Using Web Conferencing to Build a Persistent Virtual Campus Experience for Student Use

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Abstract: Growing online populations in higher education make it more important than ever for schools to create engaging online experiences for students. Synchronous interaction using web conferencing software is one approach to creating engagement, allowing students and instructors to communicate and collaborate in real time. The Eagle Stream project involved the systemic use of meeting software to create a persistent virtual campus experience for online students, allowing them to have a synchronous interactive college experience similar to that of traditional students on campus. Adobe Connect web conference software was used to create virtual analogues of four selected areas of Wake Tech's college during the 2017/18 school year in order to demonstrate how a persistent virtual campus experience might be integrated into a college. These four areas included campus clubs and activities, introductory online gateway courses, resource centers, and a developmental program for ESL students. Overall student attendance data, as well as several indirect measures of impact, suggest that students found value in these activities occurring in the persistent virtual campus.

The Emerging Need for Virtual Campuses

Student engagement is linked to positive student outcomes (Webber, Krylow, & Zhang, 2013). However, research suggests that online students are less engaged than traditional students (Myer, 2014; Fisher, 2010). As online enrollment grows in higher education, there is an increasing demand for strategic approaches to engaging online students (Seaman, Allen & Seaman, 2018). This demand is especially acute for community colleges and other institutions serving a disproportionate share of low-income and disadvantaged students (Jaggers, 2011). Most studies of online student engagement strategies focus on course design and pedagogy (Myer, 2014, Baxter, 2012). However, disengaged online students feel socially distant, not only from their instructors and from classmates, but from campus life (Fisher, 2010). One solution is to leverage web conferencing software, create opportunities for synchronous interaction among online students meeting remotely.

In the fall of 2016, Wake Technical Community College began using web conferencing software to provide interactive live streams of events occurring on its seven campuses to online and remote students. Unlike webcasting (Facebook, YouTube, etc.), web conferencing software allows for more flexibility in interaction among participants, providing a more collaborative synchronous experience. When used in conjunction with high quality external microphones and cameras, web conferencing software can "blend" online and remote students into live events occurring on campus, such as club meetings, lectures, and review sessions. Survey data from the fall semester showed that participants found these blended events to be both engaging and valuable (Roddenberry, 2017). Furthermore, the survey data showed that, for many of these students, virtual attendance was the only way they could participate.

Eagle Stream - A Virtual Campus Prototype

Based on the positive response from students and instructors, "Eagle Stream" was born in the fall of 2017. This service is an attempt to create a prototype of a virtual campus that could supplement a typical brick and mortar college to support their online population more effectively. This virtual campus provides online students access to blended and online interaction across all areas of the college thanks to the integrated, frequent and widespread use of web conferencing software. The first iteration of Eagle Stream demonstrates how a persistent virtual campus can support students with opportunities for interactive, synchronous access in four distinct areas of the school. These areas included opportunities ranged from providing volunteer extracurricular activities for college transfer students to serving as a mandatory platform for an online developmental program. These four areas, described below, represent on a small scale what a virtual campus might look like for institutions of higher learning, and what services it might offer.

Clubs and Activities

Research has shown a link between student participation in extracurricular activities and the development of leadership qualities (Ewing, Briggs, & Ricketts 2009), decision-making abilities (Rubin, Bommer, & Baldwin, 2002), and community values (Foreman & Retallick, 2016). However, it is often difficult for online and commuter students to participate in extracurricular activities (Jaggers, 2012). For this reason, Wake Tech's vibrant club and events schedule was the first area supported with a virtual campus. During the 2017/18 school year, students had more than 70 interactive club meetings, events, and seminars to participate in remotely. Table 1 contains a list showing the wide range of the clubs and extracurricular events provided.

Event Type	Description
Campus-wide Events and Programming	**National Endowment for the Humanities (NEH) speaker series** Grant-funded speaker series designed to educate faculty and students regarding the experience of military veterans and their families.
Student Success Workshops	**Individualized Learning Center (ILC) "After Dinner Workshop Series"** Interactive webinars facilitated by learning center staff members.
Fostering an Inclusive Campus	**The Michael Eure show** - Title III Student Success Coach Michael Eure interviews local minority achievers.
Transfer success	**Lunch with Liza** - Live Q&A with admissions counselors from local four-year colleges.
Campus Clubs	• Business Club • Social Science Club • Full Spectrum LGBTQ Association • Equity in STEM Club

Table 1: A list of extracurricular events supported by Eagle Stream during the 2017/18 school year

Gateway Online Courses

Although the research is equivocal, results generally suggest that online student outcomes are generally poorer in online courses than in seated courses (Jaggers & Xu, 2011), achievement gaps widen (Xu & Jaggers, 2013), and developmental students are particularly challenged (Jaggers & Xu, 2010). This deficiency is extremely important in introductory classes that serve as gateways for students, because failure essentially prevents any progress toward the student's academic goals.

The second virtual campus was a demonstration of how the instructor might use web conferencing software to support a typical online course. For this demonstration, a subset of Wake Tech's most popular online introductory courses, selected instructors teaching Introduction to Business and Introduction to Psychology

supported their online courses using web conferencing software. The regular use of web conferencing in these two gateway courses was part of a four-year project funded by the Department of Education to test the efficacy of a high-engagement model of online instruction to improve student performance in online gateway courses with high enrollment and low success. For project COMPASS (Constructing and Online Model to Promote At-risk Student Success), regular web conferencing was one of three "high tech" tools used by instructors to engage in a semi-intrusive "high-touch" teaching protocol. COMPASS instructors used web conferencing for regular lectures, review sessions, virtual office hours, and other academic activities directly related to the class.. Though not mandatory, students were encouraged to interact with their instructor using web conferencing.

Foreign Language and Fine Arts (FL/FA)

Like most other colleges, Wake Tech has a plethora of resource centers on campus designed to support student achievement. Research has generally supported the usefulness of these resource centers in positively affecting student outcomes (Cooper, 2010; Vick, Robles-Piña, Martirosyan, & Kite 2015). However, it is sometimes difficult for non-traditional students on commuter campuses to take advantage of these walk-in services. The foreign language department created a drop-in virtual tutoring lab to demonstrate how web conferencing could be used to create synchronous resource centers. One of the advantages of web conferencing for a virtual language lab was the ability of participants to stream their audio and video. Language instruction, more than any other class, relies on synchronous conversation and non-verbal cues. As a side note, most instructors in both the foreign language department and Fine Arts department adopted the use of web conferencing to hold office hours and exam reviews for their students.

High School Equivalency (HEP) Program

Finally, web conferencing to demonstrate how a virtual campus could include fully synchronous online classes, where web conferencing was an integral part of the instructional process. In this particular case, web conferencing was used to transition Wake Tech's HEP program from a seated satellite campus model to a fully synchronous online model. HEP is a national initiative, funded by the U.S. Department of Education to help migrant and seasonal farm workers obtain high school equivalency diplomas. Almost all of these students are Hispanic, and many do not speak English well, making this an especially challenging population to serve. Transportation is one major challenge for this sub population of students, making anything that decreases their need for transportation very valuable. Wake Tech's HEP program recently transitioned from a satellite campus model meeting students three times a week, to hybrid and fully online models supported by the use of web conferencing software. For this group, participation in regular synchronous meetings was a mandatory part of their program activities, with students attending weekly lectures and office hours.

College Area	Activity	Instructional	Mandatory
Clubs & Activities	Participatory activities for student interest provided with web conferencing	No	No
Gateway Courses	Online classes supported with web conferencing	Yes	No
FL/FA	Virtual resource center	Yes	No
HEP	Virtual resource center	Yes	No

Table 2: Areas of the virtual campus prototype during the 2017/18 school year

These four areas broadly represent collegiate activities that might be included in a virtual campus. Some of these areas involved instructional activities directed by teachers, while others were non-instructional. Some

were mandatory for the students involved, while others were voluntary. Table 2 includes a list of the four areas of the college integrated with the Eagle Stream virtual platform, describing their usage cases.

The Impact of a Virtual Campus

It is difficult to isolate and assess the impact of a campus initiative providing educational and non-educational activities to multiple student populations across a school like Wake Tech, which serves 20,000 students on seven different campuses. While there was no standardized evaluation to directly demonstrate the impact of web conferencing across the school during the 2017/2018 school year, there were several indirect indicators that build a case for the value of this virtual campus approach.

Overall Student participation

One measure was student participation across the four areas. Student participation was robust, with 1,734 students 5,546 visits to virtual campus activities during the school year. The number of visits divided by the number of unique visitors for each college area yielded a measure of user frequency (visits per user). As would be expected, there were differences in user frequency among the areas, most likely related to logistics, expectations, and types of activities. Table 3 shows the student usage patterns for the different college areas. The student attendance patterns across usage types suggests that students participated more frequently in virtual meetings directed toward instructional activities than non-instructional activities. Of course, the HEP program, a mandatory usage case, boasted the highest rate of use, while clubs and activities (non-instructional and not mandatory) saw the most sporadic use. These data suggest that online and remote students were able to adapt to the requirements for synchronous interaction placed on them in these different environments.

College Area	Unique Users	Visits	Visits per User	Use
Clubs & Activities	1,039	1,682	1.62	Support for extracurricular activities
Project COMPASS (Gateway Online Courses)	297	1,450	4.88	Integrated with asynchronous online class
Foreign Language and Fine Arts (FL/FA	269	893	3.32	Instructional support
High School Equivalency Program (HEP)	96	1,639	17.1	Used to deliver synchronous education

Table 3: Patterns of student participation in web conferencing activities across areas of the college

Club Attendees Perceptions

A primary objective of this study was to directly measure student perception of engagement because of improved technical capabilities. Survey data from the fall 2016 semester suggested that, while students found the events valuable, they often suffered from poor technical quality. These anonymous surveys were administered immediately after a club event or activity to ensure validity and increase response rate, which resulted in a substantial sample size from the spring 2018 semester. The most recent survey assessed, among other things, if these technical qualities had been addressed and affected student perception of engagement. Along with questions regarding technical quality, students evaluated how engaging and valuable they found the event. A total of 201 of the 881 spring 2018 club participants (23%) completed event surveys.

The relationship between the technical quality of the livestream and students perceptions of value were not straightforward. Students who rated their quality as “somewhat poor” still found it valuable and had a favorable opinion of the event, implying that the novelty of being able to watch and hear live events outweighed any technical issues. An ANOVA of audio quality and video quality vs how valuable the students

found a web conferencing event was not impacted by audio quality, $F(3,194) = 1.18$, $p=0.319$ but was impacted by quality $F(2,194) = 4.64$, $p=0.011$, highlighting the importance of the live video to mimic the engagement that was previously missing for these students.

An ANOVA showed a signficant relationship between students perceptions of how engaged they were by the event and how valuable they found the event to be, $F(2,188) = 31.70$, $p<0.0001$. In examining other factors that may have affected a student's perception of the value of an event, the reason for attending the web conferencing event was, surprisingly, not a factor, $F(8,188) = 1.26$, $p=0.269$, Students' level of engagement was not influenced by receiving credit or extra credit towards their course. Finally, a comparison was made to examine students who took classes primarily online versus seated. Students who were primarily online were much less likely to come to campus for future events, compared to those that took primarily seated or mixed formats ($p<0.001$). Students who took classes primarily online were also more likely to attend future live stream events ($p<0.05$).

Takeaways from the Survey

One of the reasons for focusing on improving audio and video quality was feedback from students in an earlier semseter, who were pleased with the video provided but often critiqued the audio as being too faint, broken, or choppy. This seemed to influence their overall ability to get the full benefits of the event. By focusing on improving the quality of both audio and video by using higher-end, portable equipment, the goal was to provide an engaging environment that were more closely aligned with the experiences that online students desired.

As the perceived level of engagement was a primary determinant of how valuable they found the event, the protocol can be modified when streaming events to focus on making it more engaging. For instance, there could be more effort to follow the speaker with the camera, making it seem more like a direct conversation with the speaker. Additionally, multiple camera angles might provide a 360 degree view of the event, making it more of an immersive experience.

Returning to the primary question of the technological factors that contribute most to the development of a virtual campus, our results indicate that audio quality plays a less signficant role compared to video quality. This could be interpreted in two ways. First, the audio quality may still need significant improvements, therefore affecting its contribution to the overall perception of the event. Second, even with improved audio quality, students may still find the live video to be more important, emphasizing the lack of engagement that was experienced by students who wanted to be on campus but were not physically able to do so. This also highlights the limitations of antiquated techniques of delivering information, such as audio-only recordings or still images, and the importance of bringing live video streams to increase feelings of engagement.

All of our results emphasize how valuable a resource this is for students who otherwise would not have been able to connect with their campus. In fact, the data highlight the genuine appeal and usefulness of this technology as enjoyment of an event was more likely to be internal, and not a secondary result of being required to attend or receiving anything in return for attending.

Impact on Perceptions of Presence in Online Gateway courses

In another indirect test, perceptions of students in the psychology and business gateway classes supported with regular web conferencing were compared with the perceptions of students in these gateway courses not supported by web conferencing. Students in these classes completed the Community of Inquiry (COI) survey, which measures three types of "presence" thought to exist in the optimum learning environment (Garrison, Anderson, Archer, 2001, Swan et al., 2008). As Table 4 shows, students in classes supported by web conferencing perceived significantly higher levels of teaching, social, and cognitive presence than students in classes not supported by web conferencing. Although providing web conferencing activities was only a part of the FITW protocol, the experimental design lends support for the value of web conferencing.

Outcome	Supported by Synchronous Interaction (n=461)		Comparison Group (n=178)		Estimated Effects		
	Adjusted Mean	SD	Adjusted Mean	SD	Adj Mean Difference	Effect Size	p-value
Teaching presence	4.59	0.7	4.32	0.85	0.27	0.27	0.0004
Social presence	4.19	0.76	3.94	0.83	0.25	0.28	0.0005
Cognitive presence	4.29	0.71	4.01	0.8	0.28	0.34	0.0005

Table 4: Comparing perceptions of presence between gateway courses with synchronous interaction and those without synchronous interaction (Adapted from Edmunds, Gicheva, Thrift, Bray & Hull, 2018)

No Negative Impact in the HEP program

As mentioned, lack of transportation is one of the main challenges to our institutions Hispanic, Spanish speaking, HEP program population, which would make the notion of adopting an all-online model seem attractive. However, student outcomes are not always as good for Hispanic students in online courses (Xu & Jaggers, 2013). Although there were several practical advantages associated with transitioning to an online program, program administrators were unsure whether this primarily non-English speaking population would be able to adapt to the new online model. The working hypothesis behind the use of synchronous meetings with full video and audio interactivity was that it would allow the Hispanic instructors to establish a strong multicultural presence in their online courses that aligned with their learners' needs, values, and communication styles. Such a culturally responsive *high-context* learning environment should support this population's success (Ibarra, 2000; Smith & Ayers, 2006; Yeboah & Smith, 2016).

Although a change in the state exams prevented the longitudinal comparison of student performance before and after the transition, retention rates for the history of the program were available for analysis. Student retention rate for the first online cohort (spring 2018) were compared with retention data compiled during the previous three cohorts (fall 2016, spring and fall 2017) of the latest program cycle. This very preliminary analysis suggested no drop in student perseverance for the first online cohort compared to the three previous cohorts, $X^2(1) = 2.23$, $p = .13$. Student retention rates for the three previous program reporting cycles, as well as the comparison groups in the current cycle, are presented in the figure below.

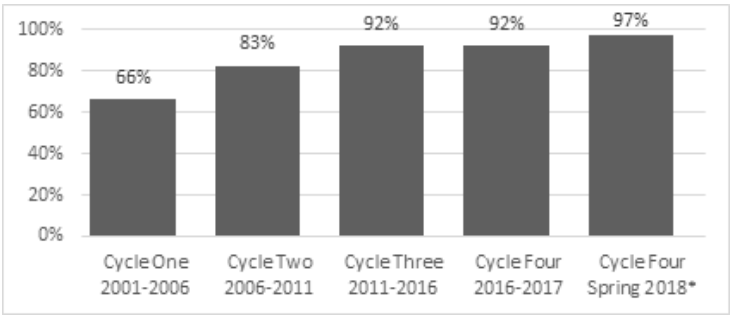

Figure: Retention rates for measured periods in the history of the HEP program (*online)

Discussion

During the 2017/18 school year, Wake Tech deployed and evaluated a virtual campus built using web conferencing software that integrates online and remote students into the the college more effectively. Web conferencing software was used to create opportunities for synchronous interaction in four different areas of the Wake Tech student experience. Indirect measurements around each of these areas suggests that students were sufficiently supported by regular synchronous interaction.

As always with any other technological innovations, there were challenges to overcome. Internet connectivity, device compatibility, and cost are issues that each adopter will face as they integrate the use of computer-mediated synchronous activity into their school's day-to-day schedule of activities. The first major challenge was managing connectivity to provide consistently high quality events. The majority of Wi-Fi is sufficient but not optimal for web conferencing, especially if there are too many users attempting to access the synchronous event. While video and audio settings can be adjusted, it results in a significant sacrifice of quality, which can defeat the purpose of offering the service. Using a direct high-speed Ethernet connection always improved live stream quality, allowing meetings to stream at a much higher audio and video setting, and to handle more simultaneous users.

Cost considerations are also important for those schools looking to create their own virtual campuses.. For students, there are no specific minimum requirements for its use other than having a device (computer or mobile phone) with an internet condition. Equipment needs can vary widely, but at a minimum requires a device, a camera, and a microphone, as well as web conferencing software. Blended events, where live and remote students interact together, require a laptop, an external microphone, and an external camera. Because web conferencing uses common computer equipment found in most college classrooms, it is even possible to set up a live stream with only an external camera and microphone in many situations. To increase the consistency of quality for these blended events, the Eagle Stream committee purchased three mobile kits, each containing all of the equipment necessary for a high quality remote broadcast. Appendix A contains a list of all the items needed to equip a mobile kit, as well as a cost estimate for each item

Finally, there are also potential costs associated with the choice of web conferencing software adopted by the school. While there are no costs for the end user (student), the meeting host (instructor) and their institution will have to purchase an annual subscription for the product. These subscriptions vary in price depending on the product and number of users. Wake Tech adopted Adobe Connect as its meeting software due to its utility, though several similar products are available at many price points, including free.

Education is continuing to shift toward distance learning and eLearning, and it will be important in the future to deliberate on the systematic use of web conferencing and other synchronous interaction. While there are many examples of institutions and programs that use synchronous interactivity, these schools usually specialize in online education, or are brick and mortar colleges that offer individual programs with synchronous components. The time has come for all institutions to leverage the systemic use of mediated synchronous interaction to support and engage their online students across all areas of their campus community.

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Appendix
Mobile Web Conferencing Kit
Suggested Itemized List
(Spring 2018)

Item	Price	Reason	Notes
laptop	$600	Web Conferencing control center	Needs at least two USB ports or a USB splitter
keyboard	$125	Ability to type without using screen keyboard	
Blue yeti microphone	$150	Picking up audio of multiple speakers	Can be difficult with speakers who move
Wireless microphone	$75	Audio for a single speaker	You will not be able to hear questions in the classroom with this mic
camera	$125	Video capture	Do not use the camera's microphone
tripod	$50	Camera setup	Allows for optimal setup of camera
Power strip	$12		Never live stream on your computer's battery
tape	$10		Tape down all cords to avoid trip hazards
Ethernet adapter	$24	Connect to ethernet port for hard connection	Always use a hard case if possible
backpack	$70		
USB splitter	$30		For use with laptops that do not have more than one USB