

# **Beyond the foundations: The role of vision and belief in teachers' preparation for integration of technology**

Peter R. Albion, University of Southern Queensland, Australia

Peggy A. Ertmer, Purdue University, USA

The foundations for the successful adoption and use of information technology, including a favorable policy environment, access to technology, and suitably skilled teachers, are rapidly becoming reality (Education Week, 2001). Nevertheless, the impact of technology on schooling has been fairly limited.

Using data from a study of 4000 teachers in 1100 schools across the U.S., Becker (2000) concluded that computers have not transformed the teaching practices of a majority of teachers but where teachers have the necessary computing skills, some freedom in the curriculum, convenient access to equipment, and personal philosophical beliefs supporting constructivist pedagogy, computers can be valuable instructional tools. There is now clear evidence that teachers with more constructivist philosophical beliefs use computers more frequently, in more challenging ways, and have greater technical expertise (Becker, 2001).

Substantial progress has been made towards providing teachers with access to equipment and essential skills. Moreover, where necessary, policy makers and administrators at all levels can provide for improved access to equipment, skills development for teachers, and freedom to innovate curriculum in the classroom. However, the personal philosophical beliefs of teachers are less easily changed and deserve consideration as a critical influence on the successful integration of technology. According to the Office of Educational Research and Improvement (1993) teachers are not motivated to tackle the challenges of integrating technology unless they have a vision for how it will improve teaching and learning. Thus, if our efforts to extend the

educational applications of technology are to be successful, it is important to understand how such visions and beliefs are both formed and transformed.

### Beliefs and Teacher Behavior

The significance of beliefs for understanding human behavior is well established. In a review of the research on teachers' beliefs, Pajares (1992) cited several sources supporting the assumption that "beliefs are the best indicators of the decisions individuals make throughout their lives" (p. 307) and noted strong relationships among teachers' beliefs and their planning, instructional decisions, and classroom practices. He expressed the view that beliefs are "far more influential than knowledge in determining how individuals organize and define tasks and problems and are stronger predictors of behavior" (p. 311). Kagan (1992) noted that teachers' beliefs appear to lie at the heart of teaching and tend to be associated with a congruent style of teaching. Hence, changes to teaching style, as might be required by working with technology, may necessitate changes to teachers' beliefs, which Kagan described as stable and resistant to change.

The potency of beliefs as an influence on behavior is inherently related to the nature of beliefs, as outlined by Nespor (1987). Among other characteristics, Nespor described beliefs as relying upon episodic memory, organized in terms of personal experience, and as being "unbounded," that is, readily extended to apply to phenomena that may be unrelated to the context in which they were formed. Nespor argued that teachers frequently encounter ill-structured problems, for which there are large amounts of information available and no single correct solution. In such contexts, the episodic and unbounded nature of beliefs makes it possible to apply them flexibly to new problems. Moreover, the nonconsensual nature of beliefs makes them relatively immune to contradiction.

Different beliefs held by individuals will exhibit varying degrees of resistance to change. Rokeach (1972) described belief systems as comprising five types of beliefs ordered along a central-peripheral dimension (see Figure 1). At the central end are Type A beliefs, that is, core beliefs that are formed through personal experience, reinforced through social consensus, and thus, most resistant to change. Closer to the peripheral end of the continuum are Type D beliefs, which are derived from the authorities in which we believe and which can be changed, providing the suggestion for change comes from the relevant authority. Finally, Type E beliefs are located at the peripheral end and include inconsequential beliefs that are essentially matters of taste. Rokeach did not specifically address teachers' beliefs about teaching but it would not be surprising if at least some beliefs about the nature of teaching are formed over many years of experience as a student and are resistant to change because they have been supported by strong authority and broad consensus.

Insert Figure 1 about here

Although a broad spectrum of beliefs may influence behavior in any particular context, Bandura (1997) argued that beliefs of personal efficacy, that is, "beliefs in one's capabilities to organize and execute the courses of action required to produce given attainments," are the key factor of human agency (p. 3). In this view, even if a teacher believes in the value of integrating technology within a constructivist approach, he or she may be dissuaded from attempting it if belief in the personal capacity to implement the change is not strong.

### Changing Teachers' Beliefs

In reviewing the research on changing teachers' beliefs, Murphy (2000) noted that it was a complex process because beliefs appear to be static, resistant to change, and generally not affected by reading and applying research. Pajares (1992) noted that change is easiest for new

beliefs and that “change in beliefs follows, rather than precedes, change in behavior” (p. 321).

This suggests then, that teachers’ practice (e.g., use of technology) may actually lead to changes in beliefs about teaching. Similarly, Kagan (1992) proposed that teachers form the ideas on which their beliefs are based from practice, both their own and that of their peers, rather than through reading and applying research.

These findings are consistent with the close coupling between beliefs and personal experience as suggested by the theories about the nature of beliefs (Rokeach, 1972; Nespor, 1987). If beliefs are formed and developed through personal experience then it seems logical that changes in beliefs should also be effected through experience. Nespor (1987) argued that instructional change is not a matter of abandoning beliefs, but of gradually replacing them with more relevant beliefs, which Dwyer, Ringstaff, and Sandholtz (1990) suggested are shaped by experiences in an altered context.

Self-efficacy theory (Bandura, 1997) identifies four influences on the development of self-efficacy of which the strongest is personal success in the relevant domain, followed by vicarious experiences, which allow comparison with the attainments of others. The relationship of these influences to theories of beliefs as grounded in experience and authority (Rokeach, 1972; Nespor, 1987) is apparent. (The other two influences on personal self-efficacy, social persuasion and physiological responses, are of less relevance to this discussion.)

### Teachers’ Beliefs about Teaching with Technology

There is compelling evidence of an association between technology use and constructivist beliefs (Honey & Moeller, 1990; Becker, 2000, 2001), even to the point of increased technology use and adoption of constructivist practices occurring together (Sandholtz, Ringstaff, & Dwyer, 2000). However, it is not clear that technology *causes* teachers to adopt constructivist beliefs.

Dexter, Anderson, and Becker (1999) found no support for the view that computers are a catalyst for instructional change and concluded that the view of computer as catalyst underestimates the impact of teachers' beliefs on how they teach, simplifies the processes of professional growth, and diverts attention from examination of how social norms and structures influence change. In their view, if teachers decide to use the computer in a constructivist manner, they do so, not because of features inherent in the technology, but on the basis of their knowledge and expertise.

The importance of a social network of computer-using teachers for sustaining the work of exemplary computer-using teachers has also been reported (Becker, 1994). In one study, the only variable found to be a significant predictor of teachers' computer use was "subjective norms," that is, "expectations of computer use from among teachers' significant others – principals, colleagues, students, and the profession" (Marcinkiewicz, 1994, p. 522). In a more recent study, Lumpe and Chambers (2001) found that teachers' reported use of technology-related engaged learning practices was influenced by their self-efficacy for teaching with computers and their context beliefs about factors that would enable them to be effective teachers and the likelihood of those factors occurring in their schools.

These studies point to the importance of the school environment as an influence on how teachers' beliefs about technology use will be developed and implemented. A recent study of three teachers learning to use technology in the context of a laptop program found that the ways in which they learned to integrate technology were "powerfully mediated by their interrelated belief systems about learners in schools, about what constituted 'good teaching' in the context of the institutional culture, and about the role of technology in students' lives" (Windschitl & Sahl, 2002, p. 165). According to one teacher, "What made the process of learning how to use the laptop so challenging was conceiving of the intersection between the technology, the curriculum,

and classroom management without ‘knowing what a laptop-equipped classroom looked like’” (p. 178).

Teachers’ beliefs about teaching are likely formed through personal experience over many years, first as a student, and later as a teacher. They are also likely to be reinforced by consensus of their professional peers and by the expectations of learners in their classrooms. Moreover, the working conditions of many teachers restrict their opportunities for observing alternative classroom practices. Thus, teachers’ beliefs about teaching are resistant to change. However, as indicated by theory and research outlined above, effecting changes may be accomplished by providing teachers with alternative visions of what teaching with technology looks like and opportunities to experience alternative approaches in supportive contexts.

Perhaps the ideal way to achieve these conditions would include opportunities for teachers to observe peers working with technology and access to mentors or coaching support as they implement changes in their own teaching. Unfortunately, such ideal conditions are seldom achieved. Suitable models for observation are not widely available and, even when they are, releasing teachers from their own classrooms for observation is expensive and disruptive of schools. Even when suitable support is available in their schools, teachers may be reluctant to initiate changes in their routines for fear of disadvantaging their students. Approaches are needed that expose teachers to alternative visions of teaching and offer them the opportunity to test their ideas without risk to the progress of their students. Creative applications of technology may have a significant role to play in providing the experiences that can help change teachers’ beliefs. In the next section, we describe two approaches that appear to offer promising results.

## Using Technology to Affect Change in Teachers' Visions and Beliefs

Ertmer and Albion, in separate studies, have developed and evaluated the use of multimedia materials to increase teachers' ideas and beliefs about teaching with technology. Ertmer and her colleagues (Ertmer, Conklin, Lewandowski, Osika, Selo, & Wignall, in press) examined whether electronic models of exemplary technology-using teachers could provide a viable method for developing pre-service teachers' ideas about and self-efficacy for technology integration. Sixty-nine students, enrolled in a one-credit technology course, completed demographic and online survey instruments before and after interacting with VisionQuest, a CD-ROM teacher development tool (Ertmer, 2001) that featured six teachers' classroom technology visions, beliefs, and practices. Results indicated a significant increase in participants' ideas about and self-efficacy for technology integration. From an instructor's perspective, electronic models can have a positive impact on the authentic nature of a course and simultaneously increase the confidence and integration beliefs of students. Based on the results of this study, this type of modeling appears to help pre-service teachers develop a vision for what technology integration looks like in real classrooms as well as strategies for implementing those visions.

Albion (2000) described the development and evaluation of multimedia materials intended to increase pre-service teachers' self-efficacy beliefs for teaching with technology. The materials comprised a set of four problem-based scenarios, each presented as a series of tasks, some with interactive simulations, and a collection of relevant resources. Sample solutions prepared by a group of six practicing teachers were included together with video clips of the same teachers talking about their use of computers. The materials were evaluated in use with a group of 24, final year, pre-service teachers in a Queensland university. Participants in the trials reported that the materials were engaging and assisted their learning about integrating computers in their

teaching. Compared to a control group ( $n = 27$ ), a statistically significant increase in self-efficacy for teaching with computers was found for participants who worked with the materials and who had initially low self-efficacy for teaching with computers. Other data confirmed that users had changed conceptions of how technology could be integrated into their teaching.

Each of these projects was developed in light of the theory and research described in this paper. They have been designed to include material that represents the experiences of real teachers who use technology in their own classrooms and to present those experiences in a context that makes clear its complexity and particularity. In each case the response of users has been very positive about the opportunities afforded them by the multimedia materials to share something of the experience of real teachers. Each of these projects has achieved some degree of success in assisting teachers to obtain different views of technology integration and to adjust their own beliefs about teaching and learning in ways that should assist them to use technology more confidently and effectively in their own classrooms. However, much work remains to be done in regards to both *acknowledging* the role that beliefs play in the integration process as well as *assisting* teachers to adapt their beliefs to accommodate technology in the classroom. Yet, providing opportunities for teachers to examine, via multimedia case studies, the beliefs and practices of exemplary technology-using teachers offers a promising starting point.

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## Author Bios

Peter Albion was a teacher and administrator in Queensland schools for 17 years before joining USQ in 1991. He currently teaches and conducts research in areas related to classroom integration of technology.

Peter can be reached at:

Dr Peter Albion  
Faculty of Education  
University of Southern Queensland  
TOOWOOMBA, Q, 4350  
Australia

After teaching elementary and special education students for 10 years, Peg Ertmer now teaches educational technology and instructional design students at Purdue University. Her research focuses on facilitating student-centered learning through the use of case-based instruction, technology integration, and self-regulation learning strategies.

Peg can be reached at:

Dr. Peg Ertmer  
Purdue University  
Department of Curriculum and Instruction  
1442 BRNG  
West Lafayette, IN 47907-1442