

# Role of instructional technology in the transformation of higher education

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**Abstract** It is argued in this article that the convergence of collaborative constructivist ideas and emerging instructional technologies are transforming higher education. The article begins with an overview of instructional and communications technology and how this technology is being used in the service of either sustaining or transforming teaching and learning in higher education. Next, the idea of collaborative constructivist approaches to teaching and learning are explored and the case for a guiding framework is made. The Community of Inquiry framework is briefly described and assessed from a theoretical and practical level. Finally, the discussion turns to the nature and importance of institutional leadership if instructional technologies are to transform the quality of the teaching and learning experience in higher education.

**Keywords** Collaborative constructivism · Collaborative leadership · Community of inquiry · Instructional technology · Teaching presence · Cognitive presence · Social presence · Web 2.0

In the classical theory of paradigm shifts (Kuhn 1970) there is a period when new paradigms emerge that challenge traditional and wide spread beliefs and approaches. At the heart of any new paradigm are ideas that challenge accepted assumptions along with emerging technologies that dramatically raise possibilities

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that could not be imagined within the old paradigm. This would appear to be what is happening as online and blended learning ideas have begun to shift the thinking and practice of educators and leaders in higher education. Collaborative constructivist teaching and learning ideas have come to the fore as the affordances of emerging technologies create design possibilities that make such approaches to learning practical. While new and emerging information and technological tools are a catalyst for new educational paradigms, it is the convergence of the valued idea of collaborative constructivist approaches and new communications technology that has given life to online and blended learning in higher education.

In this paper we will explore the relationship between collaborative constructivist ideas and instructional technologies that together have begun to transform higher education. Unlike Kuhn's classical paradigm shift, this shift is less revolutionary in nature as it is evolutionary in transforming educational practice. That is to say, traditions such as the passive lecture are being viewed critically because instructional technology has provided new possibilities where educators can create and sustain collaborative learning communities not constrained by time and space. This is truly a new possibility unimagined until the recent arrival of the Internet. The idea of sustained learning communities made possible with new and emerging instructional technologies is challenging passive learning environments in higher education.

It is argued here that the successful use of instructional technology in higher education will be driven by educationally valued ideas of teaching and learning (i.e., collaborative constructivist approaches) integrated with the transformative potential of new communications technology. We begin with an overview of instructional and communications technology and an exploration of the question: to what extent has instructional technology contributed to a transformation of higher education. Next, we outline collaborative constructivist teaching and learning ideas that have historically been the foundation of higher education. The overriding question is whether these re-discovered approaches are transforming higher education or are the new and emerging instructional technologies simply supporting and reinforcing existing practices? At the heart of this discussion is the Community of Inquiry framework consisting of three core presences (social, cognitive and teaching) that has considerable potential to guide the adoption of instructional technologies for collaborative constructivist teaching and learning. Finally, we discuss strategic institutional leadership issues and the constraints for the successful adoption of instructional technology.

## **Instructional technology**

As a field and occupational category, instructional technology emerged in the early 1960s. However, it has a long history that began in ancient times (Saettler 2004). Since the early use of audiovisual devices (Reiser 2007; Saettler 2004), many different technologies have been developed for learning. Each new medium entered the educational scene with great promise and there was a great deal of initial interest, enthusiasm and hope for an impact on instructional practices (Eraut 1994;

Reiser 2007). This caused a massive infusion of technologies into educational environments. In the context of higher education, most universities are equipped with the latest instructional technologies linked to a high-speed internet connection. However, the technology has not yet had a significant effect on instructional practices (Grineski 1999; Reiser 2007; Salomon 2002; Merrill 2002; Reigeluth and Joseph 2002; Salinas 2008). For example, Merrill (2002) in his review of a large number of instructional courses from different areas indicated that the vast majority of the courses do not represent effective instruction and some do not teach at all. This situation has triggered significant debates about the effects of technology on learning.

In the early 1980s a debate about the effects of technology was initiated between Richard E. Clark and Robert B. Kozma. The debate began with Clark's (1983) vehicle analogy—"media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes" (p. 445). At the time, Clark argued that it is the instructional method—teaching—that affects learning. In 1991, Kozma responded to Clark's assertion, contending that the attributes of a particular medium may influence learning. He argued that the media and method have a more integral relationship such that, within a particular design, the medium enables and constrains the method and the method draws on and instantiates the capabilities of the medium. In support of Kozma, Hastings and Tracey (2005) suggested that today's technologies (i.e., computers) offer cost-efficient delivery methods which are capable of supporting instructional methods that previous media could not.

Today a new group of emerging communication technologies (namely Web 2.0) is beginning to attract the attention of both practitioners and researchers because of their unique capabilities. Examples of these technologies are wikis, blogs, instant messaging, mashups, internet telephony, social bookmarking, social media sharing and social networking sites. The previous generation of communication technologies was offering a collection of read only web sites such as Encyclopedia Britannica; however, Web 2.0 brings the opportunity to increase interactivity and participation by enabling collaborative communication, creation and content sharing such as Wikipedia. Web 2.0 applications provide venues for collaboration, construction and sharing of information in support of active and social learning (Maloney 2007; Ajjan and Hartshorne 2008). They provide the means to create a learning environment in which learners can be creative, critical, constructive, and become producers of their own perspectives and identity informed by other participants (Nagy and Bigum 2007). This is why these emerging communication technologies are believed to be causing a paradigm shift in distance education (Kesim and Agaoglu 2007). As well as their extensive use in distance education, their use to support in-class teaching and learning in higher education (i.e., blended learning) is also increasing.

If today's technologies have the potential to improve teaching and learning, then the question is more about how the technology is being used in educational environments. More specifically, is the technology being used to sustain traditional approaches? Reigeluth and Joseph (2002) indicate that the current educational system reflects most of the industrial-age key markers such as standardization as

opposed to customization of the information age. It would appear that prevailing methods of instruction impede the most effective application of technology. As Salomon (2002) suggests, technology cannot make a difference as long as it is being domesticated and trivialized to be totally subservient to ongoing practices. In this regard and to the theme of this paper, current use of new technologies have not fundamentally reorganized the ways in which we teach and learn as we have not yet discovered how to make new technologies transformative (Howard 2004).

What is advocated by many for the effective use of instructional technology is the need for change in the learning paradigm to utilize the uniqueness of new communications technology as a tool of construction, creation, communication and design to learn with technology (Salomon 2002; Merrill 2002; Reigeluth and Joseph 2002; Salinas 2008). Emerging communications technology capabilities are not congruent with teacher-centered learning environments where the teacher is the main source of knowledge and the learner passively receives this information without much reflection or discourse. As Reigeluth and Joseph (2002) indicated “we must think beyond the methods that we have traditionally used, and work on inventing methods that are consistent with the key markers of the learning focused paradigm, keeping in mind the new capabilities that technology offers” (p. 11). In short, adoption of instructional technologies must be driven by innovative ideas.

There are also other reasons for ineffective use of technology in higher education. Meyer and Xu (2007) found that instructional workload and responsibilities are an important factor influencing the adoption and use of technology by faculty. Too much emphasis on the technology itself (Salomon 2002) and the lack of support for faculty (Merrill 2002) are other important obstacles suppressing the effective application of instructional technology. In the end, the use of instructional technology in higher education context is a necessary ingredient for academic success and future employment (Grineski 1999). Next, we focus on instructional approaches that fit well with emerging communications technology to enhance learning in higher education.

### **Collaborative constructivist approaches**

The premise here is that the successful use of instructional technology is dependent upon approaches and designs that are congruent with the ideals, values and emerging needs of higher education. Successful use of instructional technology is not simply to mitigate the deficiencies of current realities such as lectures and large classes. There is a shift in higher education to initiatives that collaboratively construct knowledge consistent with the critical thinking and discourse ideals of higher education (Garrison and Archer 2000). It is through the integration and sustainability of reflection and discourse where students become engaged in deep and meaningful learning experiences. The analysis of research on collaborative/cooperative learning experiences has shown greater academic success, social adjustment and retention (Johnson et al. 1998).

The successful use of instructional technology will be directed to capturing the ideals and associated practices of higher education. Collaboration provides the

means for discourse and engaged learning experiences. Collaboration goes beyond simple interaction in the sense that it is clearly focused on a problem or dilemma where students are deeply engaged in purposeful discourse to construct meaning and collaboratively share meaning and validate understanding. Such activities are not well suited to large lecture halls. Only by capitalizing on the new and emerging communications technology can we practically overcome the constraints in higher education that have made the large lecture a necessity. Not only can instructional technology provide the means to meaningfully engage students in a cost-effective manner, it can sustain that engagement over time. However, it has been stated that there is no integrative model that can guide teachers in the selection and use of classroom technologies from a learner-centered perspective in higher education (Salinas 2008). It is to this issue of an integrative model that we now turn our attention.

### Community of inquiry framework

To move beyond deficient individual practices in higher education requires an integrative model that can provide meaning and guide the design of collaborative constructivist approaches to teaching and learning. The position here is that the successful use of instructional technology should be focused on the creation of a community of inquiry that supports individuals constructing meaning and collaboratively testing understanding through discourse. Contrary to Salinas (2008), there is one integrative model that has shown considerable potential to guide the adoption of instructional technologies in higher education—the Community of Inquiry framework (Garrison et al. 2000). The purpose of this framework is to guide the use of instructional technologies in creating and sustaining deep and meaningful learning through reflection and discourse in online and blended learning environments. The empirical support and adoption of the Community of Inquiry framework is growing (Garrison and Arbaugh 2007; Arbaugh et al. 2008).

The interdependent elements of the Community of Inquiry framework are teaching presence, cognitive presence and social presence. Teaching presence includes three areas of responsibility—design, facilitation and direct instruction. Teaching presence provides the essential leadership and cohesiveness for a purposeful and successful learning experience. Research has shown that teaching presence plays a critical role in creating and sustaining a collaborative community of inquiry (Garrison and Cleveland-Innes 2005; Shea et al. 2005). Evidence continues to grow demonstrating the importance of teaching presence for the successful use of instructional technologies to support online learning communities (Meyer 2003; Murphy 2004; Swan and Shih 2005; Vaughan and Garrison 2006; Wu and Hiltz 2004). Conversely, instructional technologies expand, exponentially, teaching presence. For instance, in terms of design and organization category, Web 2.0 technologies lead to designing innovative, challenging, collaborative learning activities and environments. In terms of facilitation, these new technologies provide new means for communication and interaction between and among students and teachers, thus enhancing immediacy. Direct instruction could be implemented through sharing and injecting information from diverse sources in variety of forms

with the help of emerging technologies. As Garrison and Anderson (2003) indicate, now the content can be expressed and displayed in a more advanced manner; it can be animated and given agent like properties of autonomy, volition, and rationality and can be programmed to take a more active part in student-content interaction.

The second element of a community of inquiry, cognitive presence, reflects the core purpose of a community of inquiry. Cognitive presence is operationally defined in terms of the Practical Inquiry model (Garrison et al. 2001) and its four phases that parallel an educational experience. The first phase is the presentation of a problem; the second phase is the exploration of the problem through information gathering and discussion; the third phase brings relevant information and ideas together that have the potential to resolve the problem; and, the fourth phase is the testing of proposed solutions. A recent study that used the Practical Inquiry and two other models (Bloom and SOLO taxonomies) to evaluate cognition in online conferences concluded: “The Practical Inquiry Model was found to be the most relevant to the analysis of the cognitive dimension and represents a clear picture of the knowledge-building processes occurring in online discussion” (Schrire 2004, p. 491). It is important to emphasize that the key to cognitive presence is teaching presence as manifested through task specification and active facilitation/moderation (Meyer 2003; Murphy 2004; Schrire 2004; Shea and Bidjeramo 2008). Indeed, the potentials of emerging instructional technologies serve best for the development and support of cognitive presence in a learning environment. Their main contribution stems from their affordance of collaborative information discovery and creation which are the underpinnings of a community of inquiry. For example, O’Reilly (2005) emphasizes the power of Web 2.0 to harness the collective intelligence by enabling users to add and discover new content and new sites. O’Reilly (2005) describes this as “Much as synapses form in the brain, with associations becoming stronger through repetition or intensity, the web of connections grows organically as an output of the collective activity of all web users” (Harnessing Collective Intelligence, lines 6–9).

Social presence represents the third essential element in the creation of a collaborative community of inquiry. Social presence is defined as the ability of participants to identify with the community, communicate purposefully in a trusting environment, and develop inter-personal relationships (Garrison, in press). Social presence is seen as having an immediate influence in supporting collaboration and developing a functional community of inquiry. However, in the early days of exploring technologically mediated communities of learning (i.e., computer conferencing), considerable skepticism existed that social presence could be established in a virtual environment. Some scholars argued that the lack of non-verbal and vocal cues prevented students from developing a sense of personal connection and belonging (Short et al. 1976). In the subsequent decade of research, however, this has been shown to be false (Gunawardena 1995; Swan 2003; Swan and Shih 2005). Text-based communication does not restrict social presence (Rogers and Lea 2005). This is especially true of the new features of text-based communication found in Web 2.0 technologies that make it easier to interact and communicate affective responses in both synchronous and asynchronous formats. For instance, personal blogs, social media sharing or social networking sites could support the development of social presence by means of providing ways for

self-disclosure or to express emotions, leading to a learning environment where learners better know and trust each other and feel comfortable during the learning process. The growing evidence is that social presence, as an intervening variable between teaching and cognitive presence, is important to the success of online learning communities (Picciano 2002; Richardson and Swan 2003; Shea and Bidjeramo 2008; Swan 2002).

The assumption is that a collaborative constructivist learning experience is created through the interplay among the three presences. Through the integration of all three presences it is possible to create a community of inquiry that transcends practices dominated by the lecture and information transmission (Akyol and Garrison 2008). Moreover, research into online communities of inquiry has demonstrated that instructional technologies can create and sustain collaborative constructivist learning environments. Future research, however, must focus on the exploration of the integration of the elements of a collaborative community of learners if we are to generate practical guidelines.

The creation of a community of inquiry is a complex and challenging educational task that, in most higher education contexts, is dependent upon the intelligent use of instructional technologies. Introductory courses in higher education are invariably offered through large classroom lectures. Students sit passively while professors transmit information with little opportunity to construct meaning, clarify misunderstandings, or to share insights with others. In this modern higher education context, the only practical means of creating communities where students can meaningfully engage in collaborative knowledge construction is through the use of instructional technologies. Instructional technologies must be able to support integrated presence, cognitive presence, and social presence such that they can be integrated to create sustainable communities of inquiry.

To date, the impact of instructional technologies has not reached the tipping point in terms of transforming higher education. Most educators have an awareness of the potential of instructional technologies, that the technology is generally available, and that most institutions have the instructional expertise to provide the necessary support. However, what too often is missing is institutional leadership.

### **Institutional leadership**

The successful adoption of instructional technology on a large scale within higher education institutions is not going to occur without strong leadership across the various levels of the organization. Initiatives to introduce instructional technology in higher education on a broad scale have most often been met with resistance. This has been perplexing for those in the field of instructional technology who recognize the educational gains that would be possible with instructional technology. Considering the general resistance of higher education to change (Duderstadt et al. 2002), a concerted effort is required to achieve institutional wide adoption of instructional technology.

It has been recognized that institutional change requires strong leadership at senior levels. To get beyond rhetoric, the characteristics of sound leadership such as

vision and communication must be combined with action strategies. New approaches are required based less on individual charismatic leadership and more on productive collaboration. It is argued here that transformational change at the institutional level will only occur when the idea of collaborative leadership (not unlike collaborative knowledge building) is understood and adopted. The successful implementation of instructional technology requires collaborative effort and cooperation among leaders at various levels of an organization.

The idea and value of collaborative leadership is not very different from that discussed previously in terms of the process of constructing meaningful and valid knowledge. Not only must all participants have a sense of ownership but the complexity is such that solutions require input from a variety of sources. Instructional technology must be adapted to specific contexts and needs. Leadership at the various levels of an organization has different responsibilities and, therefore, roles to play in the successful implementation of instructional technology. Clear direction (policy/plans/communication), sustained commitment, and financial incentives must be provided by senior leaders. Deans and department heads must provide ongoing academic support and recognition.

Kathryn Sullivan (2008) argues that we have to change the way we approach teaching and learning through generative leadership that allow leaders and students to build solutions in safe, rich and active environments. The problem is that even after “the world-shaping impact of computer technologies, many [most?] schools are stuck using an education model based on the factories and armies of the 19th century...but it’s not a recipe for an effective learning environment” (Sullivan 2008, Out of the Factory Model section, Section 1). New approaches to leadership are required among leaders and learners. The successful implementation of instructional technology will be dependent upon generative leadership that can bring together participants at all levels of an organization to question deeply held assumptions and practices and change the way higher education approaches teaching and learning; to use instructional technologies to engage students in collaborative communities of inquiry that facilitate deep and meaningful approaches to learning.

Merrill (2002) has indicated that merely providing tools is unlikely to provide a significant increase in effective use of technology in instruction, unless there is a significant change in support. As such, teaching and learning centers that support faculty members and students in the use of instructional technology are gaining importance at universities and colleges. Along with the growth of these support centers, the services that these units provide are also widening. Although it may vary from institution to institution, Nworie (2007) lists various services as instructional development, faculty consultation and professional development, learning space/environment design and support, knowledge management/learning objects support, academic communications, research and development, assessment of learning outcomes, multimedia development and production, and distance learning support and consulting services. As indicated, these teaching and learning centers need to be supported by administrators in order to accomplish their goals. Consistent with the idea of collaborative leadership, faculty involvement in support centers to identifying programs and policies is critical in creating a sense of

ownership (Nworie 2007). Without generative leadership and concerted support, the probability of large scale, institutional adoption of instructional technology will approach zero.

## Conclusion

We should not be seduced by technology. The best of technology emerges through sound instructional ideas and approaches. It is the relationship between educational ideas and technological capabilities that will ensure the successful use of instructional technology in higher education. The ideas that drive and shape technologically mediated teaching and learning experiences must also be congruent with the ideals and values of higher education. This is a back to the future scenario in the sense that with the adoption of instructional technologies we are able to recapture the timeless values of critical reflection and discourse. The most promising approach to achieve this is generative (i.e., collaborative) leadership and the creation of sustainable learning communities.

The ideals of higher education must shape instructional design and the use of technology. Mistakes in the adoption of new instructional technologies have occurred when educators became too enamored with technology and lose sight of the educational goals. These misguided technological initiatives in mainstream higher education have not been productive and have increased resistance to instructional technology. We need to understand the properties of technology and their congruence with higher educational goals in terms of advancing the quality of higher education. Moreover, the integration of instruction and technology requires that we have a framework and clear assumptions to guide the successful design and assessment of instructional technology. The Community of Inquiry framework has shown to be a useful conceptual tool for the successful use of instructional technology in online and blended learning environments (Garrison and Anderson 2003; Garrison and Vaughan 2008).

The successful use of instructional technology will be predicated on the insights of educators who see how technological breakthroughs can create and sustain learning communities and the courage of educational leaders to collaboratively support the evolutionary transformation of higher education practice. Educational leaders must move beyond issues of access and recognize the importance of building and sustaining educational communities of inquiry where students are given the control and assume responsibility to construct and confirm meaning collaboratively. It is these ideas of generative leadership and collaborative commitment that will shape the successful use of instructional technology.

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