tech-Intensive Classes Aligns With Future Demographic Needs

A recent report published by Southeast Michigan Counsel of Governments (SEMCOG, 2019)—*Future Skills: Preparing for the Changing World of Work*—made recommendations for preparing the workforce for jobs through 2045. The report confirms shrinking/aging workforce demographics into 2045 and confirms that workers must be better prepared to meet new tech job needs (Turner, 2019b). Figure 4 shows that knowledge-based tech jobs will be the largest growing major sector through 2045, while government will be flat and retail and manufacturing will decline (SEMCOG, 2019).
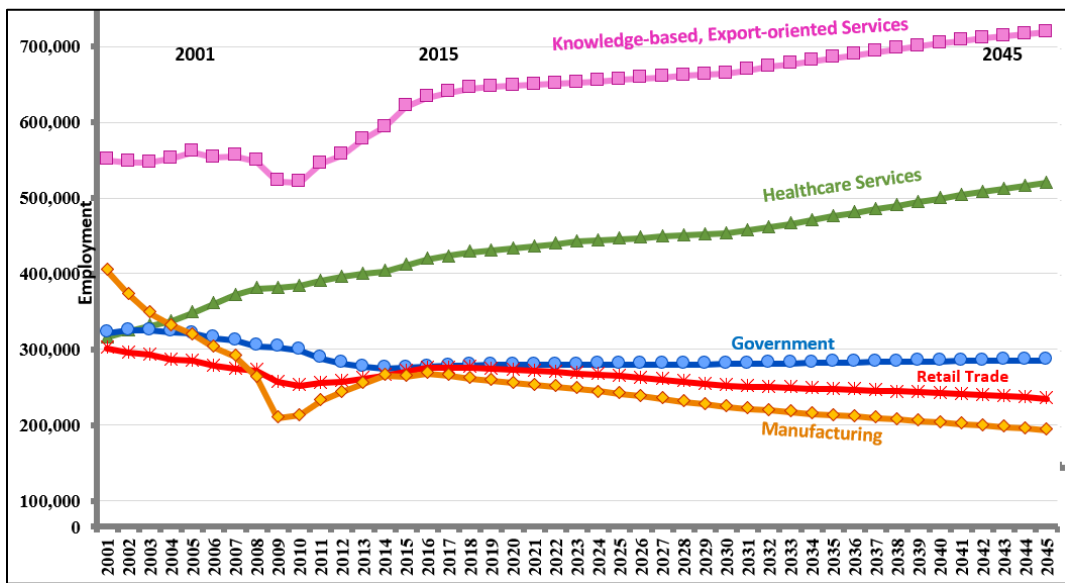

Figure 4: Southeastern Michigan employment trends by major sector (SEMCOG, 2019).

Schoolcraft Uniquely Qualified to Carry Out This Vision

Patrick Turner, Schoolcraft's Vice President and Chief Information Officer, originally presented the concept of remote access to campus computing to the Schoolcraft College

Board of Trustees in 2014; the board approved the implementation of the virtual computing hardware infrastructure that has been in place on campus since late 2015. The next step of the project was to provide remote access to virtual desktops. The remote access capability was prototyped in 2016 and proved viable. The concept that originated at Schoolcraft was commercialized in partnership with major virtualization and student information system vendors with Schoolcraft as the primary development partner for the commercialized product. Schoolcraft had utilized this capability in a proof of concept (POC) manner for over eighteen months and, subsequently, made this capability a reality, to the advantage of the college and its students. Turner describes this reality in an [interview](#) with Ellucian personnel at a recent conference (Ellucian, 2019).

Many course sections have been implemented using the current system with positive responses from faculty and students alike. In fact, additional students and faculty regularly ask when this methodology will be available for a wider range of courses at Schoolcraft. The improvements, which make technology intensive courses available remotely on common personal devices, increase IT system accessibility and reliability for all campus populations, especially those who are nontraditional and/or less mobile.

Remote Access Benefits All Students

The potential challenge for campuses transitioning from hardware PCs to virtual desktop technology, regardless of long-term cost savings, is the significant initial up-front investment. Schoolcraft spent ~$3.5M to virtualize 2,500 desktops in 2015. Recommendations for future work include providing the needed programming in an open source, free project, to make the methodology easy to implement for a broad range of higher education institutions.

Increasing remote access to tech heavy classes for all student populations on simple personal devices has the potential to accelerate one of the fastest growing segments of college business—online/distance learning. VMware's® motto, "any application, on any device, anywhere," (n.d.) can be a reality for college students with a minimal incremental institutional investment. Adopting the use of virtualized computers has the potential to improve competitive positioning, increase revenue opportunities, and revolutionize learning at any community college by enabling student learning through convenient and cost-saving technology access. Virtual technology brings the full capability of campus technology to students, wherever they may be, thereby making compute-intensive homework, projects, and communication feasible and affordable. In a time when a college degree is paramount to individual prosperity, access to modern technology is essential for student and institutional success. Increasing remote access to tech heavy classes across all student populations is a conduit, providing enhanced technology accessibility, mobility, affordability, and equity for all.

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Lead image: Difference between a traditional computer platform and a virtual computing platform. Virtual computing can place many computers on a single hardware platform (Turner, 2014).

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