THE IMPACT OF TECHNOLOGY INTEGRATION UPON COLLEGIATE PEDAGOGY FROM THE LENS OF MULTIPLE DISCIPLINES

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ABSTRACT

Technology integration on college campuses has become both a reality and necessity to meet the demands for function and flow in an ever advancing world of learning. This study qualitatively reviewed how a multi-disciplinary sample of collegiate instructors viewed technology and how they incorporated it into their pedagogy. Results indicated a range of technology use largely dependent upon personal faculty self-efficacy with technological tools, and additionally their philosophical and pedagogical beliefs rather than disciplinary alignment. However, significant impact was reported on technology enhancing all discipline-related information, tools, and methods of study.

KEYWORDS

Collegiate pedagogy, technology, teaching philosophies

1. INTRODUCTION

Technology integration on college campuses is no longer a question for the future, but rather a reality for today. It is central to the function and flow of everyday business for colleges. There isn't a realm of collegiate operation that has not been touched and influenced in some way by technological advances and innovations; this invites inquiry into the impact of the integration of technology into collegiate pedagogy. Technology provides faculty opportunities to modify teaching approaches beyond the traditional lecture within four walls (Renes & Strange, 2011). All academic divisions and disciplines on college campuses have experienced encouragement to integrate and infuse technology into their pedagogy and disciplinary practices. It has been clearly heralded that success for the future is to involve technology. Even the United States Department of Education claims that technology is an impetus for improving learning, productivity and performance (Georgian & Olson, 2008).

Trends to increase the use of technology have led educators to think in new and innovative ways to face the challenges for education today. In 2010, a report predicted that the key technologies that in the next five years would surface in the collegiate realm: mobile computing, open content, electronic books, augmented reality, gesture-based computing and visual data analysis (Johnson, et al., 2010). As each of these innovations has and is taking a foothold in collegiate education, it is not clear which have become more discipline specific and which are being effectively integrated, and additionally, for what purposes.

For the purpose of this study, technology is defined as tools, innovations and advancements designed to improve conditions or states of being. According to *Merriam Webster*, technology is "a manner of accomplishing a task especially using technical processes, methods, or knowledge" (http://www.merriam-webster.com/dictionary/technology). Educational technology accomplishes the task of promoting educative experiences, often using software and hardware. Additionally, emerging technologies for education are interdisciplinary. For the purposes of this study, technology used for instruction was defined as technology that was used beyond the perfunctory role of classroom management, and includes uses such as presentation applications, collaboration tools, interactive software applications, multimedia adaptive diagnostic tools and learning management systems (Paver, Walker, and Hung, 2014). The use of learning technologies is often described as technology-enhanced learning; and includes innovations such as computer-based learning, computerized tools and applications which provide multimedia options, animations, virtual environments,

games and simulations, mobile learning, digital portfolios, wikis, blogs and more (Graesser, Chipman, & King, 2008; Ragupathi & Hubball, 2015).

The theoretical lens used in this study centered on the work done by Bernauer and Tomei (2015) in which they purport that the integration of pedagogy and technology must center on the pillars of teaching and learning: content (what), implications (how), philosophy (why), and the teacher-learner relationship. The following research questions then became the framework from which the researcher examined the higher education technology integration:

1) What do faculty members report as the impact that technology has had on their discipline, their pedagogy, and their research?
2) How is their teaching philosophy evident in their technology implementation?
3) What does faculty's technological implementation reveal about the teacher-learner relationships in the case study?

2. LITERATURE REVIEW

Most higher education institutions have invested in equipment and infrastructure, enabling them to have technology enhanced classrooms, learning management systems, and online administrative functioning. In the collegiate setting students complete online admissions applications, utilize online registration, communicate primarily through email, and now even have options for online and blended learning courses. Modern technological structures have also changed how higher education institutions function administratively. The demand for increased technology in the collegiate setting has resulted in an environment where knowledge is convenient and accessible which impacts instruction both in content and delivery (Chaudhry & Malik, 2014). Literature is now surfacing which investigates how technology is being integrated into education and has enhanced learning, specifically, the impact of technology on pedagogy and student learning outcomes. Kirkwood and Price (2013) argue that "technology itself is not the agent of change: it is the teacher." Despite all the innovative implementations of technology into collegiate life and study, the most effective uses appear to be in concert with student learning style preferences and adaptations that align most to the cultural and epistemological uniqueness of academic disciplines (Arenas, 2015). The actual characteristics of particular disciplines need to be taken into consideration as well as the teacher's pedagogical stance and the student's learning style. Additionally, technologies also embody philosophies and ideologies in themselves (Siemens & Tittenberger, 2009) so the philosophical and ideological components of the technology used should be considered within the alignment and integration into the course content and delivery.

2.1 Faculty

According to current studies, faculty typically approach technology according to their conceptions about learning and their teaching style (teacher-centered or learner-centered) and either have the perspective that technology use should be "strategic (i.e. general approach)" or "tactical (i.e. particular applications)" (Kirkwood & Price, 2013, p.328). These beliefs about teaching are intricately tied to their pedagogical development and what role and influence technology will play. One of the largest barriers to new technology use in collegiate situations is reported is a lack of relevance for using technology in a particular situation (Greener & Wakefield, 2015). Literature reviews of technology use in higher education have revealed more of an emphasis on the implementation of technology, creating and using new innovations in higher education, and less about the actual process of teaching and learning (Kirkwood & Price, 2013). Essentially, these findings serve to challenge faculty to be sure their technology use is aligned with their pedagogy, rather than the technology driving the teaching methods.

Newer faculty, especially those beginning their tenure-track journey, tend to seek appropriate and applicable selections of technologies compatible with their discipline and desired learning outcomes (Ragupathi & Hubball, 2015). Many colleges are encouraging increased use of technology for educational purposes by creating support systems through faculty learning groups, and developing teaching and learning centers which offer workshops, seminars and one-on-one support (Ragupathi & Hubball, 2015). Information

technology and media services are growing as a result of the need to service technical support for teaching and learning. Professional development for technology integration is on the rise and needs to continue as the rapid rate of advancements in technology are very difficult for individual faculty to keep abreast of on their own. This is especially true for early career faculty who very much need the support of a professional learning community (Ragupathi & Hubball, 2015). However, Georgian and Olson (2007) found that only half of faculty offered trainings about technology integration actually utilize that resource. They stress that when training does occur, faculty need to go beyond learning how the technology works; they need to assess if it is appropriate for their circumstances, and if it can be integrated appropriately into their discipline. Other researchers also stress that departmental cultures differ and should have unique trainings geared toward integration that fits that discipline (Brown, 2003, Ertmer, 2005). Additionally, "Broadening technological and pedagogical horizons may include re-visioning our ideas, practices, and training schemes in order to impart our pedagogical messages" (Georgian & Olson, 2007, p. 8).

Some institutions have begun to provide incentives such as funding to faculty for experimenting with innovative technological pedagogies (Greener & Wakefield, 2015; Ragupathi & Hubball, 2015). However, some spheres of faculty are hesitant about, and even resistant to incorporating technology into their repertoire of instructional strategies. Although collegiate administrations attempt to persuade faculty use of technology through examples of peer success, professional development, and support, Paver, Walker, and Hung (2014) found that intention and attitude significantly predicted the successful integration of technology for instruction by community college faculty. Other research also supports increased success when peers are used for technology integration training, especially when the training is discipline specific (Brown, 2003, Ertmer, 2005, Georgian & Olson, 2008). Naturally, an educator's self-efficacy for using the technology will increase as technology application and integration become transferable to their discipline. One key mentioned by Paver, Walker and Hung (2014) was for faculty to understand such integration could occur within already existing teaching styles.

Changes occur as new generations, with new perspectives, replace leadership. Faculty need to be aware that the students of today, who are becoming leaders, are entering college campuses with the experience of always having technology as a part of their lives. They were born post the invention of the world wide web. These students don't know a world where technology is not integral in their daily functioning. "No generation has ever had to wait so little time for so much information" (Renard, 2005, p. 44). Today's students are often called "digital natives", having grown up around technology and are instructed by "digital immigrants" , professors who often struggle to adapt teaching to available technological resources and formats (Prensky, 2010). Using technology is not foreign to these students. However, even digital natives sometime struggle with the rate of change in technology and how to appropriately incorporate that into educational experiences (Li, Worch, Ahou & Aguiton, 2015), especially since they view specific technology as compartmentalized only for specific purposes (Swanson & Walker, 2015).

2.2 Disciplines

Faculty members are typically well trained in discipline specific content and research methodology. With the introduction of new technologies, a new struggle has emerged in which these faculty members are now challenged to make pedagogical adaptations to accommodate the technological advances. Considering these disciplines may have unique and tailored perspectives on how they approach instruction, then their nature may impact how they potentially incorporate technology. Biglan (1973) classifies the nature of academic disciplines according into four groups: hard-pure, hard-applied, soft-pure and soft-applied. There seems to be a lack of research to date that explores the different manners in which these disciplines integrate technology. It is essential for institutions to know how to support academic and professional development while taking into consideration technological advances and multidisciplinary applications of technology.

Serious considerations need to be made as to how and when technology should be used on college campuses for pedagogical purposes. Research is being done to determine the impact on learning when specific components of technology are integrated into teaching and learning situations. Churcher, Downs, and Tewksbury (2014) who researched using social media and web 2.0 technologies in collegiate courses purport more deliberative consideration needs to be given about using theoretical implications of supplementing higher education experiences with technology. "Content, context, and pedagogy must be equal partners with technology" when there is technology integration in collegiate courses (Renes & Strange, 2011; Harris,

Mishra, & Koehler, 2009). Each technological component has implications specific to that medium and to the discipline in which it is being integrated.

"As in all moments of major technological change, people, companies, and institutions feel the depth of the change, but they are often overwhelmed by it, out of sheer ignorance of its effects" (Castells, p.10). To better understand the process and impact in which technology integration is happening at the collegiate level, this study provides an interdisciplinary analysis as to how faculty at one institution have incorporated technology. The study sought to reveal patterns and purposes for technology integration and to determine factors upon which that technology use was dependent. Lastly, the study sought to analyze disciplinary perspectives on the impact of technology integration on their particular pedagogy.

3. METHODS

This study is a descriptive comparative, qualitative analysis conducted in the form of a case study which focused upon the technological integration experiences of faculty in one private liberal arts intuition in north eastern United States. The study examines how the use of technology intersected with pedagogical approaches across a sample of disciplines.

3.1 Sample/Participants

The populations for this study consisted of a cross sectional sample of higher education faculty in a liberal arts institution in northeastern United States (N=16). Data for this research study was gathered via interviews and lectures presented by these faculty who were specifically asked to address technology integration into their discipline. Each of the faculty members who were interviewed or presented their perspectives on technology integration in their discipline were described as either un-tenured, tenure-track or tenured faculty. Their range of experience in their discipline spanned three years to nearly thirty years in higher education. The disciplinary fields represented were distributed broadly across academic programs and departments (see Appendix A).

Additional data was gathered from a student survey where they indicated their coursework they had taken that year and the ways technology was being used in those courses. Those students additionally represented a range of programs and majors, thus having had courses in a variety of disciplines.

3.2 Procedure

Faculty members from across disciplines were asked to present to a freshman seminar about the impact of technology upon their discipline, their pedagogical approach, and their research. They were allowed to present in any manner that they desired and in any location on campus. The instructions were general in effort keep researcher bias from tainting faculty participants' concepts of technology as they shared with their audience. Notes were taken during the faculty presentations which were then coded for indications of technological impact on the faculty's particular discipline and on their personal pedagogical approach and use. Additionally, the researcher noted the faculty's choice of whether to use technology in their presentation and coded what type of innovation was accessed.

4. RESULTS

4.1 What do Faculty Members Report as the Impact that Technology has had on their Discipline, their Pedagogy, and their Research?

An analysis displaying how technology was utilized by faculty and their self-report of how technology impacted their different disciplines is displayed in Appendix A. A total of 16 faculty presented to a group of students about the impact of technology. Each instructor represented a different discipline or program

including the following: Information Technology - GIS, Library Science, Chemistry, Geology, Physics, Psychology, Management and Business, World Language and Literature (Spanish), Information Technology – Media Services, Classics, Anthropology, Music, Dance, Art – Visual Design, and Performing Arts - Lighting and Sound.

The overwhelming consensus for technological impact centered in how these faculty were able access and present information. They shared about new content but also about the processes of getting that data. Some of the content knowledge they teach about was not even in existence or available prior to recent technological advancements. One example of such advancement was clearly evident when the psychology professor demonstrated how her technological equipment allowed for measurement and analysis of rapid eye movement during reading. Another example of change and impact was noted by the Information technologist who used GIS (Geographic Information System) mapping to gather data on a local tree census, which was then used by local environmentalist and government for community decision making. Additionally, the Management and Business professor explained how technology helps industries gather consumer preference information which businesses and her students use.

There was no significant difference in types of technology used when compared by faculty gender. There was, however, a difference in using technological advancements when it came to faculty status. Most of the early career faculty members were more inclined to incorporate presentation software. Most faculty in the case study also revealed that advancements in technology have significantly impacted their research endeavors. The archeology professor demonstrated this by explaining how instead of having to carry a tremendous amount of equipment, she was able to easily and effectively use digital equipment for capturing images deep in caves, and the recent use of multispectral imaging and lasers to gather data.

4.2 How is their Teaching Philosophy Evident in their Technology Implementation?

Technology doesn't take the place of the teacher, it should enable the educator to more deeply explore and express their beliefs and understandings about pedagogy for their particular discipline. In each of the presentations and interviews with the faculty in the case study, it became evident that they have developed their own style and comfort level with how they used technology. The technology use varied more by teaching philosophy than by discipline. This was evident when the classics professor demonstrated the use of required pre-class homework involving online lectures exploring ancient images in order to utilize class time for discussion and interaction. Contrastingly, the language instructor mentioned student's having access to many online tools but little to no technology was required in or out of class. Both classes involved pedagogy based upon discussion format but their philosophy of teaching varied when it came to how technology could be incorporated.

4.3 What Does Faculty's Technological Implementation Reveal about the Teacher-Learner Relationships in the Case Study?

Two of the faculty admitted they personally do not frequently use technology in their lectures and presentations; rather they encourage students to practice and apply materials using simulations and online activities outside of class as a means of enrichment. This process gives students autonomy and responsibility for deeper learning. In contrast, some instructors require technologically based assignments inside and/or outside of class, or within labs. The physics professor demonstrated lab projects involving technology (computer simulations, robotic equipment, etc.) he would require using technology which then would supplement his lectures and reading. Both perspectives, required or not required, understood that the technology use could serve to motivate and provide deeper learning.

Several faculty members commented on how technology has assisted in collaborative research with students. Projects were able to be expanded because of the skills students brought to the situation, or developed as a result of the collaboration. Technology played a major role in these cases, exemplified when a classics student discovered ways to enhance ancient script to a readable level.

5. CONCLUSION AND DISCUSSION

One major implication from this study is the importance of encouragement for effective implementation and integration of technology via peer collaboration and demonstration of possibilities for technology use. Faculty shared they had participated in workshops to strengthen their technological skills and several mentioned having met with peers to share about their pedagogical practices. These were the individuals most readily taking advantage of technological innovations. The workshops and peer collaborations described were primarily interdisciplinary and highly productive.

Even when the instructor themselves did not have the necessary skills to implement and produce technology enriched pedagogy, it was noted many encouraged student projects which utilized the students' technological skills and knowledge. One implication from the study reinforces the concept of empowering students education related technological advancements. Regardless of the discipline, instructors play a role in assisting learners in transferring and applying their knowledge, which often is often expressed with or uses technological innovations. As evidenced in this study, effective technology use can be in addition to or utilized outside regular class time.

Changes in higher education will always include technology. The impact of technology integration rests heavily upon faculty's personal approach to the process and their theoretical belief about teaching and learning. Faculty in this study who were successfully using technology, regardless of their discipline were motivated by enhancing their students' learning. Numerous opportunities exist for professional development and peer collaboration. Faculty taking advantage of those opportunities show greater self-efficacy for technology integration and increase potential for student learning.

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Appendix A – Sample of technological use and impact on disciplines

Faculty/ Discipline	Gender	Impact on medium/tools used	Impact on discipline	Impact on pedagogy
Information Technology GIS instructor	male	computers/ projection *Fulcrum* software Mobile Devices/ smart phones	core content	presentation mode digital mapping enables research, use of satellites, rapid changes
Library Science	female	computer/ projection, web-based databases new resources	changed access to information revolutionized use of library space & tools	communication presentation, research, all modes changed
Science – Chemistry	female	computer/projection, Interactive software lab tools, visuals	advanced analysis software & tools access to information	use of interactive software, simulations,
Science – Geology	female	projected visuals	access to information software & tool advances	changed modes of displaying information
Information Technology	female	computer/projection software applications	rapid changes	constant professional development needed
Music	male	computer, synthesizers, soundboard, recording equipment, instruments	production time and modes changed, performance changed	instant playback, visuals and other new tools available
Dance	female	large screen projection	enhanced productions performance critiques	recording used for access to examples