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Assessment of Delivery Technology in Distance Learning Environment: A Case Study of Selected High Schools in the United States

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Abstract: *This article is an excerpt from a previous research. The study was a qualitative case study and the purpose was to explore various technologies of delivery and their reliability in distance learning environment. To preserve anonymity of the cases and participants involved in the study, all names were changed to pseudonyms. The schools are identified as follows: Private School A (PSA), Private School B (PSB) and Online Public School (OPS). The study findings can inform systems where quality education is needed to better prepare under-served school populations for higher education and for further contribution to the development and prosperity of that nation.*

1. INTRODUCTION

Education plays a significant role in shaping a nation, and the proliferation of Internet-based educational opportunities has expanded distance learning modalities to all parts of the globe (Nsiah, 2011). The purpose of this research was to study distance education programs in the U.S. as potential models for other systems. In view of this, how the studied cases used technology to provide education was of interest. Reports of the technologies employed by the studied cases in their program delivery provided examples of strategies, successes, and failures.

According to Cavanaugh (2003), even given the best plan, program, instructors, materials, and students, distance learning does not occur without the technology for delivery. The evolution of technology has fueled a similar evolution in the practice of distance education. Evans et al. (2007) noted that online delivery has become a widely-used method in distance education due to its rapid delivery and response time. Modern distance technologies can take advantage of real time lectures, asynchronous discussions, and the inclusion of a variety of media including course management and conferencing tools such as WebCT (Web Course Tools), Blackboard, NetMeeting, Centra, Elluminate Live and Moodle. Each of these technologies is designed to extend the reach of the traditional classroom to those who, for a variety of reasons, do not have access to brick-and-mortar classroom opportunities. The following interview questions provided the basis for data collection for this study:

- IQ 1: What media of delivery do you use and why were they selected?
- IQ 2: How did you find expertise for developing, directing, and delivering your program?
- IQ 3: How reliable is your delivery technology?
- IQ 4: How do you resolve technical issues such as loss of Internet connection and loss of data at both the transmitting and receiving sites?

In line with the above questions, the following related categories of issues emerged:

Technologies of delivery and technology reliability. These categories, together with their related sub-issues, emerged as a result of building a logical chain of evidence through identification of patterns of uniformity in the interview questions that align with the research questions. Issue categories were therefore organized to coincide with the research questions, the foundational theoretical framework of the study, and the study's overall research purpose.

2. TECHNOLOGIES OF DELIVERY

As has been mentioned, distance learning, even with a well thought out plan, adequate program, qualified and trained instructors, supporting materials, and students requires delivery technology (Cavanaugh, 2003). Evolving technology encourages and makes more efficient the practice of distance education. Picciano (2002) believed that technology is becoming the tool of choice for communicating, accessing, and learning about our world. In view of this, technology should be integrated with any educational vision or plan.

All three schools leverage interactive technologies to reach students and to facilitate interactions between teachers and students. In spite of variations in each program's technology use and product selections, the goal remained consistent in the effort to bridge transactional distance and to maintain consistent communication between teachers, students, and content. Unlike the categories of issues that are discussed using participants' voices in their own words, this category does not require participant quotations.

2.1. Private School A (PSA)

PSA employed the use of advanced course management software and the latest in realtime interactive videoconferencing using Desire2Learn (D2L), an integrated learning management platform that facilitates the transmission of assignments, communications, and additional instructional methods. This user-centric service is accessible via a web browser available from the school's website and gives students, parents, and facilitators the ability to monitor student progress and to provide a level of functionality which might otherwise be logistically challenging.

In addition to this, PSA invested heavily in equipment and network infrastructure (IP videoconferencing via Lucent Polycom and a control bridge) to facilitate real-time interactive videoconferences. Such technology allowed the creation of a sense of community. This medium of instruction allows students to take charge of their learning experience under the guidance of a facilitator. Students start by logging in on their computers to receive their assignments for the day. Once they have the materials in hand, students organize the required tasks and begin working. Assignments include individual research, collaborative group projects, experiments, and reflective written work.

Interactive video sessions throughout the day placed the students in face-to-face learning environments with their teachers and fellow students who are at other PSA locations. E-mail, instant messaging, and course management software called Desire to Learn (D2L) kept students and teachers in frequent contact with each other. This allowed for real-time answers to questions, lively discussion on relevant issues, and a highly interactive learning environment. PSA worked to strengthen the bonds between students by complementing these media of delivery with face-to-face field trips twice each year. The purpose of these events was to emphasize service and the building of social relationships among students.

2.2. Private School B

PSB began their program focusing on two-way desktop audio-conferencing but then later upgraded to a two-way desktop video-conferencing feature called iLinc that delivered lessons via the Internet. Though teachers were isolated from the students, they could see each participating student on a screen. Additional features of the system included white boarding and social networking software called First Class. These allowed the students to chat, e-mail, and contact other students within the confines of a safe network. Assignments were submitted mainly through e-mail. In addition to the online socialization and interaction, PSB scheduled regional events quarterly and service events yearly. At these times, PSB brought students from the entire program together to socialize and do service learning. PSB also engaged students in service using Internet-based service learning projects, which included responding to people who had questions about PSB's belief system and sending e-cards to people who needed encouragement.

2.3. Online Public School

Like PSA and PSB, OPS offered asynchronous web-based courses, which require the use of computers with Internet connection. The entire program was web-based, but students received certain course materials like science or lab equipment via postal mail or shipment. Students used

e-mails, instant messaging, webinar, elluminate, phone, etc. for student-teacher and student-student interactions. OPS teachers worked from home on their computers. The OPS program encouraged socialization and service learning through several online clubs and events for students. OPS also had events around the state where teachers met with students for person to-person or face-to-face interactions.

All three schools leveraged interactive technologies to reach students and to facilitate interactions between teachers and students and socialization among students. PSA employed the use of advanced course management software and the latest in real-time interactive videoconferencing using Desire2Learn (D2L), which allows the creation of a sense of community. PSB began their program with a focused on two-way desktop audio-conferencing but later upgraded to two-way desktop video-conferencing that delivered lessons via the Internet. The system featured white boarding and social networking via software called First Class that provided students a safe network in which to chat, e-mail, and contact other students. Asynchronous web-based course offerings that require Internet connected computer use were part of their program as well. The OPS program encouraged socialization and service learning through several online clubs and events planned for students.

3. TECHNOLOGY RELIABILITY AND ISSUE RESOLUTION

As contemporary distance education delivery depends heavily on technology, the importance of reliability of a delivery technology is vital. Technology reliability is foundational to a successful program. Students may opt out of a program when technology is unreliable. Participants in all three case studies highlighted the importance of reliability of their technology of delivery; they also articulated the efforts being made to maintain this reliability.

When asked about the reliability of their delivery technology, Mathew, technical director at PSA, stated, ―*When it is configured properly, it is close to 100% reliable*. Ben, PSA program director, explained how far they have come in terms of reliability:

> *The reliability has increased amazingly well in the last three to five years. If you were to talk to Elizabeth at some length about transmission and reliability and all that kind of stuff, they had all sorts of challenges, and it just was not reliable, and sites got fed up with it and quit. Even today, as good as it is, there are still challenges on the far end. If they don't get the right setup--technology wise, they will get a poor signal. They will get poor reception from the program, or it's going to bounce in and out. But we have come so far in ten or twelve years on that issue. We don't even think about it anymore quite often. We just don't think about it. It's that reliable.*

Teresa, administrator/teacher at PSA, affirmed the above assertions and also emphasized the importance of backup measures.

> *Right now I would say it's very reliable and stable. Four or five years ago, it was not so much reliable. We were still making a lot of changes. Right now I would say very stable. Our major problem would be if there's a site located where a huge ice storm comes through, or they have a hurricane come through or something that takes down their Internet access. Even with that, we have backup systems in place for that. If they lose an Internet connection, we have an 800 number they can call in. If they lose the video, they can still call in and hear what's going on and participate in what's going on. They just can't see their picture while they're talking. We also do recorded sessions so in the main classroom where we have classes taking place, they're always recorded and students have ten days--we save them for up to ten days so students can go back and pull up the session and review the course if they miss the class.*

Jonathan, a PSB teacher, described the reliability of their delivery technology (desktop audio/videoconferencing):

> *The technology was very stable because it didn't matter how fast of an Internet connection you had, you were able to participate. Some of our students had dialup connections, and you know really how slow it is, but they were still able to participate. They just weren't able to see the video as smoothly as those with high speed Internet connection, but it was pretty reliable.*

Andrews, vice president at OPS, which offers an asynchronous distance education program, reflected on the reliability issue:

> *We have an entire IT department that keeps us running. We have a very traditional information technology department in the sense that we have dual sites—one server located in [one city] and the other in [another city within the state]. We've created our own management system on the front end called VSA—Virtual Student Administrator. It tracks all students' grades and gives them access. And then we actually use a learning management system from UCompass which is a program called Educator, which actually is a traditional LMS (Learning Management System) that our courses are actually located in. We do most of our maintenance at odd hours; you know 2:00 in the morning. So I think we've had a good reliability there.*

Samantha, e-soultion manager at OPS confirmed Andrews' statement, remarking,

> *It's pretty reliable. We have a big technology department that monitors the technology constantly. Beside that, we have two different serving sites. They're always undergoing maintenance. They're very up front about what's going on and when there are issues*
>
> *They let teachers know, everybody knows, and they make adjustments. It's a big deal when you have all those kids logging in, and all those teachers logging in. So they are really reliable. If we weren't reliable, then we wouldn't still be here because we all know how frustrating it is when you're working on the Internet and it doesn't work.*

All three sites expressed belief in the reliability of their delivery technology. PSA had backup systems, prerecord sessions, and ability to ensure property configuration of their technology. PSB students also received technical support when needed. OPS had a technology department for resolving technical issues as well as dual sites and servers. They also had their own management system, help desk, recovery center and do frequent maintenance for reliability. Another important thing in running distance education is management of technical issues. As noted, technical challenges can lead to frustration and lack of satisfaction with the online course. Technical complications can affect motivation, especially among low achieving students (Anderson & Kent, 2002; Lester, 2000; Roblyner & Marshall, 2002-2003). No matter how reliable the technology is, challenges are encountered at some point, according to the interviewees involved in this research. In view of this, knowing how technical issues are resolved was valuable. All cases involved in the study talked about how they handle technical challenges. Jerry, superintendent for PSA, explained:

> *We have a contract with the people that sold us the bridge, and they support any lost connections and so forth. It's a yearly service contract.* He further remarked*, —We also video stream every lecture. So if something happened, let's say one site's Internet connection goes down, they can go back and pick up that lecture because it is video streamed.*

Beyond what Jerry offered, Mathew, the technical director for PSA, gave further explanation about handling technical issues, including the pace at which an issue should be addressed:

> *Technical issues have to be addressed at the local level, and there has to be a protocol to address them efficiently because the user experience depends so heavily on the function of the equipment and the network. I would say 80%, 90%, 100% of the problems experienced at the local level are due to the network from the end user's Internet connection, and the configuration of their local router that serves that connection. So, if you have a problem with that local connection, the user will experience a problem that day and their classes that day. So you have to have a protocol to address any issues that come up immediately. If you don't, then really your users will languish in a world of being disconnected from the central hub of activity.*

On the other hand, Boris, initiator/director of the now defunct PSB program, also explained the handling of technical issues as follows:

> *We were able to resolve issues by preparing students for what to do in case the Internet did go out, just preparing plans in advance. It really wasn't a major issue. We also had technical*

> *contacts at each site that were responsible for keeping the technology running. Certainly as the Internet became more stable, it became much less of an issue.*

Jonathan, former instructor at PSB added, *―The kids would call and let us know that the Internet was down. When that happened, we worked with them and maybe we would postpone some of the assignments.* Such instructional inconveniences can be detrimental to the learning process if they recur, and so both proactive measures and efficient reactive strategies have to be in place. Andrews, vice president at OPS, explained their handling process:

> *All the duplicate systems that we have are keeping our data current and accurate. We do our backups and so forth. Let's imagine that the student has a problem. We have a help desk. We actually outsource our level-one help desk. But we take on the more challenging questions. We have a whole customer care center where students can call, or parents can call if they have a question of a technical nature. For instance, if ―I forgot my password‖ or something like that, we have a whole center that does that in our main office here as well. We do have also help for students if they need homework help, or tutoring. We have those offerings as well for students for free.*

Samantha, e-solution manager at OPS, talked about the ability to reset exams should any technical issue come up. She also described folders which enable students to save their work on the learning management system:

> *One of the ways we can handle this is having the ability to reset exams for students. Sometimes, some things will save. We also have student folders so students are able to save their work to the folders and on to the learning management system.*

All three sites had measures in place to resolve technical issues. PSA had a contract with their program vendor whom they contacted in the wake of any technical challenge. T hey recorded classes and had a toll free number which allows sites or students to phone in for technical support. They had a protocol to address issues immediately. PSB provided advance training for it students, and had proactive measures in place to handle technical matters. OPS had measures such as backing up files, tutoring students, and giving students the opportunity to reset exams in the wake of any technical problem. All three sites took resolution of technical issues seriously. Beside technological reliability, how instructors relate to this medium of instruction is of great interest as teacher-medium relations emerged as a category.

4. SUMMARY AND CONCLUSION

Regarding the discussion of technology delivery, distance education is impossible without technology for delivery (Cavanaugh, 2003). In other words, distance education is about technology since all three schools leveraged interactive technologies to reach students and to facilitate interactions between teachers and students. Private School A (PSA) employed advanced course management software and the latest in real-time interactive videoconferencing using Desire2Learn (D2L). This school also invested heavily in equipment and network infrastructure (IP videoconferencing via Lucent Polycom and a control bridge) to facilitate real-time interactive videoconferences. Private School B's (PSB) initial program used two-way desktop audio-conferencing. Later they upgraded to iLinc, a two-way desktop video-conferencing service that delivered lessons via the Internet. Online Public School (OPS) required a technological delivery system, too, but offered asynchronous web based courses that required only the use of computers with Internet connection.

These different media utilized by the various institutions to deliver education at a distance underscore the fact that distance education is not delivered through a single medium. Depending on financial capability, one may decide the type of medium to employ in offering distance education. Regarding technology reliability, all cases indicated that they took technology reliability seriously and had prevention and mitigation measures in place to deal with challenges when they occurred. PSA had backup systems, prerecorded sessions, and ensured proper configuration of their technology. PSB students also were provided technical support when needed. OPS had a technology department to resolve technical issues. They operated dual sites

and used two servers. They also maintained their own management system, help desk, and recovery center and did frequent maintenance for reliability.

Regarding technical issue resolution, PSA had a contract with their program vendor whom they contacted in the wake of any technical challenge. They prerecorded classes and had a toll free number that allowed sites or students to phone in for technical support. Their protocol allowed them to address issues immediately. In this area, PSB provided advance training for its students and had proactive measures in place to handle technical matters. OPS had measures such as backing up files, tutoring students, and giving students the opportunity to reset exams in the wake of any technical problem. The measures taken at all three sites showed how seriously they took technical issue resolution.

All three institutions indicated that all of these precautionary measures were in place to ensure reliability of their technology. Given the critical nature of such planning, it will be important for other systems to establish similar precautionary measures to handle technical issues.

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