Prospects for Instructional Design and Teacher Education

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Abstract

With most academic instructional design and technology (IDT) degree programs located within education units in higher education, teacher education is a focal point for research on the classroom teacher as instructional designer and implementer of technology in K-12. Further, teacher education serves as a locus for modelling and testing theory-based teaching practice arising from the discipline. This review examines the historical foundations and recent scholarship in teacher education from an instructional design and technology perspective in US and international contexts, providing a lens to the issues of theory versus practice and evolving research paradigms. Research areas reviewed include teacher thinking and planning, novice versus expert teacher differences, the use of systematic instructional design in classroom practices, and the teacher as designer of instructional materials. Changing research approaches and constructivist philosophies have widened the understanding of teacher instructional planning and action from earlier process–product causation to a more complex, situated view of practice. From an examination of the uneasy relationship between the two disciplines, prospects for future cooperation and research are explored in terms of theory building, impacts on training, debates on the nature of design practice, and potential for shaping educational reform efforts.

Keywords

Teacher education • Preservice teachers • Lesson planning • Instructional systems design

Introduction

For over half a century, scholars in instructional design and technology (IDT) have proposed that the field has significant contributions to make to improving public education, arguing that creating more efficient and effective instruction could result from application of evidence-based principles and processes of instructional design (ID) widely used in other organizational settings. The education of classroom teachers has historically been proposed as a mechanism for school improvement by increasing teachers' skills in designing "instructional materials and programs" (Salisbury, 1987, p. 3). Among the approaches to introducing ID in teacher education are graduate programs in IDT in the USA which commonly require instructional design courses taken by teachers and preservice teacher technology courses that include ID. The use of textbooks on lesson planning based on instructional design written specifically for teachers has a long tradition (Carr-Chelman, 2011; Reiser & Dick, 1996; Shambaugh & Magliaro, 2006). While much of the literature on instructional design and schools originates in the USA, reformers in other nations have also looked to ID as a way to understand and impact teaching practice as is detailed below.

The "teacher as designer" role is one that Norton and her coauthors (2009) observe is fundamental but less visible than

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that of the school teacher directing classroom instruction and interacting with students.

> The teacher as designer recognizes the centrality of planning, structuring, provisioning, and orchestrating learning. While the role of designer may be the least observed and recognized teacher role, the intellectual analysis of construction of learning opportunities for students underpins all robust and worthwhile K-12 learning opportunities…. Thus, teachers are and ought to be designers. And they must come to understand that they are designers and learn theories and principles that guide their ability to create designs that promote opportunities to learn. (p. 53)

Studies on what teachers do in their classrooms and why in relation to the design and implementation of instruction have been shaped by larger trends in educational research, including changing epistemologies, acceptance of a wider range of research methods, new understandings of learning in cognitive psychology, and the differing purposes of the researcher(s) conducting the study (Lagemann, 2000; Rosiek & Atkinson, 2005; Willis, 2008; Zeichner, 1999). Parallel areas of current concern such as practice versus theory, expertise, training, and school reform underscore research directions by which both teacher education and IDT might benefit through greater cross-disciplinary efforts.

In the following review, the focus is on instructional design in teaching in primary and secondary schools, and on teacher education as the context in which teachers are trained in instructional planning and implementation both initially and through graduate and professional development programs. The chapter highlights instructional design scholarship within an explicit instructional context—one that represents the largest formal educational endeavor in the world. While the studies in this chapter are international in scope, the review is limited to works published in English and therefore may not fully cover unique efforts in non-English speaking locales. In addition, numerous studies are published on technology in schools, but these are reported only when the research involves design of instruction more generally. Other chapters in this Handbook cover schools and technology integration in greater detail.

Research on Teacher Thinking and Planning

Just as instructional systems design grew from a period of increased emphasis on rational and scientifically based approaches in education to produce efficient and effective instruction, instructional planning in schools took a similar approach primarily based on objectives-first lesson planning as proposed by Robert W. Tyler in the 1940s and 1950s (Friesen, 2010; Molenda, 2009; Reiser, 2001; Wiburg, 1995). While early systematic ID frameworks and models were being explored by Robert Gagne and others in the 1960s, public schools widely adopted the related cognitively inspired mastery-based learning of the Madeline Hunter method (Hunter, 1967; Schrock & Byrd, 1987). Concerns with the Hunter method emerged when studies in the late 1970s found that teachers using it for lesson planning were no more effective or perhaps even less effective than those who did not use the Hunter method (Hunter, 1985; Slavin, 1989). Further, the findings were accompanied by widespread complaints from teachers about the time and effort this method required when dictated by school administrators, so the Hunter method faded from use. Despite decreased support by the educational establishment, the Hunter objectives-first model continued to be taught in some teacher education programs into the 1990s and recent texts on its use remain in print (Hunter & Hunter, 2004; Marzano, 2007).

Process–Product Research Foundations for Classroom Studies

Research on teaching into the 1970s was dominated by the "process–product" approach of attempting to identify characteristics such as training background and use of particular instructional techniques of expert teachers who produced high levels of student achievement (Borko & Shavelson, 1990). Based in a positivistic research tradition, the studies were focused on measurable variables, including observational data from objective outside observers counting particular instructional actions, along with demographic statistics such as gender, education, age, years of teaching, and other traits directly related to the teacher. Environmental and student characteristics were uncommon considerations in these studies which focused on teacher behavior and background and often examined teaching in laboratory or simulated settings. Underlying such studies are assumptions about the central role of the teacher in classrooms and a transmission model of instruction in which the teacher is the primary purveyor of learning. Understanding what teachers do in classrooms was therefore viewed as the prime causal determinant of the potential for students to accomplish content learning and the context for how planning is designed and implemented. As Cohen, Raudenbush, and Ball (2003) note, this type of causative study focused solely on teachers continues at present pushed by policy-makers seeking ready solutions to the complex problems of school reform, and is further confounded by an assumption that presence of resources is equivalent to classroom use.

Examples of research on teacher planning and design of instruction from the early process–product period include studies by Taylor (1970), who examined course plans from over 250 British secondary teachers, and Zahorik (1975), who studied teachers from a US urban area. Other studies employed experimental methods, setting various treatment conditions to see how planning was conducted (Zahorik, 1970). Common to these studies were findings that neither objectives nor assessment were foremost considerations in planning by school teachers despite the then prevalent rational,

objectives-first models such as those of Tylor or Hunter (Molenda, 2009). While the foundations of such process–product studies are no longer as central in educational research design, some conclusions have been reconfirmed through more recent studies described further below. These include nonuse in practice of commonly accepted formal planning models and high variability among teachers in planning approaches.

The Interpretive and Cognitive Shift in Research

The 1970s were a period of concentrated political and scholarly questioning of the rational, technical and scientific paradigm of progress, with new views of education evolving that promoted emergence, deconstruction, and contextualism as themes of inquiry. This allowed fresh perspectives about the art of teaching as well as promoted the expansion of more naturalistic and interpretive methods in education research. The outcome of this fomentation and reexamination of educational practice was a more nuanced examination of teaching and learning along with expanded tools and methods for research (Blumenfeld, Marx, Patrick, Krajick, & Soloway, 1997; Borko, Liston, & Whitcomb, 2007; Lagemann, 2000; Willis, 2008; Zeichner, 1999). In particular, researchers shifted from observable characteristics to psychological frames attempting to evoke how teachers thought about teaching, planning and classroom strategies, and how this promoted or constrained their instructional practices (Borko & Shavelson, 1990). As Shavelson and Stern (1981) noted, a practical purpose of such studies was to understand teacher thinking as a way to empirically establish the nature of professional practice and find ways to increase the number of expert teachers. Areas of research focus included the impact of tacit models, beliefs, attitudes, and professional and practical knowledge in instructional decision-making.

While the handful of initial studies on teacher thinking in the 1970s continued to be influenced by the process–product paradigm using correlative or experimental designs (Peterson & Clark, 1978; Peterson, Marx, & Clark, 1978), later influential studies on the topic such as those by Yinger (1979, 1980) and McCutcheon (1980) took a qualitative approach, using case studies in classroom settings involving small numbers of teachers. These more intensive investigations included multiple methods such as studying teachers over time and applying stimulated recall and "think-aloud" or process-tracing sessions in reviewing instructional actions in addition to observation, interviews, and content analysis of written documents like classroom materials, planbooks, and teacher journals. Central to the findings on teacher thinking related to instructional planning and action were:

- Teachers did not follow rational or systematic planning models they may have learned in teacher education or through professional development.
- Much planning occurred mentally rather than on paper.
- Objectives are rarely a focus of planning while student needs and activities are a more common starting point.
- Curriculum materials are consulted for new ideas and strategies, but also serve as constraints based on resource availability and district mandates.
- Planning is a multistage process involving yearly, unit, weekly, and daily plans.
- Planning is more a general idea of what will happen when implemented in the classroom, with implementation shaped by a teacher's understanding and anticipation of the response of students in the classroom at any given time (Borko, Roberts, & Shavelson, 2008; Borko & Shavelson, 1990).

From initial descriptive studies, researchers increasingly applied concepts from cognitive psychology to develop a model of teacher thinking based on teacher's personal implicit theories or mental schema founded on professional beliefs, values, knowledge, and experiences through which teacher classroom action was shaped. Teaching involves a longer-term "preactive" or planning stage, and an "interactive" or enactment stage that involves applying preplans and schemas in the immediacy of classroom actions (Clark & Yinger, 1977; Yinger, 1979, 1980). In particular, Yinger proposed that teacher decision-making is premised on creating routines to deal with the complexity and uncertainty of classroom teaching. These routines serve to establish particular patterns of instruction and classroom management that allow a level of predictability. Yinger applied the term "automaticity" in referring to the way teachers are able to apply their implicit or tacit theories without much conscious thought, thus avoiding overload on a teacher's cognitive processing. Further, Calderhead (1981a) contended that much teacher classroom practice is routinized or rule-based, applying heuristics in response to students so that teacher action is as much managerial as instructionally focused. A number of major reviews on teacher thinking summarize these studies in greater detail (Ben-Peretz, 2011; Blumenfeld et al., 1997; Borko & Shavelson, 1990; Calderhead, 1981b; Clark & Yinger, 1977; Fang, 1996; Raths & McAninch, 2003; Shavelson & Stern, 1981).

Recent Approaches

The studies on teacher thinking continue into the present, bringing newer tools along with research methods from outside education that have gained increased acceptance among educational scholars. For example, Gill and Hoffman (2009) applied discourse analysis of teacher meetings as a method to overcome some of the concerns about using primarily retrospective self-reporting in previous studies of teacher planning. Luehmann (2008) analyzed teacher blogs as a way to approach teacher thinking over time. In a related study,

Power (2009) used autoethnography as a way to explore the relationship between higher education faculty at a Canadian university and an instructional designer to suggest the issues that hinder use of ID models in education.

> That instructional design has become equated, at least in the minds of some, with a form of insidious influence geared to mass produce educational outcomes must be recognized as a failure of the ID field and its proponents to establish its relevance and clearly reveal its usefulness to a critical and discerning population. (p. 3)

Design-based and developmental perspectives are also playing a role, reflecting trends in some segments of IDT to apply recent concepts from cognitive psychology and the neurosciences to learning and teaching scholarship (Blumenfeld et al., 1997). Rather than prescriptive theory as is foundational for ID, this iterative constructivist tradition comprises thinking in context, is learner-centered and inclusive of global and societal issues, and focuses on concrete experiences and personal views. However, Ben-Peretz (2011) notes that there is insufficient attention in recent studies to the links between teacher thinking to student outcomes and examining how knowledge is learned. Others have suggested the need for an increased understanding of the development of teacher knowledge and mental models. For example, Rimm-Kaufman, and Hamre (2010) proposed that a developmental psychological view of teacher professional trajectories would be a better basis for constructing professional development and changes in thinking over the career of a teacher. A related recommendation was to increase attention to teacher narratives in research studies to elucidate patterns in individual professional growth and teacher knowledge (Davis, Beyer, Forbes, & Stevens, 2011; Marcos & Tillema, 2006). A number of researchers have promoted greater teacher voice and self-study as approaches to enhance understanding of thinking and instructional dynamics (Cochran-Smith & Lytle, 1990; Loughran, 2007; Zeichner, 2007).

As scholars are reexamining research underlying teacher education in the light of such findings, researchers urge more careful and considered evidentiary reporting, a mix of methods that acknowledges the strength of experimental and interpretive approaches, and focus on the instructional interactions among teachers and students in which teachers are not the sole determinant of outcomes (Ball & Forzani, 2009; Borko et al., 2007; Cohen et al., 2003; Lin, Wang, Klecka, Odell, & Spalding, 2010). A provocative outcome from such reexamination is an acknowledgement of the strength of findings from and purposes of the earlier process–product research while also excoriating the limitations of these studies in terms of weak constructs and poorly conceptualized, unilinear causal chains. Rather than reject such studies, these scholars argue for more complementary efforts among quantitative and qualitative traditions to improve constructs, understanding of the situated nature of teaching and learning, and more powerful theory and results that can impact teacher education and school reform efforts.

Novice Versus Expert Planning

As studies elucidating the complexities of classroom teacher thinking about planning and instruction increased, new interest grew in examining the differences between novice and experienced teachers. This research is seen as a means of improving teacher education programs in higher education as well as professional development to support practitioners in the field (Ropo, 2004). Particularly influential in the framing of these studies is the work of Schön (1983) on the reflective and practice-based nature of professionalism, increasingly enhanced from an educational perspective by the writings of Shulman (1986, 1987) on teacher professional knowledge. In addition, these studies are rooted in psychology and research on learning differences between novices and experienced individuals emerging from examination of other professions (Boshuizen, Bromme, & Gruber, 2004; Bransford, Brown, & Cocking, 2000), as well as concepts emerging from constructivist epistemology including situated learning, cognitive apprenticeship, and communities of inquiry (Blumenfeld et al., 1997).

Several major emphases came out of novice–expert studies of preservice, beginning, and experienced teachers, many paralleling findings in studies of expertise in arenas outside of teaching (Grossman et al., 2009), including those of novice and experienced professional designers (see Tracey, this volume). First, students entering teacher education come with very strong beliefs and mental models about education from their many years in schools, and changing these through courses in higher education was shown to be difficult (Alger, 2009; Knobloch & Hoop, 2005; Richardson, 2003). Research taking a critical theory perspective indicated that such preconceptions could have negative impacts in teacher–student interactions in the classroom and impede student learning (Cook-Sather & Youens, 2007; Stillman, 2011). As ideas shifted from transmission models of learning to more situated perspectives, greater emphasis was placed on emergent classroom behaviors with teacher knowledge, beliefs, and attitudes being conditional, continually learned, and flexibly applied in response to classroom interactions and constraints (John, 1991, 2006; Jonassen, Cernusca, & Ionas, 2007)

In relation to classroom practice, preservice teachers typically are able to identify fewer instructional strategies (Brown, 2010; Graham, Burgoyne, & Borup, 2010; Sato, Akita, & Iwakawa, 1993) and develop more factual but less flexible lesson plans (So & Watkins, 2005). By contrast, experts are more sensitive to learner variations, classroom interactions and characteristics of task situations, identify

problem parameters more rapidly, and spend more time on analysis while producing better solutions to problems (Elliott, Stemler, Sternberg, Grigorenko, & Hoffman, 2011; Ropo, 2004). In a multicountry study examining general pedagogical knowledge of preservice teachers at three points from initiation of the teacher education process to teaching internship, the researchers found distinct differences in focus among students from the countries studied: teaching methods and didactics in Germany; assessment in the USA; and cognition and content in South Korea and Taiwan (Blömeke et al., 2008). Across all countries, there were high effect sizes indicating the positive impacts of teacher education, particularly on lesson goals, decreases in feasibility concerns, increased use of technical terms, and more attention to affective and motivational instructional goals.

When hired into beginning teaching, new teachers struggle with establishing routines, focus more on classroom management, contextualize problems in terms of self, and have difficulty in the issues of hierarchical planning linked to overall curriculum, forcing planning into a daily cycle of activities with limited attention to longer-term learner goals and responses to individual learners (Alger, 2009; Liston, Whitcomb, & Borko, 2006; Sardo-Brown, 1993; Shoham, Penso, & Shiloah, 2003). When research on planning focuses on experienced teachers, findings indicate practicing teachers do not follow the models taught in their teacher education programs, even when these are reinforced in continuing professional development or enhanced in graduate-level teacher education programs (Cross, 2009; Knobloch & Hoop, 2005; Lloyd, 2007; Sardo-Brown, 1990). Yet surveys show that experienced teachers continue to promote the teaching of formal planning methods in teacher education even though they do not personally apply such models (Borko & Shavelson, 1990; Westerman, 1991).

What About Instructional Design for Teachers?

Given the important role of planning and design in teaching, IDT has continually seemed poised to make significant contributions to teacher education (Carr-Chelman, 2011; Flouris, 1988; Reiser & Dick, 1996; Shambaugh & Magliaro, 2006; Willis, Thompson, & Sadera, 1999). Despite the fact that most IDT programs are housed in schools, departments or colleges of education where teachers are prepared, the relationship between teacher education and the field of instructional design and technology has often been contentious as well as poorly defined. Critics have raised concerns including differing goals, strategies, resource requirements, and limited perspectives that are incompatible with school-level teaching and learning (John, 2006; Martin & Clemente, 1990; Oser & Baeriswyl, 2001). Burkman (1987) noted the chasm in the USA over 30 years ago, reporting on surveys of education leaders and analysis of content in educational psychology textbooks, concluding instructional design skills were covered spottily and inconsistently in teacher education programs. Multiple authors pointed to the growth of emphasis on the reflective practitioner over technical skills and educator rejection of rational ends-means planning (Earle, 1998; Martin & Clemente, 1990; Schneider, 2010; Schrock & Byrd, 1987; Snelbecker, 1987), making any inroads into teacher education challenging. In parts of Europe, the empirical foundation of didactics grew as a reform tradition and ID was generally ignored as an instructional theory (Oser & Baeriswyl, 2001; Seel & Dijkstra, 1997).

Empirical studies have examined impacts of instructional design on teacher planning and instruction since the 1980s, moving beyond earlier traditions focused on audiovisual and instructional materials in schools, and in conjunction with the adoption by the Association of Educational and Communications Technology (AECT) of a definition of the field emphasizing design. These studies have taken two primary routes: what happens when teachers learn instructional design in terms of their planning processes, and closely related but different, how does instructional design relate to the application and use of instructional technologies by teachers (see next section).

A handful of studies on teachers' uses of systematic planning appeared in the 1980s but studies of more classic ID understanding and application by teachers grew in the 1990s. B. Martin (1990) elaborated on results from earlier teacher planning studies using an instructional design lens, examining the differences between long-range and daily planning, written versus mental planning, and the application of planned strategies in contrast to implementation in daily classroom activities. She found that when looking at teachers' long-term plans, objectives played a more central role than indicated in earlier studies, often influenced by district-provided curriculum guides. Although the study included five teachers trained in instructional design and five without formal training, there was little difference in the plans they submitted as part of the research, with four of the five non-ID trained teachers having "at least a rudimentary knowledge of ISD even if they did not know it by that name." One of the non-ISD trained teacher participants stated, "[ISD] seems like common practice to me" (p. 69). In conclusion, Martin writes,

> It is important to remember that teaching is not instructional design, but rather a complex host of other behaviors, skills, and attitudes. Given this caveat, the use of instructional design may be an exceptionally useful tool for teachers to incorporate into their repertoire of teaching behaviors. A quote from one [ID trained] teacher is especially germane as she cautions us to take into account what teaching is and to keep instructional design flexible in this setting. 'I would hate to see lessons so rigidly planned that any spontaneity is discouraged.' (p. 72)

Moallem and Earle (Earle, 1996; Moallem, 1998; Moallem & Applefield, 1997; Moallem & Earle, 1998) provided the

most detailed studies of teacher planning practices in relation to ID principles, including an intensive 3-year study of a beginning elementary teacher and a similar ethnographic study of an expert teacher. These researchers argued that the highly contextualized, reflective and social way of thinking about instruction of classroom teachers studies provided a stark contrast with the rational, technical and prescriptive process of ID, leading to the need for different instructional design models before there would be meaningful impact in schools. Young, Reiser, and Dick (1998) examined the planning processes of nine expert teachers, comparing their practices to that found in the Reiser and Dick textbook for teachers (Reiser & Dick, 1996). Despite finding little evidence of systematic planning practice, the authors proposed that ID training provides a solid foundation for novices to develop a personal planning style and coherent process of design. The ID-related teacher studies were complementary to findings of the teacher-thinking research summarized above, but also showed that approaching studies from an instructional design perspective provided a useful frame within which to examine decision-making, instructional strategies, and complex classroom realities.

Earle (1998) reviewed the debate on the potential of ID for schools, noting that research suggested some ID principles are used by teachers. At the same time, he suggested the empirical evidence from teacher thinking studies showed that existing models were inappropriate for the way teachers work, with a need "to bridge the gap between the theory of instructional design and the practice of teaching, developing practical models and principles to reach our common goal of enhancing teaching and learning" (p. 43). Among the findings Earle highlighted resulting from studies related to instructional design:

- Teachers implicitly apply ID principles but do not employ a classic ID model.
- ID can be taught successfully to preservice teachers. One course is insufficient, but does enhance perceptions about what is important in teacher planning.
- Teacher mental models differ from classic ID models, and there is a need for a common technical language of instruction as well as validation of the scientific basis of instruction.

In the USA, the past 10 years have seen different emphases in the relation of IDT to teacher education, in part because of increased grant funding in the areas of technology, mathematics and science, as well as state and federal mandates for standards and content testing in K-12 schools. In general, the findings of the earlier studies remain unchallenged. Research has continued on mental models as used by professional and beginner instructional designers (see Tracey, this volume), while a number of studies of teachers have examined teacher thinking in relation to technology (Ertmer & Ottenbreit-Leftwich, 2010; Graham et al., 2010; Mitchem, Wells, & Wells, 2003; Palak & Walls, 2009; Sang, Valcke, Braak, & Tondeur, 2010).

More recent studies that examined outcomes of teaching teachers formal ID models and frameworks have primarily occurred outside the USA, where ID instruction has been applied as part of a reform effort to improve teaching practice (Altun & Büyükduman, 2007; Alzand, 2010; Könings, Brand-Gruwel, & van Merriënboer, 2010; Krull, Oras, & Pikksaar, 2010; Ozdilek & Robeck, 2009). Interviews with eight elementary teachers in exploring the use of ID processes in planning indicated that teachers are constrained by central administration mandates on objectives, curriculum materials, and testing, minimizing analysis and design phases in teacher planning (Karaca, Yildirim, & Kiraz, 2008). Student-centered concerns and activities are central to lesson planning. Teachers develop detailed lesson plans as required by administrators but those interviewed admitted actual implementation is more improvisational. Researchers in Taipei surveyed 223 elementary teachers on their use of elements of the ADDIE model in instruction, with 69 having previous ID training (Ho, Kuo, Tsai, & Kuo, 2006). The respondents indicated they do not have time to use formal models, but the researchers found that all had an tacit understanding of the model elements.

Rose and Tingley (2008) found similar results from interviews with six Canadian mathematics and science teachers, suggesting that the participants intuitively understand ID concepts and perceive themselves as instructional designers when the term is explained. The teachers started with general goals in their planning often derived by consulting curriculum guides and teacher manuals. Central to their planning is caring about students, so that planning is not systematic but a "constant process of innovation and adaptation based on a keen attentiveness to their students' needs" (n.p.). The researchers argued that classic ID models are inherently dismissive of affective dimensions important to classroom teachers.

> A significant factor in the fundamental disconnect between systematic instructional design models and teachers' practices is the fact that instructional design models offer no apparent means by which teachers can express and act upon their belief that care is at least as important a part of the educational experience as the development of competence. (n.p.)

Design and Technology in the Classroom

The interrelationship in IDT of design and technology encourages curriculum that interconnects the two in teacher education course work and professional development efforts. Research from this perspective is oriented to the approach of the teacher as a user of technologies and modifier or creator of curriculum materials within the larger planning context.

Thirty years ago, F. E. Clark and Angert (1981) proposed that teacher educators should demonstrate and model the selection and use of audiovisual resources through systematic instructional design processes as a way to improve the quality and effectiveness of materials used in instruction. The concept of linking ID models and technology continues, as shown by textbook content commonly used in required teacher education technology courses (Lever-Duffy & McDonald, 2011; Morrison & Lowther, 2010; Newby, Stepich, Lehman, Russell, & Ottenbreit-Todd, 2011; Roblyer & Doering, 2010; Rogers, 2002; Smaldino, Lowther, & Russell, 2011). This combined approach of teaching instructional design in the context of technology is recommended by some advocates as one way to incorporate ID into the crammed teacher education curriculum (Hannafin, 1999; Savenye, Davidson, & Smith, 1991; Snelbecker, 1987; Summerville & Reid-Griffin, 2008). By the end of the 1990s, many studies involving instructional design and K-12 teaching in the USA had shifted to a technology integration focus.

Recent studies have indicated the key role curriculum materials play in new teacher planning and learning (Grossman & Thompson, 2008). Teacher design practices are seen as a way of customizing curriculum for localized student needs (Lloyd, 2007), developing pools of teacher-created, reusable resources that can be shared, and increasing the awareness of the instructional appropriateness and effectiveness of technology tools by formally applying ID principles to evaluation efforts (Wiburg, 1995). However, critics note that the teacher-as-materials-designer model promoted in some teacher education programs may be an idealistic position given constraints of time, costs, and pressures for standardized curriculum in school settings and the limited capabilities of novice teachers to create or adapt curricular materials. F. E. Clark and Angert (1981) pointed out that little research had been done to indicate the effectiveness of the ID-technologies based approach for future student achievement, a situation that continues into the present. Further, following research on teacher application of ID in materials selection and development in university course work, Kerr (1981) noted that insufficient attention had been given in such approaches to understanding teacher perspectives.

> If our goal is to affect positively the quality of instruction, we cannot afford to demand an approach to design that is not based on reality. The time has come to pay attention to the D in ID, and to discover how educators design. (p. 376)

Many recent analyses of systematic instructional design applied to teacher-created technology projects in the USA are case studies of preservice courses or graduate-level courses for in-service teachers. Many of these articles are preliminary narrative without a formal, detailed evaluation component reported. More a form of practitioner action research or best practices review, the conclusions are based on standard classroom artifacts such as student work, student end-of-course evaluations, and teacher-centered observation for assessment of outcomes rather than more formal research design and analysis. For example, Zhang (2000) notes the initial resistance to the formality of using the Dick and Carey ID model in designing Web-based units in a graduate-level technology course. These in-service teachers indicated that they were already experienced in curriculum and the ID model was too detailed and linear as they began the project, but the systematic design process resulted in better products because of the alignment of objectives, strategies, and assessments.

In another case study, Summerville and Reid-Griffin (2008) report on applying online modules to teach a modified ID model, the "Summerville Integrated Model," in a preservice technology course. The researchers reviewed model application based on examination of student work and questionnaires. In rejecting earlier ID models for their course, the authors noted that none had the level of flexibility, constructivist and learner-centered approach, and interrelatedness that their own circular model provided, including promoting higher-order thinking and reflective practice. The preservice teachers in the study used the revised model process in evaluating online learning resources and in developing a lesson plan that included instructional materials they created in the course. By applying the model, the researchers indicate that students gained confidence in both tool uses and lesson planning, were positive about the learning experience, and were better able to produce learner-appropriate lesson plans in later methods courses. However, Summerville and Reid-Griffin noted their teacher education colleagues' concerns with time required to implement instructional design in the technology course, potentially decreasing time on new technologies.

Churchill (2006) conducted a longer-term qualitative multi-case study of four teachers in Singapore as a way to understand the way teachers design technology-based learning and the "private theories" that guided their decision-making. The study of the experienced teachers occurred during and after a seminar that included materials development and introduction to instructional design frameworks as a way to promote more student centered learning. His study links the teacher-as-materials-designer approach with the teacher-thinking research described above. Data collection involved examination of prototyped instructional materials at multiple stages during and after the seminar using external reviewers, a cognitive analysis technique of card sorts, teacher journals during their teaching after the seminar, and follow-up interviews 6 months later. As in earlier studies, the findings show that the professional development led to limited impacts in thinking and practice. All four teachers shifted at least slightly towards more student-centered approaches, but only one moved from a direct instruction approach to a student-centered practice, while a second intensified what was already a student-centered approach. When themes of technology,

teacher or students were the major explanatory factor for design decisions stated by a participant, that teacher's approach was direct teaching while the more student-centered teachers justified their decisions based on student learning. Churchill notes in conclusion that a teacher's focus on learning is not enough for change because of constraints that arise from the teacher's preexisting personal theories on students, impacts of an assessment-testing culture, and institutional influences which push in opposing directions. He urges greater consideration for practitioners' entrenched private theories in teacher professional development, noting that "if teachers could identify the theories that mediate their design, they are more likely to make better decisions regarding the means of implementing any desired changes" (p. 575).

A number of formal studies have examined the impact on preservice teachers of online-support tools in scaffolding lesson planning to enhance use of the systematic problem-solving approaches applied by expert teachers. One of the more comprehensive examinations of the impacts of support tools on novice teacher learning of instructional planning are the multiple quasi-experimental studies undertaken by Baylor and Kitsantas (Baylor, 2002; Baylor & Kitsantas, 2001, 2003, 2005; Kitsantas & Baylor, 2001). The support tools their team developed were tweaked in various treatment configurations, including instructivist (Reiser and Dick based) versus constructivist (Jonassan and Mayer influenced) models, incorporation of prompts by animated agents, and use of an ill-structured versus more structured learning problem. Data collection involved student questionnaires on attitudes and tool design as well as student-created lesson plans and reflective writings. The instructivist and constructivist tools equally improved performance and motivation. However, the instructivist tool better supported self-monitoring while the constructivist tool promoted cognitive flexibility. In terms of the problem structure, the instructivist tool provided better support for the ill-structured problem and a parallel improvement for solving a structured problem with the constructivist tool, the opposite of what the researchers had predicted. These results suggest that each ID approach has merit as novices approach instructional design for classrooms despite the debates between instructivist and constructivist oriented scholars.

Some studies have examined experienced teacher integration of technology more generally in relation to planning models. In one of the few studies that links systematic planning and technology to student achievement, researchers examined the impacts of professional development, showing higher-quality lesson planning resulted in positive teacher and student outcomes (Martin et al., 2010). In a series of reports from Cyprus, Angeli and Valanides (Angeli, 2005; Angeli & Valanides, 2005, 2009) examined issues of applying ID models in teacher education in relation to enhancing technology use, studying preservice teachers' thinking as well as teacher educator practices. As in earlier studies, they noted the need for changes to the classic ID models before these could be more applicable to teaching.

> Most importantly, these results show that there is a need to develop new ISD methodologies to bridge the gap between the world of teachers' work and the world of instructional design. An expanded view of PCK [professional content knowledge] provides a strong conceptual basis for such an ISD methodology, because it describes teachers' knowledge as highly contextual and situated in classroom experiences, as well as an integrative body of different forms of knowledge that interact with one another, such as content, pedagogy, and learners. These characteristics of PCK are in contrast with the generic and context- and content-free ISD models. (Angeli & Valanides, 2005, p. 295)

Conclusions: Prospects for Teacher Education

Given the important role of design in teaching, IDT has continually seemed poised to make significant contributions to teacher education with each new decade finding advocates proposing it is just around the corner. Over time, they have cited the field's understanding of audiovisual technologies, role in development of nationally adopted curriculum materials, successes in spreading ID in military and corporate settings, familiarity with computer technologies, expertise in distance learning, or expansion into the learning sciences and design fields (Carr-Chelman, 2011; Clark & Angert, 1981; Dick, 1986; Flouris, 1988; Hannafin, 1999; Norton et al., 2009; Savenye et al., 1991; Willis et al., 1999). Most of the concerns raised 20 years ago about prospects for ID in schools and teacher education (Burkman, 1987; Earle & Sheffield, 1995; Schrock & Byrd, 1987; Snelbecker, 1987) remain current. Few voices actively propose that systematic instructional design models will have major impacts on schools beyond the use of curricular materials created using ID principles or integration of emerging technologies led by those with instructional design expertise. Further, as this review has illustrated, formal research on ID and teachers is primarily occurring only within the immediate context of higher education courses. In the past decade, no studies of ID were found during this review involving practitioners in classroom settings in the USA except for those related to technology, with very limited studies on ID and school teaching outside the USA.

The findings reviewed here have much to offer IDT. While scholars in IDT have raised issues about the lack of studies of design uses in context (Bichelmeyer, Boling, & Gibbons, 2006) and have urged shifting emphasis to newer models and theory of design (Jonassen, 2008; Jonassen et al., 2007; Osguthorpe & Osguthorpe, 2007), the research on teachers and classrooms is a rich resource which remains relatively unexplored as a source of empirical evidence to enhance theory building and design frameworks. The initial research

on teacher knowledge, planning and decision-making in classroom contexts had positive influences on IDT research. These research approaches led to expansion of methodologies in ID development and design studies, increasing recognition of context that negated simple process–product causality. An active track of studies on design thinking, development processes, and role of training on professional instructional designer practice (see Tracey, this volume) parallels the teacher research reviewed. The related methods, questions, and findings suggest that there are potentials for cooperation and sharing that may be productive for both areas of research.

The studies establish that the skeleton of ADDIE and related models are a logical foundation for instructional design decision-making in schools, but application is more complex and nonlinear, subject to multiple constraints, contextually framed, and continually reshaped through practitioner experience. Such findings provide potential grounding for theoretical advances in IDT and review of ID models. Further, there are recognized differences in effective teaching of design depending on whether the learners are novices to instruction such as preservice teachers versus more experienced practitioners common among graduate students. Given the differing levels of practical experiences, development of skills, tacit models of teaching, and underlying beliefs and attitudes, teacher education curriculum may need to vary to accommodate these evidence-based differences in initial knowledge and openness to new concepts. New directions in studying strategies to address novice versus experienced practitioners, while not yet applied to teachers, may have potential for opening new research perspectives (Fadde, 2009; van Gog, Ericsson, Rikers, & Paas, 2005).

At a broader level, the prospects generally for instructional design's impacts on teacher education appear to be declining based on the decrease in studies reviewed here. To some degree, the areas of IDT growth in studying preservice and classroom teachers are from those traditions of research that have shifted to design-based research and the learning sciences or those involving teacher knowledge related to technology from a TPCK and adoption perspective (see Handbook chapters). Despite proposals over 30 years ago for more research on the impacts of ID on schools and teachers (Kerr, 1981), such studies not only did not materialize but now do not appear central in the disciplinary agenda.

Negative predictions on the fate of instructional design in schools are not a certainty despite the evidence of downturn in the reviewed studies, but it is evident that changes would be needed to counter this trend. Teacher education is under major external pressures to reform and show that its curriculum and methods have an impact not only on the teachers emerging from their programs, but ultimately on the students that they teach (Wang, Odell, Klecka, Spalding, & Lin, 2010). The same intellectual trends that promoted interpretive and situated perspectives in each disciplines' research resulted in a strong skepticism among many teacher educators towards a science of teaching which could provide a common framework for training future teachers (Burkman, 1987; Grossman & McDonald, 2008). Under increased pressure for evidence-based results, a number of internal voices are arguing that a new science must emerge to satisfy policy-makers and prove that teacher education makes a positive difference (Ball & Forzani, 2009; Cohen et al., 2003; Lin et al., 2010). Teacher education leaders are promoting an inside reexamination of teacher education scholarship as a push-back to uninformed external proposals for how evidence is evaluated and how it leads to change. Part of this is a call for a new look at research as a way to provide more solid evidence as the basis of teacher education practice, and renewing a call for a more science based and less craft or domain-specific learning approaches to curriculum in education programs (Ball, Sleep, Boerst, & Bass, 2009; Singer-Gabella, 2012; Sternberg, 2008). Identified needs in research studies include adoption of a common terminology of instruction, recognition of the contributions of differing research traditions, better understanding of the impact of instructional resources and technology, and increased research on the relationship between teaching practice and learning outcomes.

> Educational phenomena are usefully studied using tools and perspectives from other disciplines, and the interdisciplinary culture needed to support inquiry into education depends on intellectual diversity among the faculty. Too rare, however, are scholars steeped in the instructional perspective or whose specialization is instruction. (Ball & Forzani, 2007, p. 539)

IDT's historical development of constructs and interdisciplinarity have much to offer the calls for shaping future research trajectories in teacher education, particularly in the need for a common terminology and the impact of resources and technology. The teacher-as-designer research reviewed in this chapter provides a potential foundation for future cooperation and growth between these fields, in tune with recent calls to remember what has been learned before (Lin et al., 2010).

References

Alger, C. L. (2009). Secondary teachers' conceptual metaphors of teaching and learning: Changes over the career span. *Teaching and Teacher Education, 25*(5), 743–751. doi:10.1016/j.tate.2008.10.004.

Altun, S., & Büyükduman, F. (2007). Teacher and student beliefs on constructivist instructional design: A case study. *Educational Sciences: Theory and Practice, 7*(1), 30–39.

Alzand, W. (2010). Instruction design and educational quality. *Procedia - Social and Behavioral Sciences, 2*(2), 4074–4081. doi:10.1016/j.sbspro.2010.03.643.

Angeli, C. (2005). Transforming a teacher education method course through technology: Effects on preservice teachers' technology competency. *Computers in Education, 45*(4), 383–398. doi:10.1016/j.compedu.2004.06.002.

Angeli, C., & Valanides, N. (2005). Preservice elementary teachers as information and communication technology designers: An instructional systems design model based on an expanded view of pedagogical content knowledge. *Journal of Computer Assisted Learning, 21*(4), 292–302. doi:10.1111/j.1365-2729.2005.00135.x.

Angeli, C., & Valanides, N. (2009). Epistemological and methodological issues for the conceptualization, development, and assessment of ICT-TPCK: Advances in technological pedagogical content knowledge (TPCK). *Computers in Education, 52*(1), 154–168. doi:10.1016/j.compedu.2008.07.006.

Ball, D. L., & Forzani, F. M. (2007). 2007 Wallace Foundation distinguished lecture–What makes education research "educational"? *Educational Researcher, 36*(9), 529–540. doi:10.3102/0013189x07312896.

Ball, D. L., & Forzani, F. M. (2009). The work of teaching and the challenge for teacher education. *Journal of Teacher Education, 60*(5), 497–511. doi:10.1177/0022487109348479.

Ball, D. L., Sleep, L., Boerst, T. A., & Bass, H. (2009). Combining the development of practice and the practice of development in teacher education. *The Elementary School Journal, 109*(5), 458–474. doi:10.1086/596996.

Baylor, A. (2002). Expanding preservice teachers' metacognitive awareness of instructional planning through pedagogical agents. *Educational Technology Research and Development, 50*(2), 5–22. doi:10.1007/bf02504991.

Baylor, A., & Kitsantas, A. (2001). Promoting instructional planning: An experiment. In J. Price, D. A. Willis, N. Davis, & J. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2001* (pp. 1044–1049). Norfolk, VA: AACE. Retrieved from http://www.editlib.org/

Baylor, A., & Kitsantas, A. (2003). Preservice teacher instructional planning support for well- and ill-defined instructional problems. In C. Crawford, N. Davis, J. Price, R. Weber, & D. A. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2003* (pp. 1636–1638). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/18243

Baylor, A., & Kitsantas, A. (2005). Comparative analysis and validation of instructivist and constructivist self-reflective tools (IPSRT and CPSRT) for novice instructional planners. *Journal of Technology and Teacher Education, 13*(3), 433–457.

Ben-Peretz, M. (2011). Teacher knowledge: What is it? How do we uncover it? What are its implications for schooling? *Teaching and Teacher Education, 27*(1), 3–9. doi:10.1016/j.tate.2010.07.015.

Bichelmeyer, B., Boling, E., & Gibbons, A. S. (2006). Instructional design and technology models: Their impact on research and teaching in instructional design and technology. In M. Orey, V. J. McClendon, & R. M. Branch (Eds.), *Educational media and technology yearbook 2006* (Vol. 31, pp. 33–49). Littleton, CO: Libraries Unlimited.

Blömeke, S., Paine, L., Houang, R., Hsieh, F.-J., Schmidt, W., Tatto, M., et al. (2008). Future teachers' competence to plan a lesson: First results of a six-country study on the efficiency of teacher education. *ZDM: Mathematics Education, 40*(5), 749–762. doi:10.1007/s11858-008-0123-y.

Blumenfeld, P. C., Marx, R. W., Patrick, H., Krajick, J., & Soloway, E. (1997). Teaching for understanding. In B. J. Biddle, T. L. Good, & I. F. Godson (Eds.), *International handbook of teachers and teaching* (Vol. 2, pp. 819–878). Dordrecht, Netherlands: Kluwer Acacemic.

Borko, H., Liston, D., & Whitcomb, J. A. (2007). Genres of empirical research in teacher education. *Journal of Teacher Education, 58*(1), 3–11. doi:10.1177/0022487106296220.

Borko, H., Roberts, S. A., & Shavelson, R. J. (2008). Teachers' decision making: From Alan J. Bishop to today. In P. Clarkson & N. Presmeg (Eds.), *Critical issues in mathematics education: Major contributions of Alan Bishop* (pp. 37–68). New York, NY: Springer.

*Borko, H., & Shavelson, R. J. (1990). Teacher decision making. In B. F. Jones, & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 311–341). Florence, KY: Lawrence Erlbaum.

Boshuizen, H. P. A., Bromme, R., & Gruber, H. (Eds.). (2004). *Professional learning: Gaps and transitions on the way from novice to expert*. New York, NY: Kluwer.

Bransford, J., Brown, A. L., & Cocking, R. R. (Eds.). (2000). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Brown, C. P. (2010). Children of reform: The impact of high-stakes education reform on preservice teachers. *Journal of Teacher Education, 61*(5), 477–491. doi:10.1177/0022487109352905.

*Burkman, E. (1987). Prospects for instructional systems design in the public schools. *Journal of Instructional Development, 10*(4), 27–32.

Calderhead, J. (1981a). A psychological approach to research on teachers' classroom decision-making. *British Educational Research Journal, 7*(1), 51–57.

Calderhead, J. (1981b). Stimulated recall: A method for research on teaching. *The British Journal of Educational Psychology, 51*(2), 211–217.

Carr-Chelman, A. A. (2011). *Instructional design for teachers: Improving classroom practice*. New York, NY: Routledge.

Churchill, D. (2006). Teachers' private theories and their design of technology-based learning. *British Journal of Educational Technology, 37*(4), 559–576. doi:10.1111/j.1467-8535.2005.00554.x.

*Clark, F. E., & Angert, J. F. (1981). Teacher commitment to instructional design: The problem of media selection and use. *Educational Technology, 21*(5), 9–15.

*Clark, C. M., & Yinger, R. J. (1977). Research on teacher thinking. *Curriculum Inquiry, 7*(4), 279–304.

Cochran-Smith, M., & Lytle, S. L. (1990). Research on teaching and teacher research: The issues that divide. *Educational Researcher, 19*(2), 2–11.

Cohen, D. K., Raudenbush, S. W., & Ball, D. L. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis, 25*(2), 119–142.

Cook-Sather, A., & Youens, B. (2007). Repositioning students in initial teacher preparation. *Journal of Teacher Education, 58*(1), 62–75. doi:10.1177/0022487106296216.

Cross, D. (2009). Alignment, cohesion, and change: Examining mathematics teachers' belief structures and their influence on instructional practices. *Journal of Mathematics Teacher Education, 12*(5), 325–346. doi:10.1007/s10857-009-9120-5.

Davis, E. A., Beyer, C., Forbes, C. T., & Stevens, S. (2011). Understanding pedagogical design capacity through teachers' narratives. *Teaching and Teacher Education, 27*(4), 797–810. doi:10.1016/j.tate.2011.01.005.

*Dick, W. (1986). Instructional design and the curriculum development process. *Educational Leadership, 44*(4), 54–56.

Earle, R. S. (1996). Instructional design fundamentals as elements of teacher planning routines: Perspectives and practices from two studies. *Proceedings of Selected Research and Development Presentations at the 1996 National Convention of the Association for Educational Communications and Technology* (pp. 183–192). Indianapolis, IN: AECT. Retrieved from http://www.eric.ed.gov/

*Earle, R. S. (1998). Instructional design and teacher planning: Reflections and perspectives. In R. Branch & M. Fitzgerald (Eds.), *Educational Media and Technology Yearbook* (Vol. 23, pp. 36–45). Englewood, NJ: Libraries Unlimited, Inc.

Earle, R. S., & Sheffield, C. J. (1995). Changes in ID fundamentals: Implications for teacher education. In B. Seels (Ed.), *Instructional design fundamentals: A reconsideration* (Vol. 1, pp. 209–221). Englewood Cliffs, NJ: Educational Technology.

Elliott, J. G., Stemler, S. E., Sternberg, R. J., Grigorenko, E. L., & Hoffman, N. (2011). The socially skilled teacher and the development

of tacit knowledge. *British Educational Research Journal, 37*(1), 83–103. doi:10.1080/01411920903420016.

Ertmer, P. A., & Ottenbreit-Leftwich, A. T. (2010). Teacher technology change: How knowledge, confidence, beliefs, and culture intersect. *Journal of Research on Technology in Education, 42*(3), 255–284.

Fadde, P. (2009). Instructional design for advanced learners: Training recognition skills to hasten expertise. *Educational Technology Research and Development, 57*(3), 359–376. doi:10.1007/s11423-007-9046-5.

Fang, Z. (1996). A review of research on teacher beliefs and practices. *Educational Research, 38*(1), 47.

Flouris, G. (1988). An instructional design model: Classroom applications. *European Journal of Teacher Education, 11*(1), 59–72.

Friesen, N. (2010). Anglo-American approaches to lesson planning. *Bildung und Erziehung* (*Formation and Education*), *63*(4), 417–430. Retrieved from http://learningspaces.org/n/papers/lessonplanning.pdf

Gill, M. G., & Hoffman, B. (2009). Shared planning time: A novel context for studying teachers' discourse and beliefs about learning and instruction. *Teachers College Record*, *111*(5), 1242–1273. Retrieved from http://www.tcrecord.org

Graham, C. R., Burgoyne, N., & Borup, J. (2010). The decision-making processes of preservice teachers as they integrate technology. In D. Gibson, & B. Dodge (Eds.), *Proceedings of the Society for Information Technology & Teacher Education International Conference 2010* (pp. 3826–3832). San Diego: AACE. Retrieved from http://www.editlib.org/

Grossman, P., Compton, C., Igra, D., Ronfeldt, M., Shahan, E., & Williamson, P. (2009). Teaching practice: A cross-professional perspective. *Teachers College Record*, *111*(9), 2055–2100. Retrieved from http://www.tcrecord.org/

Grossman, P., & McDonald, M. (2008). Back to the future: Directions for research in teaching and teacher education. *American Educational Research Journal, 45*(1), 184–205.

Grossman, P., & Thompson, C. (2008). Learning from curriculum materials: Scaffolds for new teachers? *Teaching and Teacher Education, 24*(8), 2014–2026. doi:10.1016/j.tate.2008.05.002.

*Hannafin, R. (1999). Introduction to special issue on instructional technology and teacher education. *Educational Technology Research and Development, 47*(4), 27–28. doi: 10.1007/bf02299595

Ho, L.-A., Kuo, T.-H., Tsai, S.-H., & Kuo, Y.-K. (2006). An investigation of the actual practice of instructional design at elementary schools in Taipei-- From teachers' perspective. In C. M. Crawford, R. Carlsen, K. McFerrin, J. Price, R. Weber, & D. A. Willis (Eds.), *Proceedings of the Society for Information Technology & Teacher Education International Conference 2006* (pp. 1218–1224). Orlando, Florida, USA: AACE. Retrieved from http://www.editlib.org/

Hunter, M. (1967). *Teach more - faster*. Thousand Oaks, CA: Corwin Press.

Hunter, M. (1985). What's wrong with Madeline hunter? *Educational Leadership, 42*(5), 57.

Hunter, R., & Hunter, M. (2004). *Mastery teaching*. Thousand Oaks, CA: Corwin Press.

John, P. D. (1991). Course, curricular, and classroom influences on the development of student teachers' lesson planning perspectives. *Teaching and Teacher Education, 7*(4), 359–372. doi:10.1016/0742-051x(91)90005-a.

John, P. D. (2006). Lesson planning and the student teacher: Re-thinking the dominant model. *Journal of Curriculum Studies, 38*(4), 483–498.

Jonassen, D. H. (2008). Instructional design as design problem solving: An iterative process. *Educational Technology, 38*(3), 21–26.

Jonassen, D. H., Cernusca, D., & Ionas, I. G. (2007). Constructivism and instructional design: The emergence of the learning sciences and design research. In R. A. Reiser & J. V. Dempsey (Eds.), *Trends and issues in instructional design and technology* (2nd ed., pp. 45–52). Upper Saddle River, NJ: Pearson Education.

Karaca, F., Yildirim, S., & Kiraz, E. (2008). Elementary school teachers' instructional design process: An insight into teachers' daily practices. In K. McFerrin, R. Weber, R. Carlsen, & D. A. Willis (Eds.), *Proceedings of the Society for Information Technology & Teacher Education International Conference 2008* (pp. 3364–3371). Las Vegas, Nevada, USA: AACE. Retrieved from http://www.editlib.org/

Kerr, S. T. (1981). How teachers design their materials: Implications for instructional design. *Instructional Science, 10*(4), 363–378. doi:10.1007/bf00162734.

Kitsantas, A., & Baylor, A. (2001). The impact of the instructional planning self-reflective tool on preservice teacher performance, disposition, and self-efficacy beliefs regarding systematic instructional planning. *Educational Technology Research and Development, 49*(4), 97–106. doi:10.1007/bf02504949.

Knobloch, N. A., & Hoop, S. E. (2005). Preservice teachers' epistemological beliefs, attitudes, and behaviors regarding instructional planning. *Proceedings of the 2005 American Association for Agricultural Education* (*AAAE*) *North Central Agricultural Education Research Conference*. Columbus, OH: AAAE. Retrieved from http://www.ydae.purdue.edu/lct/SoTL/teachers2.html

Könings, K. D., Brand-Gruwel, S., & van Merriënboer, J. J. G. (2010). An approach to participatory instructional design in secondary education: An exploratory study. *Educational Research, 52*(1), 45–59. doi:10.1080/00131881003588204.

Krull, E., Oras, K., & Pikksaar, E. (2010). Promoting student teachers' lesson analysis and observation skills by using Gagne's model of an instructional unit. *Journal of Education for Teaching, 36*(2), 197–210. doi:10.1080/02607471003651789.

Lagemann, E. C. (2000). *An elusive science: The troubling history of education research*. Chicago, IL: University of Chicago Press.

Lever-Duffy, J., & McDonald, J. B. (2011). *Teaching and learning with technology* (4th ed.). Boston, MA: Pearson.

Lin, E., Wang, J., Klecka, C. L., Odell, S. J., & Spalding, E. (2010). Judging research in teacher education. *Journal of Teacher Education, 61*(4), 295–301. doi:10.1177/0022487110374013.

Liston, D., Whitcomb, J., & Borko, H. (2006). Too little or too much: Teacher preparation and the first years of teaching. *Journal of Teacher Education, 57*(4), 351–358. doi:10.1177/0022487106291976.

Lloyd, G. M. (2007). Strategic compromise a student teacher's design of kindergarten mathematics instruction in a high-stakes testing climate. *Journal of Teacher Education, 58*(4), 328–347. doi:10.1177/0022487107305260.

Loughran, J. (2007). Researching teacher education practices: Responding to the challenges, demands, and expectations of self-study. *Journal of Teacher Education, 58*(1), 12–20. doi:10.1177/0022487106296217.

Luehmann, A. L. (2008). Using blogging in support of teacher professional identity development: A case study. *The Journal of the Learning Sciences, 17*(3), 287–337. doi:10.1080/10508400802192706.

Marcos, J. J. M., & Tillema, H. (2006). Studying studies on teacher reflection and action: An appraisal of research contributions. *Educational Research Review, 1*(2), 112–132. doi:10.1016/j.edurev.2006.08.003.

Martin, B. L. (1990). Teachers' planning processes: Does ISD make a difference? *Performance Improvement Quarterly, 3*(4), 53–73. doi:10.1111/j.1937-8327.1990.tb00477.x.

*Martin, B. L., & Clemente, R. (1990). Instructional systems design and public schools. *Educational Technology Research and Development, 38*(2), 61–75. doi: 10.1007/bf02298270

Martin, W., Strother, S., Beglau, M., Bates, L., Reitzes, T., & Culp, K. M. (2010). Connecting instructional technology professional development to teacher and student outcomes. *Journal of Research on Technology in Education, 43*(1), 53–74.

Marzano, R. J. (2007). *The art and science of teaching: A comprehensive framework for effective instruction*. Alexandria, VA: Association for Supervision and Curriculum Development.

McCutcheon, G. (1980). How do elementary school teachers plan? The nature of planning and influences on it. *The Elementary School Journal, 81*(1), 4–23.

Mitchem, K., Wells, D. L., & Wells, J. G. (2003). Effective integration of instructional technologies (IT): Evaluating professional development and instructional change. *Journal of Technology and Teacher Education, 11*(3), 397–414.

Moallem, M. (1998). An expert teacher's thinking and teaching and instructional design models and principles: An ethnographic study. *Educational Technology Research and Development, 46*(2), 37–64. doi:10.1007/BF02299788.

Moallem, M., & Applefield, J. (1997). Instructional systems design and preservice teachers' processes of thinking, teaching and planning: What do they learn and how do they change? *Proceedings of Selected Research and Development Presentations at the 1997 National Convention of the Association for Educational Communications and Technology* (*AECT*) (pp. 217–232). Albuquerque, NM: AECT. Retrieved from http://www.eric.ed.gov/

*Moallem, M., & Earle, R. S. (1998). Instructional design models and teacher thinking: Toward a new conceptual model for research and development. *Educational Technology, 38*(2), 5–22.

Molenda, M. (2009). Origins and evolution of instructional systems design. In K. H. Silber & W. R. Foshay (Eds.), *Handbook of improving performance in the workplace: Instructional design and training delivery* (pp. 53–92). San Francisco, CA: John Wiley & Sons.

Morrison, G. R., & Lowther, D. L. (2010). *Integrating computer technology into the classroom: Skills for the 21st century*. Boston, MA: Allyn & Bacon.

Newby, T. J., Stepich, D., Lehman, J. D., Russell, J. D., & Ottenbreit-Todd, A. (2011). *Educational technology for teaching and learning* (4th ed.). Boston, MA: Pearson.

Norton, P., Rooij, S. W., Jerome, M. K., Clark, K., Behrmann, M., & Bannan-Ritland, B. (2009). Linking theory and practice through design: An instructional technology program. In M. Orey, V. J. McClendon, & R. M. Branch (Eds.), *Educational media and technology yearbook* (Vol. 34, pp. 47–59). New York, NY: Springer.

Oser, F. K., & Baeriswyl, F. J. (2001). Choreographies of teaching: Bridging instruction to learning. In V. Richardson (Ed.), *Handbook of research on teaching* (4th ed., pp. 1031–1065). Washington, DC: American Educational Research Association.

Osguthorpe, R. T., & Osguthorpe, R. D. (2007). Instructional design as living practice: Toward a conscience of craft. *Educational Technology, 47*(4), 13–23.

Ozdilek, Z., & Robeck, E. (2009). Operational priorities of instructional designers analyzed within the steps of the ADDIE instructional design model. *Procedia - Social and Behavioral Sciences, 1*(1), 2046–2050. doi:10.1016/j.sbspro.2009.01.359.

Palak, D., & Walls, R. T. (2009). Teachers' beliefs and technology practices: A mixed-methods approach. *Journal of Research on Technology in Education, 41*(4), 417–441.

Peterson, P. L., & Clark, C. M. (1978). Teachers' reports of their cognitive processes during teaching. *American Educational Research Journal, 15*(4), 555–565.

Peterson, P. L., Marx, R. W., & Clark, C. M. (1978). Teacher planning, teacher behavior, and student achievement. *American Educational Research Journal, 15*(3), 417–432.

Power, M. (2009). *A designer's log: Case studies in instructional design*. Edmonton, Canada: Athabasca University Press.

Raths, J. D., & McAninch, A. R. (Eds.). (2003). *Teacher beliefs and classroom performance: The impact of teacher education*. Greenwich, CN: Information Age Publishing.

Reiser, R. (2001). A history of instructional design and technology: Part II: A history of instructional design. *Educational Technology Research and Development, 49*(2), 57–67.

*Reiser, R., & Dick, W. (1996). *Instructional planning: A guide for teachers* (2nd ed.). Boston, MA: Allyn and Bacon.

Richardson, V. (2003). Preservice teachers' beliefs. In J. D. Raths & A. R. McAninch (Eds.), *Teacher beliefs and classroom performance: The impact of teacher education* (pp. 1–22). Greenwich, CN: Information Age Publishers.

Rimm-Kaufman, S. E., & Hamre, B. K. (2010). The role of psychological and developmental science in efforts to improve teacher quality. *Teachers College Record*, *112*(12), 2988–3023. Retrieved from http://www.tcrecord.org

Roblyer, M. D., & Doering, A. H. (2010). *Integrating educational technology into teaching*. Upper Saddle River, NJ: Pearson Merrill Prentice Hall.

Rogers, P. L. (2002). *Designing instruction for technology-enhanced learning*. Hershey, PA: Idea Group.

Ropo, E. (2004). Teaching expertise. In H. P. A. Boshuizen, R. Bromme, & H. Gruber (Eds.), *Professional learning: Gaps and transitions on the way from novice to expert*. New York, NY: Kluwer.

Rose, E., & Tingley, K. (2008). Science and math teachers as instructional designers: Linking ID to the ethic of caring. *Canadian Journal of Learning and Technology*, *34*(1), Article 1. Retrieved from http://www.cjlt.ca/index.php/cjlt/article/view/171/167

Rosiek, J., & Atkinson, B. (2005). Bridging the divides: The need for a pragmatic semiotics of teacher knowledge research. *Educational Theory, 55*(4), 421–442. doi:10.1111/j.1741-5446.2005.00004.x.

Salisbury, D. F. (1987). Introduction to special issue. *Journal of Instructional Development, 10*(4), 2.

Sang, G., Valcke, M., Braak, J. V., & Tondeur, J. (2010). Student teachers' thinking processes and ICT integration: Predictors of prospective teaching behaviors with educational technology. *Computers in Education, 54*(1), 103–112. doi:10.1016/j.compedu.2009.07.010.

Sardo-Brown, D. (1990). Experienced teachers' planning practices: A US survey. *Journal of Education for Teaching, 16*(1), 57.

Sardo-Brown, D. (1993). Descriptions of two novice secondary teachers' planning. *Curriculum Inquiry, 23*(1), 63–84.

Sato, M., Akita, K., & Iwakawa, N. (1993). Practical thinking styles of teachers: A comparative study of expert and novice thought processes and its implications for rethinking teacher education in Japan. *Peabody Journal of Education, 68*(4), 100–110.

Savenye, W., Davidson, G., & Smith, P. (1991). Teaching instructional design in a computer literacy course. *Educational Technology Research and Development, 39*(3), 49–58. doi:10.1007/bf02296438.

Schneider, S. B. (2010). Signature pedagogies for social foundations: Negotiating social foundations teaching practices in the field of education. *Educational Studies, 46*(4), 416–428. doi:10.1080/00131946.2010.496349.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books.

Schrock, S. A., & Byrd, D. M. (1987). An instructional development look at staff development in the public schools. *Journal of Instructional Development, 10*(4), 45–53.

Seel, N. M., & Dijkstra, S. (1997). General introduction. In S. Dijkstra, N. M. Seel, F. Schott, & R. D. Tennyson (Eds.), *Instructional design: International perspectives* (Solving instructional design problems, Vol. 2, pp. 1–13). Mahwah, NJ: Lawrence Erlbaum.

Shambaugh, R. N., & Magliaro, S. (2006). *Instructional design: A systematic approach for reflective practice*. Boston, MA: Pearson/A and B.

*Shavelson, R. J., & Stern, P. (1981). Research on teachers' pedagogical thoughts, judgments, decisions, and behavior. *Review of Educational Research, 51*(4), 455–498.

Shoham, E., Penso, S., & Shiloah, N. (2003). Novice teachers' reasoning when analysing educational cases. *Asia Pacific Journal of Teacher Education, 31*(3), 195–211.

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4–14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1–22.

Singer-Gabella, M. (2012). Toward scholarship in practice. *Teachers College Record*, *114*(8). Retrieved from http://www.terecord.org

Slavin, R. E. (1989). PET and the pendulum: Faddism in education and how to stop it. *Phi Delta Kappan, 70*(10), 752–758.

Smaldino, S. E., Lowther, D. L., & Russell, J. D. (2011). *Instructional technology and media for learning* (10th ed.). Upper Saddle River, NJ: Pearson Merrill Prentice Hall.

Snelbecker, G. (1987). Instructional design skills for classroom teachers. *Journal of Instructional Development, 10*(4), 33–40. doi:10.1007/bf02905309.

So, W. W. M., & Watkins, D. A. (2005). From beginning teacher education to professional teaching: A study of the thinking of Hong Kong primary science teachers. *Teaching and Teacher Education, 21*(5), 525–541. doi:10.1016/j.tate.2005.03.003.

Sternberg, R. (2008). Applying psychological theories to educational practice. *American Educational Research Journal, 45*(1), 150–165. doi:10.3102/0002831207312910.

Stillman, J. (2011). Teacher learning in an era of high-stakes accountability: Productive tension and critical professional practice. *Teachers College Record*, *113*(1), 133–180. Retrieved from http://www.tcrecord.org

Summerville, J., & Reid-Griffin, A. (2008). Technology integration and instructional design. *TechTrends: Linking Research and Practice to Improve Learning, 52*(5), 45–51. doi:10.1007/s11528-008-0196-z.

Taylor, P. H. (1970). *How teachers plan their courses: Studies in curriculum planning*. New York, NY: National Foundation for Educational Research.

van Gog, T., Ericsson, K., Rikers, R., & Paas, F. (2005). Instructional design for advanced learners: Establishing connections between the theoretical frameworks of cognitive load and deliberate practice. *Educational Technology Research and Development, 53*(3), 73–81. doi:10.1007/bf02504799.

Wang, J., Odell, S. J., Klecka, C. L., Spalding, E., & Lin, E. (2010). Understanding teacher education reform. *Journal of Teacher Education, 61*(5), 395–402. doi:10.1177/0022487110384219.

Westerman, D. A. (1991). Expert and novice teacher decision making. *Journal of Teacher Education, 42*(4), 292–305. doi:10.1177/002248719104200407.

Wiburg, K. M. (1995). An historical perspective on instructional design: Is it time to exchange Skinner's teaching machine for Dewey's toolbox? In S. Goldman, J. Greeno, J. L. Schnase, & E. L. Cunius (Eds.), *Proceedings of CSCL 95*: *The first International Conference on Computer Support for Collaborative Learning* (pp. 385–391). Hillsdale, NJ: L. Erlbaum Associates. Retrieved from http://portal.acm.org/

Willis, J. W. (2008). *Qualitative research methods in education and educational technology*. Charlotte, NC: Information Age Publishing.

Willis, J. W., Thompson, A., & Sadera, W. (1999). Research on technology and teacher education: Current status and future directions. *Educational Technology Research and Development, 47*(4), 29–45. doi:10.1007/bf02299596.

Yinger, R. J. (1979). Routines in teacher planning. *Theory Into Practice, 18*(3), 163–169.

Yinger, R. J. (1980). A study of teacher planning. *The Elementary School Journal, 80*(3), 107–127.

*Young, A., Reiser, R., & Dick, W. (1998). Do superior teachers employ systematic instructional planning procedures? A descriptive study. *Educational Technology Research and Development, 46*(2), 65–78. doi: 10.1007/bf02299789

Zahorik, J. A. (1970). The effect of planning on teaching. *The Elementary School Journal, 71*(3), 143–151.

Zahorik, J. A. (1975). Teachers' planning models. *Educational Leadership, 33*(2), 134.

Zeichner, K. (1999). The new scholarship in teacher education. *Educational Researcher, 28*(9), 4–15. doi:10.3102/0013189x028009004.

Zeichner, K. (2007). Accumulating knowledge across self-studies in teacher education. *Journal of Teacher Education, 58*(1), 36–46. doi:10.1177/0022487106296219.

Zhang, Y. (2000). Technology assists to create a structured learning environment for discovery learning. In D. A. Willis, J. Price, & J. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2000* (pp. 849–851). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/