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Mobile Learning Technologies:

Aligning Mission with Innovation

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Overview

Organizations are the ground on which innovations are scattered.
—Everett Rogers

In his book *Diffusion of Innovations*, Everett Rogers demonstrates that organizations are often the places in which innovations are adopted. Innovations are defined as ideas, practices, or objects that are perceived as new by those who adopt the innovation. Rogers notes that getting these innovations adopted, even when they have obvious advantages to those within the organization, is difficult. The diffusion process is one in which the innovation is communicated through various channels over a certain period of time among the members of the organization. This process is "a kind of social change defined as a process by which alteration occurs in the structure and function of a social system [organization]. When new ideas are invented, diffused, and adopted or rejected, leading to certain consequences, social change occurs." (Rogers, 2003, p. 6).

The purpose of this research bulletin is to document how a small university adopted Tegrity (http://www.tegrity.com/), a relatively new technological innovation designed to enhance student learning of course material through note-taking hardware and software. The bulletin describes the challenges associated with the adoption of Tegrity, as well as the social changes that resulted from the adoption process. It also discusses the implications for other social systems (institutions) considering the adoption of Tegrity.

Highlights of Mobile Learning Innovations

Within organizations, the innovation process tends to follow a clear pattern (Rogers, 2003). It begins with an *initiation* step, in which members of the organization gather information and conceptualize and plan for the adoption of an innovation. This process includes *agenda setting*, where general problems become apparent and result in a perceived need for innovation to take place. This agenda-setting process was very clear at St. Mary's University of Minnesota (SMU) as it explored the options that eventually led to the adoption of Tegrity as a part of its mobile learning initiative. Founded in 1912, SMU is a small, private, Catholic, comprehensive institution, administered by the De La Salle Christian Brothers since 1933. It enrolls about 5,400 students, of which roughly 1,250 are traditional undergraduates at the Winona campus and about 4,150 are adult learners in the School of Graduate and Professional Programs.

SMU is driven by a mission that, in part, "reflects in its practice an ardent zeal for excellence in teaching and learning, creatively responding to the intellectual, developmental, spiritual, and material needs of the members in its community in personal, practical, and innovative ways" (Saint Mary's University, n.d., para. 17). While the mission suggests that the need for innovation within the university is a constant, several factors came together to contribute to increased emphasis on innovation. Just a few months prior to the decision to adopt Tegrity, the university had hired a new president, completed a self-study for accreditation and a five-year strategic operational plan, and been given the charge to "think big" when it came to making recommendations

for future directions that the university could follow. Specifically, a subcommittee of a university-wide technology planning committee was formed to study mobile technology and to make recommendations for innovations that could be adopted by the university. The mobile technology subcommittee comprised members who represented the interests of faculty, staff, administration, and the information and instructional technology areas of the university.

Matching Innovations to Goals

With the perceived need for innovation clearly established, the university progressed to next stage of the innovation initiation process, which Rogers calls *matching*. At this stage, an institution begins to identify an innovation that will match an identified problem. The technology planning committee identified mobile technology as a specific problem to address. Recent trends at the university contributed to this emphasis on mobile technology:

- Faculty demanded mobile technology hardware and software.
- Technical support reported an increase in mobile technology use by the students.
- Information technology staff installed more mobile technology hardware across campus.
- The presence of mobile technology on campus was recognized as a competitive advantage that set the university apart from other universities.

What was still needed at this stage of the innovation process was a specific innovation that could address the mobile technology needs and at the same time address the mission of the organization and the need to "think big" as the university decided future directions.

The innovation process is not easy. The first challenge the mobile technology subcommittee faced was matching limited financial resources for technology with high expectations for student learning outcomes. The subcommittee recognized that any proposed innovation would have to meet several requirements:

- Be practical—it had to be financially feasible within a small operating budget.
- Fit into existing initiatives and programs at the university to ensure that the technology would be accepted and used widely by the various campus constituencies.
- Be standardized, mobile, dynamic, and easy to use.
- Have a proven record of demonstrating student learning outcomes.

Tegrity Campus

After investigating multiple technology options, the committee recommended a product called Tegrity Campus, which allows an instructor to capture the entire content of his or

her class, including any video that was used; the audiotape of the lecture and the student-teacher discussion; and the notes the students take on paper, on Tablet PCs, or on other digital media devices. This technology allows students to upload their notes to a computer and synchronize them to the instructor content. In this way, students can, at their convenience, recall the entire content of what they learned in class.

The literature in the area of note-taking and listening provides some powerful evidence about why students can benefit from this type of tool. For some time we have known that good note-taking skills have a positive impact on the student learning process (Di Vesta & Gray, 1972; Aiken, Thomas, & Shennum, 1975; Einstein, Morris, & Smith, 1985). It is important to point out that effective note-taking is a complex skill—it requires that students actively listen and be able to effectively synthesize what they are listening to into coherent and meaningful notes. However, Baker and Lambardi (1985) found that students miss as many as half of the critical points made in a given lecture. More recent research (Zimmerman & Martinez-Pons, 1990; Van Meter, Yokoi, & Pressley, 1994; Ruban, McCoach, McGuire, & Reis, 2003; Ruban & Reis, 2006) suggests that students need assistance in higher-order thinking skills such as synthesizing the ideas presented in class into meaningful notes, applying their notes to novel situations, and understanding rather than memorizing course content when they review notes. By capturing all of the course content in Tegrity, and by giving the students the opportunity to review the course content in its entirety, this innovation assists the student in honing his or her higher-order thinking skills.

Because Tegrity was a practical fit with existing initiatives and programs at SMU, was flexible and easy to use, and provided convincing evidence that it enhanced student learning, our recommendation to adopt Tegrity was approved, and we were provided funding to execute a one-semester pilot project using Tegrity.

The Pilot Study: Methods and Participants

Four faculty members participated in the pilot study. The faculty received three hours of training before the semester started. Staff members from Information and Instructional Technology conducted spot checks on the functioning of the system as well as follow-up training after classes were under way.

Forty-six undergraduate students participated in the pilot study. The students were enrolled in one of the following classes: Calculus II, Intermediate Accounting, or Botany and Zoology. One student was enrolled two of the pilot classes. Additionally, 26 graduate students from the Global Leadership and Management class in our MBA program were included in the study.

A variety of assessment measures were used to collect data from both faculty and students during the four-month pilot study to assess how Tegrity impacted the teaching methods of the faculty and the learning outcomes of the student participants.

Faculty Interviews

Twenty-eight informal faculty interviews were conducted to discover how this innovation was being used by the faculty. The dialogue between the faculty and the interviewers

primarily focused on the technical and pedagogical implications of Tegrity in the classroom. The interviews also provided an opportunity for the faculty to describe any concerns or technical problems that should be considered and addressed by the subcommittee and IT staff. The interviewers analyzed the notes taken after these sessions and synthesized the salient themes that emerged from these informal interviews.

Three themes emerged from the informal faculty interviews:

***Theme 1: Technical Issues*.** Faculty generally have about 3–5 minutes to set up their classes, but 10 minutes was needed to set up Tegrity. The technical setup and teardown of equipment was consistently viewed as problematic. Additionally, the faculty had concerns about the sheer number of cords they had to work around when using the system. The Tegrity setup consists of a VGA cable, USB video cable, a microphone audio cable, and the power cord for the Tablet PC.

***Theme 2: Pedagogical Issues*.** Overall, the faculty used Tegrity in innovative ways. They discovered how to make course content clearer to get the best outcomes. For example, they discovered how the digital ink function in Tegrity could be used to highlight components of what the professor was saying. Additionally, they discovered a good balance for course note annotations that the faculty would do and the annotations students should do. Faculty members also reported that they experimented with the different functions in Tegrity and saw the strengths and limitations of the technology in doing so.

***Theme 3: Reflective Processing*.** Tegrity allows faculty members to view their own class sessions. Two faculty members reported that they watched themselves and that this provided them an opportunity to reflect upon what they were doing during class. They noted that they learned more about their teaching methods, as well as what their students were learning. The other two faculty members reported that they did not review their content while the course was still in session for the semester. However, they did view many components of the course after the semester was over and reported having the same reflective experience as the other two instructors.

Faculty Testimony and Discussion

Members of the faculty who were involved with the pilot test gave a presentation to non-pilot-test faculty during the third month of the study. Faculty shared their findings and perspectives regarding the innovation's impact on student learning, provided information on the technical aspects of using Tegrity, and fielded questions about Tegrity from non-pilot faculty. Two faculty members involved in the pilot could not make it to the presentation, so their comments were captured and shared. One provided his comments through a Tegrity recording to give non-pilot faculty a clear understanding of how the system works. This entire presentation was recorded and shared with all the constituencies who were involved in the decision-making process to permanently adopt Tegrity.

Two themes emerged from the faculty testimony session. Recordings of this session allowed direct quotes from the faculty to be gathered to support the development of the themes:

***Theme 1: Improving Teaching*.** Faculty expressed the idea that Tegrity helped them become better teachers. The faculty reported that because it captures the entirety of the class content, Tegrity is a teaching tool that allows them to assess the content of their course, as well as the quality of instruction that they deliver. Faculty are able to go back and review this content to see the strengths and weaknesses of their class sessions. One professor noted that Tegrity allows a person to reflect on previous classes so that he or she can construct new, more purposeful class sessions, specifically because the instructor can understand the class from the students' perspectives. Additionally, Tegrity can be useful for developing exams. Faculty reported that they found it helpful to be able to go back and remind themselves what they covered in class and thus write a more accurate exam for the course content covered in class.

***Theme 2: Improving Student Participation*.** Faculty noted how Tegrity changed the students' participation in and responses to their courses. They reported that the majority of students enjoyed using the system. Specifically, students reported that they both discussed the content more and dug deeper into the content of their Tegrity classes than they did with other classes. Overall, students in the pilot classes performed better on their exams than students had in previous semesters. An advantage for both the students and the faculty was that Tegrity reduced the time spent in class to answer remedial questions. The professors could post the course content as soon as the class was over so that students could review the material on their own instead of dedicating class time to that process. As a result, professors covered more advanced material during class time, and this satisfied both the students and the professors.

Student Survey

A student survey was designed to understand how students were using Tegrity and what impact they felt Tegrity was having on their note-taking and learning outcomes. The survey included 10 questions of the Likert-scale, either/or, or open-ended variety. Forty-four students (61 percent) completed the survey. Twenty-four of the undergraduate students indicated that Tegrity helped them in the learning process. They noted that the technology especially helped them with their note-taking skills. Because Tegrity captures the class content in its entirety, students understood that they could focus "more on what the teacher said instead of trying to write everything down." Tegrity was especially helpful to those students who are slow writers or need to hear the content a few times before understanding the material fully. The students learned how to listen for key ideas as well as minute details, and then use their notes along with the Tegrity recordings to review more fully for their exams. As one student noted, "Sometimes things are better understood the second time through. This has proven true with the lectures recorded in Tegrity. I can better understand things if I re-watch them with my notes that are already taken." Another student described the use of Tegrity to enhance note-taking skills in this way:

> I would say I used Tegrity the most to clarify my notes. When I studied for my tests, I found it very helpful to refer back to my Tegrity notes on my computer to better understand what the teacher was talking about. I thought Tegrity was unbelievable at how it used video and audio from my classes to basically give me an at-home studying guide from my personal computer. If there was an overhead my teacher used, or a diagram he drew on the board that I didn't want to copy down in my notes, I would just refer back to it on my personal computer when studying for the test. If the teacher said something I didn't understand I would just "star" that area in my notes to remind myself that this is something I need to go over before the test (this kept me from worrying the rest of the class period about that one thing I couldn't understand). I accessed all my Tegrity notes from my laptop computer, so this gave me the ability to study my notes whether it be in the library, in a classroom, or at my house (I live off campus).

Another interesting finding from the student survey was evidence that the students were encouraging the diffusion of this innovation through their conversations with their friends. Of the 44 undergraduate survey participants, 33 talked about this technology with a friend during the pilot study. They reported that their conversations regarding the technology were both lively and engaged. The students were fascinated with the possibilities Tegrity could have for learning. One student said, "My friends were all excited about it and feel it should be applied to most of the classes—one friend tells me it should be used more with the undergraduates."

While the overwhelming response to Tegrity was positive, the students did note some concerns with the technical aspects of the system. The graduate class, in particular, experienced technical problems with the hardware and software, and this caused some concern among the students. Others did not have 24-hour access to Tegrity or admitted that they were not as engaged with the technology as they could have been. While SMU set up computers in public labs for students to use Tegrity, some students did not take advantage of what this tool could provide them. Others found the Tegrity pen too large or too permanent for the subjects' liking. Regardless of technical problems and limitations with this system, everyone saw how this type of technology could be potentially very positive for learning, if these issues could be addressed.

What It Means for Higher Education

Several lessons were learned from the Tegrity pilot project. These lessons align well with what Rogers expects to occur during the implementation stage of the diffusion process.

First, there was a clear *redefinition/restructuring* that took place with Tegrity. Rogers notes that during redefinition/restructuring, the innovation is modified and reinvented to fit the organization and that the organizational structure is altered in some way by the innovation. At SMU, the faculty discovered novel ways to use Tegrity, and the institution made many changes to accommodate Tegrity in its system. As the university moved into this stage, the faculty truly took ownership of how the innovation would continue to be

used to enhance student learning. This process came naturally to the faculty and IT staff because Tegrity strongly reinforced the university's learning-centered mission. Critical to the success of this project was an existing academic and IT culture that embraces innovation and accepts the restructuring that inevitably follows when innovations are adopted.

Second, the relationship between the institution and the innovation was defined more clearly—what Rogers would call *clarifying*. The clarifying stage began as the faculty and students were introduced to the technology. They had to first learn how to be proficient users of the hardware and software, so that the relationship between the technology and themselves would run smoothly. The clarifying process continued as they used Tegrity in their classes. They discovered the ways in which Tegrity could enhance student learning and complement the mission of SMU. The clarifying process continued even after the pilot courses were over. Through the surveys, interviews, and presentations, the students and faculty reflected on the ways in which Tegrity had become a part of the curriculum and how it had an effect on the learning experience.

Third, the innovation started to become an ongoing element in the institution's activities and lost its identity, meaning that the innovation was no longer seen as novel but became a part of everyone's routine (what Rogers calls *routinizing*). This process was further solidified when the university decided to permanently adopt the Tegrity system. The success of the pilot project is expected to continue, and this should ensure the routinizing stage continues.

Lessons for higher education can be learned from the results of this study, as well. One lesson is that the adoption, implementation, and use of *any* innovation should be driven by a clear plan for that innovation that is based on solid academic research. Technological innovations are rarely inexpensive, both in terms of purchase and support costs and of the time and effort required to run the technology effectively. Even though the innovation process went relatively smoothly at SMU, there were still debates about the usefulness and cost of Tegrity, whether it would be a technology that could enhance student learning, and whether it fit into the overall direction of where the institution was headed. Institutions that are considering the adoption of new technologies need to be prepared for such debates to take place and provide an outlet for all interested parties to have their concerns addressed.

A second lesson is that innovations have the potential for being the catalyst for novel ways of learning, the enhancement of teaching, and an increase in student learning. For instance, the Tegrity system brings a degree of objectivity to the curriculum-review process that SMU has never seen before. The tool allows faculty to accurately reflect on their teaching, modify their curriculum or teaching style in dynamic ways, and receive timely, constructive feedback. Additionally, it has the effect of lessening the emotional element to curriculum and teaching-style review that are typically seen in standard student evaluations on Web sites such as RateMyProfessors.com. Because Tegrity captures and preserves the course content in its entirety so that it can be reviewed, the professors have objective data from which to review their teaching and learning outcomes. In order for an innovation to reach this potential, however, Rogers points out

that the institution must have individuals who can support the innovation and overcome resistance to it (called champions), and there must be widespread participation in the process.

Key Questions to Ask

- What measures does our institution have in place to assess student learning?
- What investments has our institution made in improving instructional effectiveness, and what else should we be doing to improve it?
- In what ways have institution executives declared that innovations in support of student learning are priorities for our institution?
- What resources do we have in place to support faculty and students who are willing to pilot test innovation technologies?
- In what ways do our information technology leaders provide support for teaching and learning? Have they indicated that additional resources are needed to provide adequate support?

Where to Learn More

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