Resistance to Technological Change:
The Case of the Unused Calculators

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Introduction

Inez Figueroa sighed as she packed up the sophisticated TI-Nspire™ handheld calculators in her office. The calculators had come to symbolize Inez’s growing frustration with her colleagues and, more broadly, her new job as a mathematics instructor at the American School for the Deaf (ASD), a private high school that enrolled only deaf students. Figueroa’s passion was teaching mathematics using innovative learning technologies, and she had been hired by ASD to introduce new technologies that would help deaf students succeed in math and science courses. But her attempts to introduce new learning technologies had been met with disinterest and disdain. For instance, neither her colleagues nor her supervisor had adopted or endorsed the new calculators even though the devices represented a vast improvement over the graphing calculators traditionally used at ASD. Indeed, her supervisor even chided Figueroa for using the devices in her own mathematics classes, and eventually told her to stop using them. The widespread resistance to new learning technologies and lack of support had left Figueroa increasingly demoralized and questioning why she had been hired in the first place. Was she hired because she was a Latina (and thus valuable in regards to diversifying the teaching staff) rather than an innovative mathematics instructor? Or were there other factors that contributed to the lack of interest in using the TI-Nspire™? As Figueroa lifted the box of calculators and headed back to her office, she wondered “How can I overcome the faculty’s resistance to new learning technologies and should I even try?”

Inez Figueroa: A Passion for Learning Technologies

In 2006, Inez Figueroa worked for the local city school district as a certified math instructor. Her reputation for identifying and incorporating exciting, innovative learning technologies in the classroom was well established throughout the district. When the superintendent of her school district wanted to introduce the TI-Nspire™ calculators to its mathematics instructors, Figueroa was an obvious choice to plan and implement a demonstration of the device. When approached about offering a workshop to showcase the features and benefits of the TI-Nspire™ and the computer software that accompanied the product, Figueroa leapt at the chance (see Appendix). She planned and led a well-attended workshop on the calculators and software for math instructors throughout the city’s school district. Figueroa’s enthusiasm for the technology proved contagious, and both the workshop and the calculator were well received by the audience.
After the workshop, Figueroa was approached by a representative (rep) of Texas Instruments, the company that manufactured the TI-Nspire™. Impressed by her mastery of learning technology and enthusiasm for incorporating learning technologies in the classroom, the company rep offered Figueroa an opportunity: If Figueroa would submit a grant application stating her willingness to act as a product representative and hold similar workshops to educators in the area, Texas Instruments would provide her with 50 new TI-Nspire™ calculators and computer software free of charge. The company also agreed to provide her with advanced training on the use of the calculators and software, as well as planning and implementing demonstrations and workshops designed to display the device’s advanced features and classroom benefits. After Figueroa held her workshops and submitted 200 completed workshop evaluation forms to Texas Instruments (which provided proof that she had demonstrated the product to at least 200 educators), the calculators and software were hers to keep.

Figueroa eagerly submitted a grant application, confident that she could obtain the required number of evaluations easily. Her grant was accepted and the calculators and software arrived as promised. She regularly gave presentations and workshops on new learning technologies in her school district, and was increasingly asked to do so in other school districts. Figueroa was in the process of gathering evaluations when she learned of the job opportunity at ASD.

Teaching at the American School for the Deaf

In late 2007, Inez Figueroa applied for the job at the American School for the Deaf, a private high school that focused on preparing deaf students for mainstream, career-oriented collegiate education. Because many deaf students had not received adequate support in public schools, they were sometimes deficient in basic mathematics, science, and writing skills; ASD aimed to improve these skills so students could excel in college and university programs. The position seemed like an ideal fit for Figueroa and her interests: ASD’s job advertisement stated that the ideal applicant was an experienced mathematics instructor who could introduce and integrate new learning technologies in the classroom. Although the job required proficiency in American Sign Language (ASL) because many students could neither hear nor speak, the college was willing to provide one year of training in ASL at no cost to the successful applicant. Figueroa applied for the job and was delighted to be selected. Upon starting the job, Figueroa was told that the hiring committee liked the fact that she integrated innovative learning technologies into the classroom, and that her expertise in this area was a deciding factor in their hiring decision.

Figueroa could hardly wait to begin introducing new technologies that would help deaf students excel in the classroom, and the TI-Nspire™ seemed to offer an ideal start. Unlike traditional graphing calculators that displayed only functions and the numbers entered by a student, the TI-Nspire™ allowed instructors and students to download and upload files directly from a personal computer; this allowed everyone in the class to share and collectively work with mathematics problems, graphs, tables, words, text, equations, functions and numbers. This capability allowed the calculator to work like a small, hand-held computer. The instructor could prepare files containing mathematics problems on a laptop or desktop computer, download them to the TI-Nspire™, and bring them to class for students to solve individually or collectively. For example, Figueroa could develop a geometry model on her laptop computer and download the model to
the calculators, so students could actually manipulate the model themselves rather than simply watching the instructor demonstrate manipulations while explaining them to the class. In statistics courses, Figueroa entered a database and graphs into the calculators, which allowed students to work statistics problems and modify graphs and tables. Students could also upload data from the TI-Nspire™ to computers and smart boards in the classroom, which allowed other students and the instructor to see and share their work. Because the TI-Nspire™ was capable of storing files, students could save and retrieve work that had been completed earlier for reference, comparison, and revision. In short, the TI-Nspire™ enabled instruction and learning to be more collaborative, experiential, flexible, timely and, most importantly for deaf students, more visual (with the aid of a smart board, a technology available in all ASD classrooms).

Figueroa believed that the TI-Nspire™ was a significant improvement over the simple graphing calculators currently used at ASD, and she was eager to introduce the calculator’s capabilities to her colleagues. For example, working out math problems with a paper and pencil was completely unnecessary for students proficient in using the calculators. Students could compare their work to that of others by sharing files, and see alternative solutions to problems or why they had answered a problem correctly or incorrectly without trading calculators or problems on paper. Collaborative, team-based work in the classroom was easier using the TI-Nspire™ because all devices shared the same data sets and problems. The device’s enhanced visual displays and capabilities were a boon to students who could not hear and were often unable to speak. Offering a workshop on the calculators and software would also allow her to gather more workshop evaluations for Texas Instruments. However, Figueroa first had to master American Sign Language.

For the next three months, Figueroa embarked on an intensive effort to learn ASL. American Sign Language is a language distinctive from Standard English, and Figueroa was attempting to become fluent in only one year. Although learning to sign was a daunting task Figueroa’s passion for learning technology was undimmed, and she longed for the opportunity to demonstrate her calculators. She received her chance when her supervisor invited her to give a presentation on the benefits of the TI-Nspire™ in Spring 2008. However, the supervisor insisted upon one condition: Figueroa must deliver the presentation entirely in ASL—no spoken English could be used. Figueroa was taken aback by this requirement; she had been learning to sign for only three months and was not yet fluent; it seemed unrealistic to give a technical presentation to instructors using only ASL, particularly after receiving only three months of training. When she expressed concern about giving the presentation entirely in ASL, her supervisor remarked, “Sign language was the ‘learning technology’ in this school long before computers and calculators came into use. It’s critical to what we do.”

The importance of ASL in Deaf culture generally, and at ASD specifically, was not lost on Figueroa. Hearing impaired people in the United States generally identified with one of two social groups: the deaf and Deaf (Moore and Levitan, 2003; Paddon and Humphries, 2006). People who were deaf (denoted by a lower case letter ‘d’) preferred to mainstream with hearing society and did not base their social identities on deafness. In contrast, the Deaf (denoted by an upper case letter ‘D’) based their social identities primarily on their deafness and considered themselves to be an empowered, capable group with a distinctive language and culture.
The Deaf community is characterized by a high degree of physical, sociocultural diversity. For example, members may be able to read lips and speak clearly, or they may be incapable of lip-reading, speech, or other forms of communication that facilitate interaction with hearing people. The Deaf community also exhibits the same degree of sociocultural diversity exhibited in American society at large (Sparrow, 2005; Paddon and Humphries, 2006). Age, race, ethnicity, social and economic status, and other demographic characteristics were therefore not the basis of Deaf identity. The group had forged a strong sociocultural identity on the basis of only two shared elements: the use of ASL for communication and the conviction that deafness is not a disability (Moore and Levitan, 2003; Paddon and Humphries, 2006). Deaf people strongly objected to the notion that they were “hearing impaired” because it implied that deafness made them less capable than hearing people. For this reason, members of this community insisted on being called Deaf rather than hearing impaired or handicapped.

Many Deaf people also viewed efforts to mainstream non-hearing people into hearing society as unnecessary and offensive (Paddon and Humphries, 1990; Lane, 1999). For example, the Deaf community has many outspoken critics of technological advances such as cochlear implants and emergent communication techniques for non-hearing people like signed English, on the grounds that these mainstreaming “advancements” are unnecessary and pose a threat to their sociocultural identity (Lane, 1999; Levy, 2002; Sparrow, 2005). Figueroa realized that it was possible that her supervisor and fellow instructors—who were both Deaf and hearing—were using her presentation as a sort of “test” to determine not only her mastery of ASL, but also her willingness to embrace Deaf culture and its values. Aware that protesting her supervisor’s demand would neither further her technological ambitions nor impress her colleagues, Figueroa reluctantly agreed to the condition and set about preparing a presentation on the TI-Nspire™ in ASL. After several weeks of intense preparation, she was finally ready.

The Demonstration at the ASD

On the appointed day, about one dozen senior colleagues and her supervisor joined Figueroa in a conference room for her presentation. Figueroa distributed the calculators to the attendees and, somewhat nervously, began to explain in ASL how the device could be used to teach mathematics to deaf students. During the presentation her colleagues and supervisor asked many questions about how Figueroa would explain mathematical concepts using ASL, but very few questions centered specifically on the TI-Nspire™. Indeed, the attendees showed scant interest in learning about the device or its classroom applications. Figueroa did her best to answer the questions and finished her presentation. As she wrapped up the session, she asked all attendees to fill out an evaluation form on the session and device, a customary practice in workshops at ASD. However, both her supervisor and colleagues left the session without completing a single evaluation.

Undeterred, Figueroa approached each attendee in his or her office and asked them to complete an evaluation form. Most were extremely reluctant, and offered a variety of excuses for not complying with her request. “I didn’t fill it out because I don’t want to be bothered by Texas Instruments,” claimed one. Others pleaded that they were “just too busy” to fill out evaluation forms or take the time to master new technologies, and one senior colleague announced that he was uninterested in learning about new classroom technologies due to his pending retirement.
Shocked and confused at being rebuffed, Figueroa tried to discuss the incident with ASD faculty who were known to use learning technologies in the classroom. Without exception, her colleagues advised her to forget about new learning technologies and focus on improving her signing. Figueroa began to suspect that the entire presentation had indeed been a ruse intended to test her developing signing skills and acculturation into the Deaf community rather than learn about the calculators. Still, she took the hint and dropped the matter, but resolved to continue using new learning technologies in her own mathematics classes.

Figueroa continued to practice American Sign Language and began to teach mathematics classes at ASD. She made active use of her TI-Nspire™ calculators and software, which were a hit with students. The students enjoyed having the ability to save and retrieve problems on the calculators, share data more easily, not have to laboriously write out answers with pencil and paper, submit their homework to Figueroa electronically, and to see their work projected on classroom smartboards. Still, many colleagues disparaged or dismissed her efforts to integrate learning technology in the classroom. After walking by the classroom where Figueroa was explaining the use of the calculators to students, her supervisor caustically remarked that hers “was more like a calculator class than a math class”—that is, a class in calculator use. Others seemed annoyed at her persistence in talking about and using new learning technologies, advising that “You can’t impose new things, Inez”; or “Our old technology is working great. Why change the technology if it’s working well for our students?” Eventually, Figueroa’s supervisor flatly told her to stop using the TI-Nspire™ in ASD classes. When she asked for an explanation, Figueroa was told that students should learn to solve math problems on older-style calculators because they were more commonly used on college campuses: “If the students’ next math instructor doesn’t know how to use the TI-Nspire™ and doesn’t want to learn, our students may have problems. Besides, it’s our policy.” Figueroa knew of no formal policy at ASD that forbade the use of this or any other advanced educational technology, but her orders were clear. Sadly, she packed up the calculators and took them home.

What Next?

The resistance to the new calculators left Figueroa frustrated and confused. She had been told that she was hired because of her expertise with learning technologies, and ASD was known for its reputation in technological innovation. Yet, every attempt to share her expertise had been rebuffed or dismissed, and even her own use of learning technologies met with criticism. She began to wonder if her expertise with learning technologies was truly the reason she had been hired. Figueroa also puzzled over why her colleagues seemed so reluctant to embrace new teaching technologies. While it was true that new technologies would force instructors to learn how to use the technology and revise lesson plans and teaching materials (problem sets, exercises, examinations, etc.), this seemed like a reasonable tradeoff for the improvement in student learning. “If this is an innovative school,” she wondered, “where is all the innovative learning technology?” Or, her colleagues’ aloofness could be more personal in origin. Figueroa had been hired to replace a Deaf mathematics instructor. ASD preferred to hire Deaf instructors when possible, and hearing faculty were a minority in the high school. Could the resistance to her calculators be a subtle, indirect protest against the hiring of a hearing instructor? Another possibility was that she had been hired because, as a Latina, her addition to the faculty helped ASD meet aggressive, self-imposed goals for workforce diversity. ASD had voluntarily
developed an aggressive Affirmative Action policy that advocated hiring qualified women and members of minorities whenever possible. At the time of this incident, ASD employed approximately 90 faculty members, four of whom were ethnically ladinos. Figueroa was the only female faculty member with Ladino roots. Could she be a token hire, she wondered, someone who was meant to be seen but not heard?

Although Figueroa’s suspicions were difficult to prove, one thing was certain: the prospect of doing nothing but teaching math classes held little appeal, and she began to question her fit with ASD. Figueroa wondered, “Why should people be so resistant to using this learning technology, and why should they care if I do? Moreover, should I continue to press the issue and introduce new learning technologies at all?”

References


Appendix

Features and Benefits of the TI-Nspire™

“Multiple representations and the power of visualization.

The latest TI math and science learning technology features the TI-Nspire family of products and services. This technology goes beyond graphing to help students see math and science in new ways.

Some unique features of TI-Nspire let you:

- View multiple representations of a problem on a single screen
- Grab a graphed function and move it to see the effect
- “Link” representations: Manipulate the properties of one and observe instant updates to others without switching screens
- Create, save, and review work in electronic documents, like a computer
- Activate the handheld’s Press-to-test feature to block access to certain geometry features not allowed on state exams
- Experience identical functions on the handheld and TI-Nspire Computer Software…Your students can use the software independently or in tandem with the handheld for work in and out of class.
- Project a full interactive handheld alongside a large handheld screen to demonstrate concepts to your class using TI-Nspire Computer Software—Teacher Edition.”

* Source: TI-Nspire™ Product Family Website.
    [Accessed on Retrieved on November 14, 2009]. This information does not represent an endorsement of the product by the authors.