Chapter 2
The Impact of Instructional Design: Questions of Conscience

J. Michael Spector

Abstract Information and communications technologies that can be used in support of learning, performance, and instruction are changing at a rapid pace. There is now a vast array of learning resources available via the Internet, and there are many powerful and affordable mobile learning devices and applications that can be used in support of education and training. This situation creates serious challenges for instructional designers who are charged with recommending, selecting, sequencing, configuring, assessing, and/or managing educational resources and learning activities that comprise courses and programs of instruction. In addition to the burden of helping to create effective, engaging, and efficient learning environments and instructional systems, instructional designers have to live with a legacy of failing to deliver on previous promises to use technology to dramatically improve learning and instruction. What seems to be happening is that there is a tension between a need to rely on instructional designers to cope with the complexities and challenges of planning and implementing learning environments in the digital age and a general distrust of instructional designers to deliver on promises to transform education using new technologies. Issues pertaining to this tension are the focus of this piece.

Keywords Educational components · Emerging technologies · Information and communications technologies · Holistic approaches · Instructional design · Technology integration

2.1 Introduction

Dijkstra (1972) claimed that computers had not solved a single problem; they had only introduced the new problem of learning to use them effectively. The same might be said with regard to educational technology. There are many powerful and

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affordable technologies now available for integration into learning environments and instructional systems (Spector 2007, 2010, 2016; Spector and Ren 2015). The challenge is to make effective and efficient use of these technologies to support learning, performance, and instruction (Spector and Anderson 2000; Tennyson 1995). However, that challenge has not been met and increases as new technologies continue to emerge at a rapid rate (Cecez-Kecmanovic et al. 2014; Ely and Plomp 1986; Klassen et al. 2011; Natividad et al. 2015; Spector and Anderson 2000; Suppes 1978).

There have been many projects that achieved significant results and that provided a foundation for subsequent educational technology projects—especially notable were the Jasper Woodbury Project at Vanderbilt University (CTGV 1992) and the CSILE Project at the Ontario Institute for Studies in Education (Scardamalia et al. 1989). While these projects were remarkable in lighting the way for anchored instruction, collaborative learning, inquiry learning, and knowledge building, they had little impact in terms of large scale, sustained integration into curricula and instruction.

Only a very few educational efforts have managed to achieve sustained impact on a large scale. Two that come to mind in the USA are the Head Start Program and Sesame Street.

The Head Start Program was initiated in 1965 and continues to exist. Head Start was aimed at providing early childhood education, health, and nutrition to low-income children and their families. Head Start was an integral part of President Lyndon Johnson's so-call War on Poverty that began as a summer program to help disadvantaged children catch-up with their age group (Peck and Bell 2014).

The Sesame Street public preschool education television program was initiated in 1969, and still continues in 2015. Sesame Street was a result of a Carnegie Corporation grant to establish the Children's Television Workshop and was subsequently funded by the Ford Foundation and the U.S. Corporation for Public Broadcasting (Fisch and Truglio 2001).

One outcome of the success of Sesame Street was a prediction that educational television would transform instruction in public schools by putting a televised expert in every classroom to speak about every subject. That did not happen, although recorded talks by well-known experts were circulated by videotape and later in digital format. However, there has been no record of those recordings having a significant impact on learning. The modern counterpart of that experience is in the form of a MOOC (massive open online course), about which predictions are being made about radical transformation and significant impact on learning and instruction. No evidence of significant impact on learning is yet to be developed for MOOCs. While there is an appropriate place (in terms of a learning progression) to integrate such efforts into learning environments and instructional systems, there is no basis on which to make claims of dramatic improvements in learning based on such efforts.

The question that should be continually asked with regard to a new educational technology is whether and to what extent use of that technology will impact learning, performance, and/or instruction (Pirnay-Dummer et al. 2010; van

Merriënboer and Sweller 2005; Volkema 2010). The reminder that needs to accompany proposals to integrate new technologies is simple—namely, the challenge is not simply to put the technology in place; rather, the challenge is to make effective and efficient of a new technology (Clark 2014; Cuban 2001; Davies 2011). That potential certainly exists as many new technologies provide rich opportunities to engage and empower learners and those who support learners (An and Reigeluth 2011; Collins et al. 1991; NMC 2015; Paas et al. 2010). The remaining remarks provide one way to think about these challenges and reframe expectations with regard to emerging technologies and promises to transform learning and instruction using these technologies.

2.2 Discussion

If one accepts the general conclusion that the impact of information and communication technologies on learning and instruction has been much less than predicted, then one might be inclined to blame instructional designers—those who are responsible for planning, implementing, managing, and evaluating learning environments and instructional systems. While instructional designers have a responsibility to provide effective and efficient support of learning and instruction, including the use of appropriate technologies and strategies, they are not entirely at fault.

There are more fundamental issues that impede systematic, systemic, and sustained integration of new and emerging education technologies. The connections that should exist between educational, learning, and instructional theory, research, practice, and policy are seldom closely or effectively aligned. The researchers involved in Jasper Woodbury and CSILE did conduct studies in schools, but adjustments were not made in school practice and policy to ensure the continuation of support and dissemination of those efforts when the projects ended. Few if any school policies emerged from those projects that made systematic changes in curricula and educational practice that directly supported the kinds of anchored inquiry learning and collaborative knowledge building involved in those projects. Practice and policy were not changed as a result of research and theory. Without changes in practice and policy, instructional designers have limited opportunities to transform learning environments and instructional systems. It should be acknowledged, however, that many small-scale changes are occurring, thanks to the efforts of well-documented research and knowledgeable instructional designers.

Breakdowns in the chain of influence from research and theory into practice and policy occur at various places for many reasons, including lack of resources, differing priorities, disparate perspectives among stakeholders, and so on. Education systems are quite complex with many different components, involving a diversity of people and technologies, working with a variety of learners and learning tasks, toward goals that are often vague (see Fig. 2.1). This makes measurement of progress difficult and challenging. Without clear evidence of positive change, policymakers are reluctant to invest the resources required to support and maintain the continuation of many promising efforts.

Figure 2.1 depicts a simple way to conceptualize the components that comprise an instructional system or learning environment. Challenges in constructing meaningful educational systems occur at every level. At the lowest level in this hierarchy are the many resources available via the Internet. Many of these information objects may not consist of reliable or accurate information; they may be disassociated from a context; and they may not be configured or structured in a manner that is pertinent to the instructional design effort underway. Associating relevant and reliable validated information resources (a.k.a. knowledge objects) with a learning goal results in what might be considered a learning object. Many of these can be found in various MOOCs. While MOOCs are a relatively new development, only recently have MOOCs been designed by professionals (i.e., trained and experienced instructional designers). Moreover, MOOCs typically lack aspects normally considered part and parcel of a course—namely, learning activities with timely and informative feedback along with assessments to track development of a student's knowledge, skill, and competency. When personalized learning and instruction become a reality, MOOCs might eventually have a significant impact on learning. At their best, MOOCs have provided some access to education previously not available, and they have in a few cases led to communities of learners. The 'C' is 'MOOC' could stand for 'community'. However, there are many barriers involving privacy, proprietary rights, and more that stand in the way of big data and learning analytics taking MOOCs to a higher level.

In summary, there are many tensions, barriers, and issues that are obstacles to systemic and sustained progress in making effective and efficient use of technologies to support learning and instruction. Roblyer and Doering (2013) mention the following issues (and others) that challenge effective technology integration:

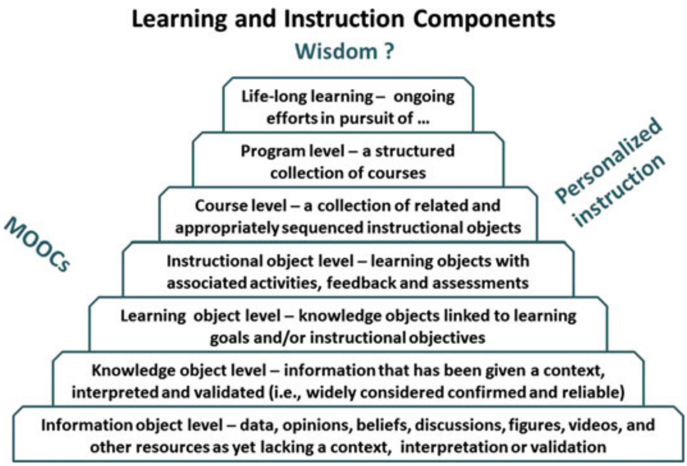

Fig. 2.1 Learning and instructional objects hierarchy

- The standards movement—this accountability movement creates expectations for what schools and teachers should do, with associated consequences; as a result, there are constraints on how innovative teachers and designers can be in embracing new approaches and technologies.
- Funding issues—federal and state funding of education has not grown much in the last 20 years in the USA, and in some cases funding has been declining; the cost of implementing new technologies and reshaping programs requires initial investments that are quite limited.
- The digital divide—integrating new technologies can put learners with limited access to those technologies at a disadvantage in their studies; the digital divide, when coupled with racial and gender issues, are serious policy challenges at every level.
- Distance education—virtual schools are appearing and traditional schools and colleges are offering more and more online courses; this creates enrollment and subsequent funding challenges, and it puts a burden on students pushed into distance learning situations who are not well prepared for the demands of those environments (e.g., success in online environments requires high degrees of self-regulation, motivation, and volition).
- Information and digital literacy—the effective use and integration of Internet-based resources requires a high degree of knowledge and skill on the part of designers, teachers and students in finding, interpreting, using and/or constructing meaningful, relevant, and reliable resources.
- Privacy, plagiarism, and Luddism—many challenges involve privacy rights and plagiarism as well as issues pertaining to work completed online without direct supervision; in addition, there are many (a.k.a Luddites) who are simply opposed to change and new technology for any number of other reasons (Ertmer and Ottenbreit-Leftwich 2010; Rogers 2003).

Another way to cluster these obstacles is in terms of (a) policy issues, (b) funding issues, and (c) expertise issues. Policy issues are perhaps the most critical in advancing progress in the area of instructional design and educational technology (Harris and Walling 2014). Policy issues are often not aligned with actual educational practices. One example of this issue now unfolding involves the Next Generation Science Standards, developed in the USA between 2010 and 2013, which are intended to emphasize understanding of the application of scientific knowledge and integration of engineering with science (see http://www.nextgenscience.org/). One of these standards for 8th grade science is to determine the factors that affect electric and magnetic forces. That standard recommends having students explore electromagnetic forces by constructing and testing an electromagnetic motor. The time allotted to teach this standard in a typical 8th grade physical science course is about a week or five 50-min lessons. The National Technology Leadership Summit (see http://ntlcoalition.org/) has been exploring this standard and its implementation in schools for 3 years and has come to the conclusion that it cannot be accomplished without substantial support (e.g., lessons and demonstrations about electromagnetic forces, an individual exercise to build a simple solenoid switch, a partially constructed electromagnetic motor followed by a small group exercise to complete the motor, test it under various conditions and explain the results of those tests). Using electricity in combination with magnetism to create mechanical movement is the technology underpinning that standard. Explaining how and why that is possible and what conditions influence the strength of the motor or switch comprise the desired science outcomes. The fact that it is yet to happen reflects a lack of alignment between a policy (in this case a national standard) and the realities of teaching and learning in a middle school in the USA. On the other hand, the new standards do reflect an approach to learning that is situated and engaging (Lave and Wenger 1991), so that standard, if properly implemented, might reflect an impact of Jasper Woodbury and CSILE.

Funding issues are the ones most often cited for lack of attainment of promised outcomes of integrating a new technology. It is generally true that limited funding limits what can be done. The researchers who create powerful educational technologies generally do so free from the funding constraints faced by educational institutions. A researcher wants to know what might be possible. Educational administrators want to know what can be done given the many constraints that exist.

There are additional challenges involving the expertise of school personnel (e.g., teachers, technicians, technology coordinators, media specialists, information systems personnel, etc.). The common thing for many educational support personnel is to do that with which they are already familiar and understand. This is not unreasonable given the reality that these people are typically quite busy and overwhelmed with existing tasks. When asked to implement something new, there is resistance, and many lack the required expertise. Training and providing professional development are then needed, but, given the funding constraints already mentioned, it becomes a challenge to train and retrain well-qualified personnel to support new educational technologies.

2.3 Conclusion

Briefly stated, the challenge facing an instructional designer is to plan, implement, test, deploy, and evaluate lessons, courses, and learning environments that are likely to be learning and cost-effective given (a) unlimited learning resources available on the Internet, (b) the power, flexibility, and mobility of available technologies, (c) the diversity of learners, and (d) ambitious learning goals and objectives. Overcoming the issues previously discussed requires recognizing a variety of learning perspectives and instructional approaches and getting those with very different backgrounds and expertise to work in unison toward reasonably well-defined and attainable goals. Rather than disparage those with different learning perspectives and instructional approaches, more could be accomplished by collaborating across various arbitrary boundaries that now divide professional practitioners (e.g., instructional designers vs. learning scientists, or direct instruction vs. open-ended inquiry).

Will instructional design and educational technologies begin to have a significant and positive impact on learning, performance, and instruction in the twenty-first century? There are some 85 years remaining to find out. Certainly policymakers, administrators, educators, researchers, and instructional designers can do better than the record established in the twentieth century. That century could be characterized as one of amazing new technologies that had little impact on systematic, systemic, large-scale sustained improvements in learning. We can do better.

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