

Design-Based Research and Educational Technology: Rethinking Technology and the Research Agenda

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ABSTRACT

The role of educational technologies in improving educational practices and outcomes has been criticized as over-hyped and insignificant. With few exceptions, the state of education has changed less than expected as a result of tools such as computers and the Internet. To a considerable degree, this is due to the minor role educational technology research plays in transforming the use of technological tools in the classroom. This article presents an analysis of technology as a process and as a value-laden system, both of which have substantial consequences to our approach to research. It is argued in the article that design-based research can address some of the deficiencies of other research methods in investigating the role of tools and techniques in the classroom. Through more democratic research practices and recognizing technology as a system beyond its tools, researchers can increase their impact on educational practice.

Keywords

Educational technology, Design-based research, Values, Methodology, Critique

“It is one thing to state the chief aim of education ... it is quite another thing to pursue this aim in a world which denies the principles on which it rests” (Jeffreys, 1955, p. 13).

Introduction

New communication, media, and computing technologies have long tantalized educators, policy-makers, and educational technologists as to their prospects for enhancing educational outcomes (Saettler, 1990). Numerous tools ranging from Edison’s film projector through Berners-Lee’s World Wide Web were originally invented for purposes other than education, but they were quickly promoted by educational technologists and others as having enormous promise for enhancing the impact of teaching and learning. Devices now considered to be simple and omnipresent in educational settings were once considered revolutionary and capable of mending social inequity and changing the face of education. For example, in the 1970s, access to handheld calculators was considered to be crucial to raising test scores for underachieving math students, and accordingly math educators and educational technologists led efforts to get calculators into the hands of children learning mathematics. However, once the access gap was closed, the results were found to be much lower than promised (Loveless & Diperna, 2000).

Educational technologies are often viewed not only as solutions to real or perceived inadequacies of traditional instruction, but also as tools for reducing the inequities in educational opportunities around the world. Light (2001) described the rhetoric of social inclusion often associated with new technologies such as cable television. Cable was promoted as a technology to improve not only educational opportunities, but also general access to information. Inequitable access in terms of race and wealth prompted policy-makers and researchers to push for equitable distribution of cable access. Clearly, cable did not achieve educational equity nor increase access to reliable and valid information, but instead is primarily used as increased bandwidth for media outlets. Much of the excitement regarding student achievement that might have been derived from cable in the classroom and other new technologies has faded into disappointment. This trend is nowhere more prevalent than with respect to today’s most heavily promoted technological solution to educational problems, the Internet.

The Internet is in danger of becoming yet another example of society’s all-too-frequent, but usually failed, infatuation with the educational potential of new technologies. Past research has shown us time and time again that, despite all the rhetoric to the contrary, educational technologies do not guarantee big leaps in educational

achievement by any measures, nor have they eliminated the inequitable distribution of learning opportunities (Cuban, 1986). However, the Internet as an educational technology can serve a much more noble and principled purpose. A new approach to educational technology research, one grounded in the *ends* of technology, directed by values and principles, must be pursued.

We argue that traditional predictive research in educational technologies has had limited impact in informing actual use. In other words, educational technology research aimed at examining the influence of tools in the educational process has offered little systematic advice to the practitioner. We argue that recognizing technology as a *process* has implications for how educational technologists conduct research. Once recognized as a process, the aims/ends of technology come to the foreground. We argue that design-based research provides an innovative proposal for research on innovation and education.

Investment and use

Governments around the world have implemented policies and made substantial funds available to deploy Internet-enabled computers in schools. The cost and maintenance of computers and online technologies in schools far exceed investments in previous technologies.

A dozen years ago, when the World Wide Web was in its infancy and other countries were still experimenting with the computer as an instructional device, the United States already had approximately 5.8 million computers in schools (Office of Technology Assessment, 1995). This trend has not faded. While Oppenheimer (2003), a journalist, calculated a 70 billion dollar “investment” in school technology, even educational researchers have estimated that more than 40 billion dollars have been spent on educational technology infrastructure and training in the past ten years (Dickard, 2003). Regardless of the actual amount, the costs are clearly enormous. Oppenheimer argued that this money should have been spent hiring 170,000 new teachers. Similar investments have been made in higher education institutions with few demonstrable benefits (Hersh & Merrow, 2005; Postman, 2003).

There is little sign that expenditures for school and campus computers are slowing down. The 2005 budget (including discretionary and mandatory appropriations) for the US Department of Education was forecasted at over 70 billion dollars, and almost 500 million were dedicated to state educational technology grants supporting technology integration into the schools (Department of Education, 2005). The same pattern of investment occurs around the world. With the aim of enhancing information and communication technology infrastructure in its schools, England committed approximately 11,200 and 65,000 pounds to each primary and secondary school, respectively, in 2003 alone. As a result, 99 percent of British schools are connected to the Internet (Department for Education and Skills, 2003). Poorer nations have followed suit. Brazil deployed over 53,000 computers in over 4,600 schools around the country as part of a federal government program for technology integration (Departamento de Informática na Educação a Distância, 2002). As demonstrated by the example of these and other countries, technology integration into education is a massive global trend.

What evidence exists that the expenditures on educational technologies such as computers and Internet access have been worthwhile? Although virtually all schools in the United States now have Internet access, recent reports of the use of computing technologies in the classroom (Cuban, 1986; Oppenheimer, 1997, 2003; see also Salomon, 2002) only reiterate what early accounts (Office of Technology Assessment, 1995) have demonstrated: educational technology has been oversold and is generally underused in classrooms around the country. There is no clear evidence of increased achievement resulting from Internet applications in education, nor

[...] has a technological revolution in teaching and learning occurred in the vast majority of American classrooms. Teachers have been infrequent and limited users of the new technologies for classroom instruction. If anything, in the midst of the swift spread of computers and the Internet to all facets of American life, “e-learning” in public schools has turned out to be word processing and Internet searches (Cuban, 2001, p. 178).

Why have we been so naïve in investing this much research time and public money in wiring the schools when past educational innovations, including films, instructional television, and programmed instruction have failed (Cuban,

1986)? What is it about the World Wide Web and other Internet technologies that entice us into believing that, this time, things will be different? It could be that the Internet as an educational delivery system is simply following the hype cycle, that is, over-enthusiasm followed by sharp disappointment with new technological tools. This cycle (found in business and everyday life as well as in education) begins with a peak of inflated expectations leading to disillusionment and finally to a plateau or realistic application. Perhaps we are simply in the midst of a period of inflated expectations that will ultimately lead to more grounded expectations (Gartner Inc., 2004; Rescher, 1980).

However, although skeptics and critics exist, many still believe in the power of the Internet and computers to change the way we teach and learn. Some believe that the online technologies can be used to foster pedagogical change, such as those who promote the constructivist pedagogy movement (see Jonassen, 1991, 2003). At the other end of the pedagogical continuum, extremists claim that the answer to the crisis in education can be solved by employing computers as tutors, without human intermediaries (Bennett, 1996; Jones, 1996) This quote from Lewis Perelman's 1992 book entitled *School's Out* exemplifies the extreme perspective:

Because of the pervasive and potent impact of HL (hyperlearning) technology, we now are experiencing the turbulent advent of an economic and social transformation more profound than the industrial revolution ... In the wake of the HL revolution, the technology called "school" and the social institution commonly thought of as "education" will be as obsolete and ultimately extinct as the dinosaurs (p. 50).

Wang and Reeves (2003) point out that many educators, as well as people in the general public, believe that computers and the Internet are simply much more powerful educational tools and cannot be compared to previous "new" technologies such as the television. Although large-scale success stories in real, school-based applications of educational technologies have been exceedingly rare (Cuban, 1986, 2001), the persistent belief that a new, more powerful technology such as the Internet will automatically change the face of education without concern for social, political, and pedagogical implications is difficult to dispel. New and more sophisticated technological devices are always being developed (such as mobile computing) and the rhetoric around their potential impact on education in popular media and even some reputable journals looms large. Abram's (2006) recent enthusiastic endorsement of iPods in education is typical:

I think that iPods and other more generic MP3 players are a bellwether technology.... To ignore iPods and their kin in the education space in 2006 is the same as ignoring the Web in 1996 or the Internet in 1986. You won't go extinct, but you won't evolve too quickly either.

If anything should have been learned from research in the field of educational technology by researchers and practitioners alike, it is that a tool itself will not change the educational system or even implicitly encourage new pedagogy. If the Internet and computers are going to reach their much-lauded potential as truly revolutionary tools, then something fundamental in the way educational technology research is done must change — and we believe this can occur. First, this change requires a shift in our concept of technology. Technology is much more than hardware. It is a process that involves the complex interactions of human, social, and cultural factors as well as the technical aspects. Second, it requires new directions in research goals, moving away from traditional predictive methods to long-term collaborations based on development goals.

Connecting education, research, and the technological condition

We argue that educational researchers of all areas should be encouraged to move towards more systematic and collaborative methods of investigation that can promote research that makes a difference. In order to promote this agenda, two things must inform research in educational technology: first, an understanding of technology and technique as processes rather than artifacts; second, a resolute concern for the values, and principles guiding educational technology research. What Winner (1993/2003) says about social constructivists well describes most of the predictive research into educational technologies at the present:

... this perspective does not explore or in any way call into question the basic commitments and projects of modern technological society. The attitude of social constructivists seems to be that it is enough to provide

clearer, well-nuanced explanations of technological development...there is something very important missing here; namely, a general position on the social and technological patterns under study (p. 241).

Much research in educational technology still ignores the complex interaction between technological interventions, the roles of educational institutions such as schools and universities, the purposes of education, and the meaning of research. Many educational technology researchers adhere to a value-free discourse regarding the role of technology. There is a spotlight on the value of technology only to the extent that it has, or does not have an effect on learning-related variables. Indeed, it almost seems that many educational technologists have taken technological determinism as a given, and are simply trying to make the best of what is thrown at them by forces beyond their control. This positions educational technology researchers and practitioners at the end of the technological process, continuously testing new devices based on educational values that are not necessarily laudable.

If technology is recognized as a process rather than a mere artifact, then two things occur. First, researchers must begin to question their research methods due to the complexity of the environment under study. Investigations of how a “tool” does or does not affect educational outcomes are too simplistic. Second, researchers must question the values that are guiding research agendas, actively engaging with practitioners in constructing what constitutes valuable research in order to help direct technological development rather than react to it. We explore these two concerns in more detail below, followed by a discussion on how design-based research methods address these issues.

Defining technology

Most educational technologists would accept the proposition that integrating technologies into an educational context is a complex task, partially because there are many stakeholders with differing respective values and interests. Fewer may be willing to concede that the Internet in itself is value laden. One could argue that computers and the Internet are inherently apolitical and value-free. After all, how could a computer promote any particular world-view? A device has no particular bias — it is up to humans to decide what purpose it should serve (for a discussion, see Pitt, 1987).

At this juncture, it becomes important to differentiate between the popular use of the term *technology*, and a more robust and accurate representation. The word is commonly used in the field of instructional and educational technologies to refer to electronic tools or devices such as the calculator, television, and the computer. This view of technology as a device prescribes educational technologists with a comfortable, albeit false, level of control and an easy, but ultimately inadequate, unit of analysis in their research pursuits.

This limited view of technology must be challenged at the definitional level. Technology is not a product and instead is a process: tools are merely a product of a technological system. A more inclusive definition of the term is offered by Hickman (2001), who uses Dewey’s pragmatism to describe technology as a process that involves the “invention, development, and cognitive deployment of tools and other artifacts, brought to bear on raw materials and intermediate stock parts, with a view to the resolution of perceived problems” (p. 26). While it might be broad in scope, it does well in describing the job that researchers and practitioners in educational technology regularly do: inquiry into techniques and tools in an effort to improve and refine the process of teaching and learning and, consequently, the design of learning environments.

The technological system is concerned with uncovering knowledge and information in so much as it leads to doing. These processes are planned, and the products that result from them are not the result of coincidence, though consequences might be unexpected. Technology can be seen as deterministic or as subservient to some other agent’s (human) control. While few would blindly ascribe to technological determinism, many naively assume the complete authority of man over the technological system (Ellul, 1980). One could create a parallel between this differentiation within educational technology research considering the distinction between types of “basic” and “applied” research, which differ based on the level of pragmatism involved in the research process (Hannafin, 2005; Reeves, 1995).

What is important here is to recognize that because of its pragmatic nature, technology cannot be considered to be value-free once it is recognized as both a process and a practice. As Ellul (1980/2003) contends, we cannot expect application to be judged as good or bad if we as researchers, from the onset, ignore the merits of moral judgment

within the research process. We maintain that educational technologists should not continue to simply investigate the impact or describe “best cases” in *post facto* applications of technological devices. This position makes them simply part of this technological system (Heidegger, 1977/2004), perpetually testing the appropriate uses of new technological devices in education.

More often than not, developments that occur outside of the educational arena are examined for educational affordances — in other words, attempting to examine the educational benefits of a new tool. There is nothing inherently wrong with the testing of new tools and techniques. Indeed, as noted earlier, that is much of what educational technology research does. Misguidance occurs as researchers get caught in a cycle of research without contemplating the merits of the investigation and the values implied by the tool or technique being used. Evidence of this trend can be seen in fifty-plus years of media comparison studies conducted by educational technology researchers to examine the influence of devices on educational achievement, with the most frequent result being “no significant differences” (Clark, 1983; Reeves, Herrington, & Oliver, 2004).

That educational technology is not value- or culture-free may be a hard proposition for some to accept. Neither education nor technology is neutral and unbiased (Freire, 1985; Hlynka, 2003). Their conception and application are guided by and provide guidance for political processes that are not necessarily grounded in principles that promote social good. Educational technologies are intricately connected with political agendas, economic gains, and social needs and consequences. Because of this, educational technologists should not be purveyors of “treatments” as if these devices and techniques were unbiased and value neutral. Computers and Internet access in schools are products of governmental policies that demand them (Department of Education, 1996, 2000), corporations that produce them, and numerous people who are often misinformed or ignorant about their purpose in education.

As part of the intricate socio-technical system that promotes the use of computers and other devices in education, educational technologists must begin to question and influence the *a priori* integration of these devices based on an investigation of its ends. As Borgmann (1984/2004) has discussed, the technological system upholds the division of ends and means. This is no different in education. Educational technologists are frequently more concerned with the possibilities of using a new technology (means), such as a newer course management system or the hottest wireless device, than seriously considering the ultimate aims of its use and its consequences.

As actors in the technological movement, educational researchers must take a critical stance towards technological development. Many of these concerns could be addressed by a serious media and technology literacy movement, but this has failed to develop into a cohesive effort in most schools (Amiel, 2006; ITEA, 2000; Petrina, 2000).

What is missing from the extant research in educational technology are questions of principle and value in regard to technological development. Hence, there is a need to add axiology (questions of quality or value) to the epistemology-theory-methodology-method thread that forms the basis of our educational inquiry (see Crotty, 1998). Design-based research calls for practitioners and researchers to engage in long-term collaborations (Reeves et al., 2004). It is necessary but not sufficient to connect research methods to compatible theoretical perspectives and epistemologies. Once a pedagogical stance is taken and we align it to a “way of knowing” (epistemology), then we must evaluate the *why* of what we want to know. The process of knowing in educational technology research is not disconnected from practice, and therefore implies change.

Far too often, researchers are tempted to adapt the educational environment to a new technique or device. For example, research using cell phones (music players, projection devices) in the classroom might have the noble objective of fostering better teaching and learning. But *better* is a value that must be disclosed. What does better teaching mean for the researcher and practitioner? To what end is this project being conducted? What are possible negative consequences? There should be clearer educational principles and foundations guiding the project, which then might demand a technological solution.

From the onset of any project, researchers into the field of educational technology must evaluate the principles that guide their research projects and the values that are promoted by their agendas. Researchers must not blindly accept the inherent values associated with technological development, and instead should seriously consider the nature of value in their practice (Koetting & Malisa, 2004). Gone unquestioned, the values promoted by the technological process are clear. Technology mediated by powerful interest groups is based on and promotes efficiency, speed, control, and reliability — values that primarily emphasize economic utility.

More often than not, the implementation of new technologies aims at making processes more efficient or more flexible, which is not necessarily valuable in its own right. Surely if research intends to effect change, we must realize that education is not simply about increasing the efficiency in the acquisition of knowledge and skills. As Postman (1995) has highlighted, “any education that is mainly about economic utility is far too limited to be useful, and in any case, so diminishes the world that it mocks one’s humanity” (p. 31). What values could be more exemplary of economic utility than the efficiency, speed, control, and reliability evidenced in the technological system? This conundrum indicates that researchers must find avenues to pursue valuable ends to the interventions they conduct in the name of education. We discuss the potential of design-based research as a framework to help us ask the right questions in educational technology research. This framework, which is based on meaningful practitioner-researcher connections from the onset of a research program, has the potential to address the issues highlighted above and guide the use of techniques and tools in education.

Potential of design-based research

Design-based research (similar approaches have been termed design research, development research, and others) has recently received considerable attention by researchers in education as an emerging framework that can guide better educational research (Van den Akker, Gravemeijer, McKenney, & Nieveen, 2006; Brown, 1992; Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Design-Based Research Collective, 2003). Reeves (2006) outlines three cornerstone principles of this research framework:

“... addressing complex problems in real contexts in collaboration with practitioners; integrating known and hypothetical design principles with technological advances to render plausible solutions to these complex problems; and conducting rigorous and reflective inquiry to test and refine innovative learning environments as well as to define new design principles” (p. 58).

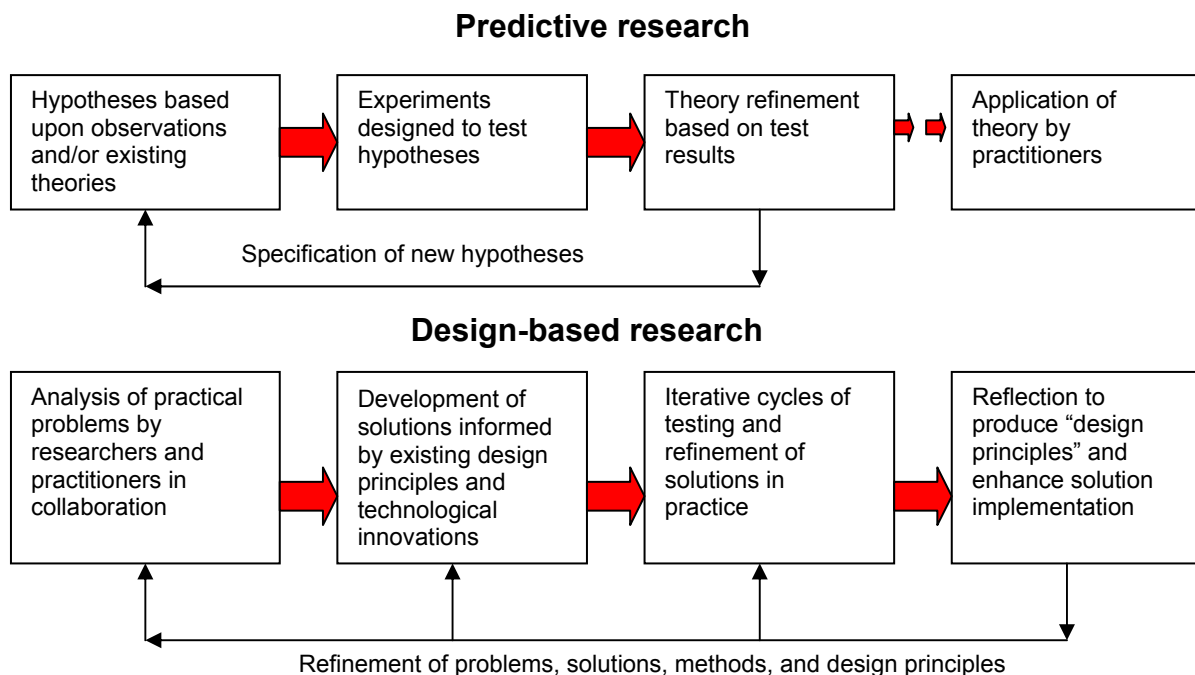


Figure 1. Predictive versus design-based research

The ultimate goal of design-based research to build a stronger connection between educational research and real-world problems. An emphasis is placed on an iterative research process that does not just evaluate an innovative product or intervention, but systematically attempts to refine the innovation while also producing design principles

that can guide similar research and development endeavors. This results in a cycle of research that is markedly different from what is currently pursued by many researchers in the field (Figure 1). In traditional empirical predictive research, a new technique or device is put to the test in a controlled environment. The time of engagement with the “stimulus” is usually limited because of time constraints. Iterations are encouraged in order to refine hypotheses, but commitment to iterative design is usually limited (one-shot studies).

Finally, researchers rarely engage directly with practitioners in the design process and, if this is done, participation is limited and occurs outside of the domain of practice. Practitioners are rarely part of the research design process, and are meant to reap the benefits of research when it is complete.

In contrast, we suggest that design-based research begin with the negotiation of research goals between practitioners and researchers (Figure 1). The practitioner is seen as a valuable partner in establishing research questions and identifying problems that merit investigation. Next, a design for the learning environment is proposed to address the concerns. This design could be a new set of strategies or it could be based on research gathered from previously tested design principles. The design-based researcher is humble in approaching research by recognizing the complexity of interactions that occur in real-world environments and the contextual limitations of proposed designs. The development of design principles will undergo a series of testing and refinement cycles. Data is collected systematically in order to re-define the problems, possible solutions, and the principles that might best address them. As data is re-examined and reflected upon, new designs are created and implemented, producing a continuous cycle of design-reflection-design. The outcomes of design-based research are a set of design principles or guidelines derived empirically and richly described, which can be implemented by others interested in studying similar settings and concerns. While the ultimate objective is the development of theory, this might only occur after long-term engagement and multiple design investigations.

While the methods used to conduct design-based research are not new, the intentions and lifecycle proposed by its framework are certainly in a unique position to address the complexities inherent in educational technology research. Critiques and analyses of design-based research have been postulated by others and are beyond the scope of this paper. Our focus is on the contribution of design-based research in studying the complexity of technology as a process and shaping the question of value of research by establishing relationships between practitioners and researchers.

How does a new research framework such as design-based research address the conception of technology as a process and the issue of value in educational technology research? Five characteristics of design-based research identified by Van den Akker et al. (2006) will be examined to address this question. They are as follows: interventionist, iterative, process oriented, utility oriented, and theory oriented.

The understanding of technology as a process greatly increases the complexity of the integration of tools into educational environments. Educational technologies become more than simply an independent variable in a study of student learning. Integrating technologies into the classroom leads to substantial changes in social organization, student-teacher relationships, and a myriad of other factors that cannot be investigated successfully by predictive research. Researchers must make a commitment to conducting interventionist research in real-world contexts such as schools, accepting the complexity of the setting. As Kafai (2005) contends, schools can become “living laboratories” in which researchers investigate in real-world settings while attempting to control for critical variables identified through theory and previous research.

Still, the sheer number of variables is indeed so many that one-shot studies of impact would lead to very limited insight. Design-based research calls for iterative cycles of study that lead to a better understanding of the process of intervention (process oriented). Indeed it would be idealistic to expect significant and transferable results from a one-time study of a technological intervention. Using iterative cycles of design and re-design allows for the investigation of these critical variables and limitations, generating more transferable and useful results.

Nelson, Ketelhut, Clarke, Bowman, and Dede (2005) describe this process in the design of a multi-user virtual environment called River City, used to teach children about water pollution. They tested multiple iterations of design with a variety of different groups of children while making systematic changes to certain aspects of design and documenting its effects. Multiple iterations allowed for design changes and testing with a variety of groups, lending greater transferability to the design itself. If enough designs are implemented and evaluated systematically, the

designs themselves have the potential to contribute to, or generate theory or conjectures (for a critique of the issue see Kelly, 2004). Barab, Arici, and Jackson (2005) describe the development of learning engagement theory as part of the design of Quest Atlantis, an immersive online environment. Systematic investigation of design factors over a sustained period of time allowed for a theory of engagement to emerge. This theory has particular value since it emerged from design within the ecology of school, as opposed to being generated in more sterile or controlled conditions.

Finally, the strong commitment to intervention in real-world settings and its orientation towards utility bring forward the concern with values in educational technology research. As a principle, design-based research advocates for practitioner-researcher partnerships. If taken seriously, such partnerships have strong implications for the position and power of educational technology researchers.

Technology can be seen as an autonomous phenomenon that perpetuates and promotes itself, subordinating political decisions to an on-going cycle in search of better and more efficient ways. Feenberg (2002, 2003) rejects the perspective that technology is inherently autonomous, suggesting instead that the technological system is historically serving the needs of a particular hegemony. In order to break with the hegemony, Ellul (1992) calls for a revisiting of the type of democratic institution that renews the power of individuals in guiding their public and private lives (see also Hickman, 2001). Here, Ellul (1992) makes a clear and strong connection between education and democracy in a technological society, arguing that the public “must be given information that allows for free decisions, not ones based solely upon a menu of options served up by technicians” (p. 44). Hickman (2001) expands on this view, arguing that a Deweyan take on technology would promote the education of citizens to encourage their involvement in the deliberation of the design and implementation of technological tools as well as the research that informs their application. This process would lead to a more balanced collaborative deliberation between experts and non-experts inquiring into societal tribulations. In order to make and interpret these decisions, dialogue and discussion are necessary.

Let us bring this debate into the realm of educational technology research, seeing school as a microcosm of society. Debate and dialogue in decision-making are fundamental to a democratic society and democratic practice (Parker, 1996), why should this be any different in the realm of research? This brings forward the necessity of recognizing the voice of practitioners as invaluable to the design process. Researchers should not see themselves as external technocrats, bringing solutions to envisioned school problems. The issues addressed by educational researchers in school must emerge from the school itself through its constituents. These problems must be negotiated between school members and researchers. It is important to highlight that this is not a reversal of directionality. As Dede (2005) points out, there is an important balance as to what practitioners consider to be pressing issues, and what researchers (and research) have identified as problems. This conflict of values and ideas opens up a valuable space for debate. Teachers become active partners in identifying priorities for research and contributors throughout the research process itself. Proponents of action research have long recognized the importance of the teacher/practitioner in research. Design-based research brings this framework into its fold, and adds the possibility of not only solving the practice-oriented problems addressed by action research, but also identifying reusable design principles.

The introduction of cooperation between researchers and practitioners at an early stage of research is a unique approach to improving both the value of educational technology research and its potential to direct technological development in schools. The reality check of engaging directly with practitioners and school environments has the potential to eliminate much research that is not valuable or socially responsible. Design-based research does not in itself demand a particular agenda for research. While researchers or teachers could ask irrelevant questions, having a serious negotiation and debate over the research agenda greatly increases the possibility that the right questions will be asked — questions that will lead to research that produces useful and applicable knowledge addressing the needs of teachers. The concerns of practitioners, if given full consideration, rarely address irrelevant issues. The job of researchers and practitioners is to cooperatively negotiate what is worthy to investigate. This negotiation in turn can help eliminate the type of studies that investigate the “affordances” of devices for the sake of novelty. The attempt to begin research on a new tool can be critically assessed through the constraints of a real-world environment and the voice of the practitioners who can help evaluate the usefulness of such tools. Cycles of design informed by real-world scenarios can help clearly identify which interventions merit adoption and in which contexts this should occur. Considering that research should help decide on adoption patterns for educational technology in schools, researchers would have an active role within the technological system, helping direct the development and acceptance of new tools and techniques.

For example, Amiel, McClendon, and Orey (2007) describe a four-year program in which researchers engaged directly with schoolteachers in Brazil and the United States. Teachers, pre-service teachers, and researchers collaborated in the design of learning environments. Researchers were interested in promoting cross-national dialogue and discussion on all areas of the curriculum as part of a democratic education framework by connecting public schools in both countries through internet-based technologies. Within this broad research and practice agenda, the concerns of schoolteachers were starting points for month-long discussions on how and why these connections would take place. The “give and take” of researchers and practitioners set the scope for what would be implemented. The dialogue and discussion between stakeholders, a cornerstone of democratic practice, is too often missing from the agenda in educational technology research. As a result of this study, Amiel, McClendon, and Orey (2007) present a model of collaboration that can occur in projects involving university staff, students, and public schools across national borders. This model evolved over time and was the product of multiple project iterations. It is by no means a theory of collaboration but a conjecture (see Kelly, 2004) or design principle that will evolve and mature over time.

Conclusion

The aforementioned call for design-based research presents educational researchers with a conundrum: if we persist in believing in education and technology as value-free, we should not attempt to engage in design-based research and should instead resign ourselves to perpetuating research that effects no systematic change. We may hide our lack of concern for impact behind the veil of academic freedom. But if the case for the new design-based methodologies is sound, then research and practice can become intertwined, and as a result, it becomes impractical and indeed *ungrounded* to promote the kinds of impartial, unengaged research that dominates the published literature.

Researchers in the field of educational technology can begin to look away from the short-term objectives of their individual projects. In order to escape the anti-humanistic values often promoted by technological development, educational technologists must recognize the transformational potential of their profession. A primary responsibility of researchers in the field should be to limit their investigation of means and contemplate educational ends or aims, making them explicit in the process of an investigation.

Design-based research provides a cycle that promotes the reflective and long-term foundation upon which such research can be undertaken. Educational technology researchers should be concerned with examining the technological process as it unfolds in schools and universities and its relationship to larger society. By carefully considering their ends and selecting an appropriate methodology, researchers in our field will be better prepared to determine their values, make their agendas explicit, and promote democratic practice.

This pursuit of socially responsible research may be more important than ever. We live in an age when a U.S. president issues his first veto in five years to ban funding for embryonic stem cell research, surrounded by children born from “rescued” embryos, ignoring the fact that none of the children would have been born without the contributions of earlier generations of embryonic researchers. We live in a world of melting glaciers and rising seas, when more people appear to believe in angels and ghosts than in global warming. Is it too simplistic to suggest that educational technology researchers might have a role in combating such global ignorance? Perhaps so. But we think not.

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