

Publishable Essay Abstract – Increasing Remote Access to Tech Heavy Classes for All Student
Populations on Simple Personal Devices

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As technology becomes a ubiquitous part of modern life, it has developed into an issue of significant urgency when it comes to higher education. In almost every career, the understanding and application of technology represents a higher percentage of the educational experience including; from learning how to navigate information, to everything that is STEAM (Science, Technology, Engineering, Arts, and Math) (Rouhiainen, 2016). In this environment, one needs to have access to devices of higher levels of power and capability to participate in the educational process (i.e., high powered, often expensive, computers). The personal expense incurred by students to attain this required accessibility too often flies in the face of equity and justice for our underserved student communities. Therefore, advancements in the level of access must be urgently prioritized. A practical solution beginning to penetrate higher education is the concept of “virtualized” computers. Commonly, a *computer* is assumed to be hardware inseparable to specific software called an operating system. On a *virtual computer* the essential hardware and software parts are separable, like the user interface parts (monitor, keyboard and mouse) on one device while all the expensive and powerful processing parts are on another device, see Figure 1.

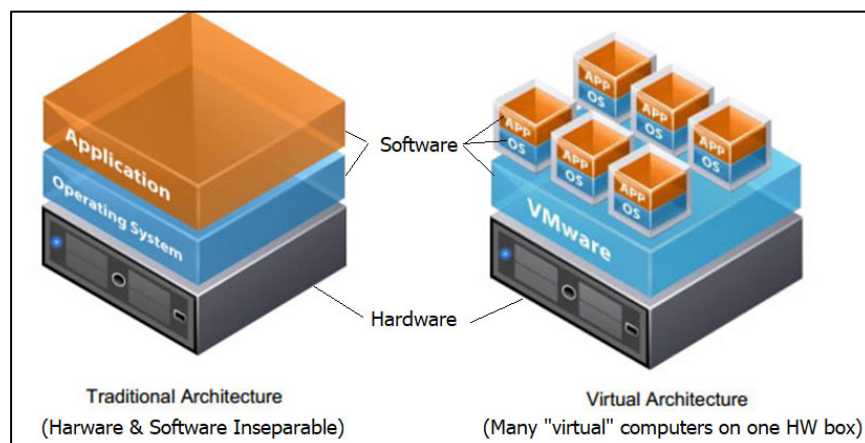


Figure 1: Difference between a traditional computer platform and a virtual computing platform. Virtual computing can place many *computers* on a single hardware platform.

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.



Figure 2: Examples of applications requiring HPC (High Performance Computing) made accessible remotely via virtual desktop technology (Turner, Winn, 2017).

Currently, students can only access HPC (High Performance Computing) technology tools while they are on-campus, as the hardware and software is expensive and too complex to install and maintain on student personal devices. Even if a student's personal computer is sufficient, the instructor is typically asked to help install the software. This can be time consuming for both instructor and student. In fact, some CIS (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 the actual teaching of course material. This reduces revenue potential and removes classes from the college's course catalog (Turner, 2019-2).

What if students could take such classes remotely at home, at the library, or a coffee shop on inexpensive devices such as a Chromebook, tablet, or even a smart phone and never have to install or maintain the software? Virtualized computers allow this more convenient scenario by using a student's local device only for display, keyboard, and a pointing device while all the heavy graphics and compute-intensive activity is done in the Cloud, or back in the campus data center. Therefore, the underprivileged student, the single parent at home, the working person who cannot get to campus, can have the same access to software and technology as students on-campus, or those who spend \$2,500 on a high-performance computer or laptop. Access to this advanced computing power and a much broader range of educational experiences is possible and currently available at campuses like Schoolcraft College. We 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, 2019-2).

As in many colleges, the Schoolcraft distance learning area is the fastest growing segment of business. In fact, the number of distance learning classes have increased forty-seven percent in the last four years. (Schoolcraft College Data Bites, 2019, September). Therefore, given that this capability is relatively new in higher education, this type of course delivery method would provide Schoolcraft, or any virtual-computing-enabled college, with a significant competitive advantage.

Proposed - Improved Accessibility to Technology Based Classes

The use of "virtual computers" where the CPU (Central Processing Unit), memory, and storage of the physical computer no longer exists on one's device, rather in a campus data center or in the Cloud, currently exists on the Schoolcraft campus. A student no longer needs to own all the expensive hardware, but can still access all the powerful capability from off campus anywhere internet is available. The new feature that is needed for a college to deploy the proposed capability

is the ability to automatically identify in which classes a student is currently enrolled. Namely, the SIS (Student Information System) that authorizes a student's access to classes, must also authorize access to the needed powerful virtual desktop. Knowing what classes each student is enrolled in assures the student has access to all this power only for the classes in which they are currently enrolled on a minute by minute basis. This automated capability is what is not yet available to, or implemented at, higher education campuses at large, but has been prototyped by Schoolcraft IT-- and it works! Moreover, the author shared the idea commercially and it was deployed as a feature of a larger commercial software system that is more than most students and colleges need, but is currently available. Alternatively, with a relatively small programming effort on any campus, the original simple prototype can be brought into production on any virtual-desktop-enabled campus, and used to the advantage of all students that currently must come on campus for these types of technology-intensive classes or to do homework. Therefore, for a relatively small investment, this capability can be available to any virtual desktop-enabled campus faculty wanting to take advantage of offering their class to a much larger portion of the student population.

Why Virtual Desktop Technology is a Wise Choice Strategically and Financially

This innovation aligns with strategic plans and trends at many higher education institutions, as many include goals to increase student access to technology services. The innovation of virtual desktop computing can also create long term financial advantages. Firstly, the trend toward online and distance learning causes a reduction in the need for on-campus computer labs. Secondly, this capability takes advantage of the increased available graphic and processor capability on typical personal devices. Thirdly, this capability enables the transition to less expensive "thin client devices" (Replaces a PC with a KVM – Keyboard, Video, Mouse device; i.e., no CPU, no storage, and no operating system) for virtual desktops being nearly 50-75% less expensive than traditional

desktop and laptop computers required for standard and HPC classes. This alone would justify the investment in the virtual desktop computing infrastructure due to the reduction in cost for three to five-year cyclical PC replacement that is a reality on all campuses. Finally, and most significantly, is the impact of virtual desktop technology on access to all levels of educational hardware and software educational resources. It is not unusual for a typical mid-sized community college to support up to 1000 separate applications required for a comprehensive course catalog and business infrastructure. It would be impossible to make all these apps as remotely 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.



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

Providing virtual desktop technology on campus is the first step toward completely changing the course delivery paradigm for all student populations. The reality of any class, on any

device, anywhere, can have the biggest impact on underserved populations, by moving toward a more equitable, just, and accessible higher education environment.

Improved Accessibility to Tech-intensive Classes Aligns with Future Demographic Needs.

A recent commissioned study by the South Eastern Michigan Counsel of Governments (SEMCOG) entitled *Future skills: Preparing for the changing world of work* conducted research and made recommendations regarding preparing the population for jobs through 2045. The report confirms shrinking/aging workforce demographics into 2045 (See Figure 4) (Turner, 2019-1).

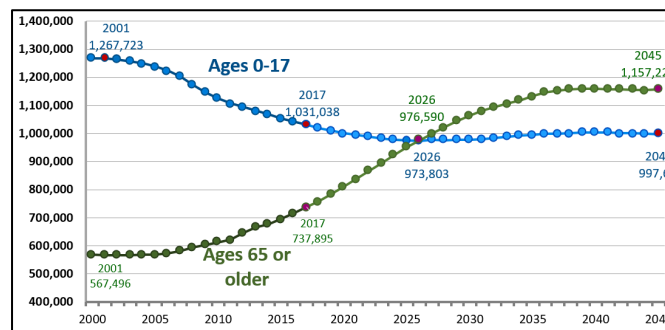


Figure 4: Children out-numbered by seniors in 2026. Diminished labor force (SEMCOG, 2019, p. 9).

Findings also confirm that workers must be better prepared to meet new tech job needs. Figure 5 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, p. 16).

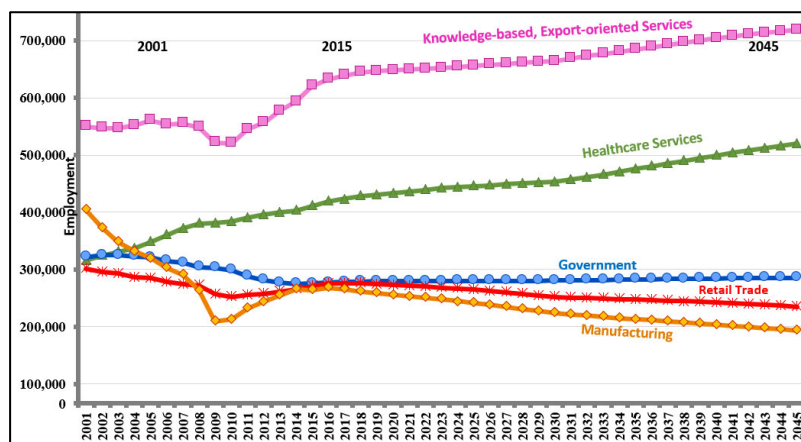
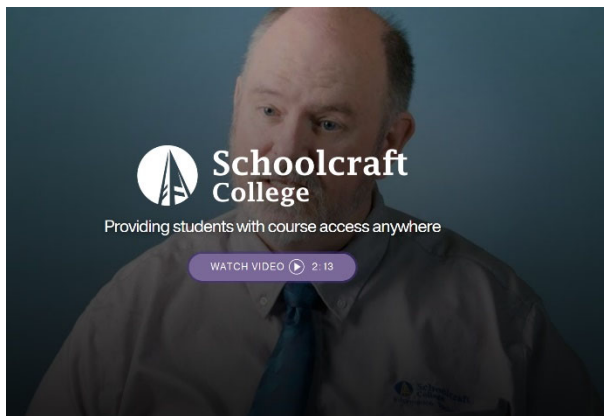


Figure 5: South Eastern Michigan – Employment trends by major sector (SEMCOG, 2019, p. 16).

Schoolcraft is uniquely qualified to carry out this vision

Patrick Turner, Schoolcraft's Vice President and Chief Information Officer, originally conceived and presented this remote access to campus computing to the Schoolcraft College Board of Trustees in 2014 who, in turn, approved the implementation of a virtual computing hardware infrastructure that has been in place and running on campus since late 2015. The next step of the proposed 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 with Schoolcraft as the primary development partner for the commercialized product. Schoolcraft has utilized this capability in a POC (Proof of Concept) manner for over eighteen months. Schoolcraft is absolutely and uniquely positioned to make this capability a reality, with high confidence, to the advantage of Schoolcraft, its students, and any college who can see the wisdom of investing in a virtual desktop campus infrastructure. Mr. Turner describes this reality in an [interview](#) with Ellucian personnel at a recent conference (Ellucian, Turner, 2019).

**Who, what, where, how, and when?**

Schoolcraft IT participated heavily in the development of the commercial product and is still managing the POC in production. Several course sections have been deployed using the current system with positive responses from faculty and students alike. In fact, additional students and faculty regularly inquire as to when this methodology will be implemented on a wider range of current course offerings at Schoolcraft. IT systems have been updated in preparation for a comprehensive deployment of this methodology and plans are to move forward with an anticipated start in Q2 or Q3 of 2020.

These improvements, making technology intensive courses available remotely on common personal devices, increase IT system accessibility and reliability for all campus populations. The proposed project continues this trend by making technically complex classes accessible to broader populations of students, especially less mobile and underserved students.

Conclusion

The potential challenge for campuses transitioning from hardware PCs to virtual desktop technology; regardless of long-term cost savings, is the significant up-front investment. Schoolcraft spent ~\$3.5M to virtualize 2500 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.

The proposed project of 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® classic motto of “Any Application, on Any Device, Anywhere” can be a reality to college students with a minimal institutional investment. Adopting the proposed strategy has the potential to improve any college's competitive positioning, increase revenue opportunities and revolutionize higher education learning by enabling the underserved student, as well as the traditional student, through convenient and cost-saving technology access. Virtual technology brings the full capability of campus technology within the convenience of the student's own home, thereby making compute-intensive homework, projects, and communication feasible and affordable. In a time when a higher education degree is paramount to individual prosperity, access to modern technology is essential for both student and campus success alike. Increasing remote access to tech heavy classes across

all student populations is a conduit, providing the student body with enhanced technology accessibility, mobility, affordability and equity for all.

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