Preface

Education Technology, Teacher Knowledge, and Classroom Impact: A Research Handbook on Frameworks and Approaches provides a compilation of strategies that can be used to conduct research, a description of the current research field, and an examination of the role of research in guiding practice. This book began with a review of literature (Ronau et al., 2010) whose original purpose to conduct a meta-analysis was de-railed as we examined the quality of evidence presented and found major gaps in the content and validity of findings that appeared to be the result of inconsistencies in design and reporting of results such as: application and alignment with clearly articulated theoretical frameworks, quality of validity evidence to justify the development of new theoretical frameworks, and quality of validity and reliability evidence provided to justify claims from primary and secondary analyses. We therefore set out to compile a guide to provide structural models and example studies for researchers and practitioners as they develop, implement, and interpret future research. The book is divided into three sections to address this purpose.

The first section begins the handbook by reviewing strategies that have been used to conduct research on teacher knowledge for integrating educational technology. Niess discusses conceptions of Technology, Pedagogy, and Content Knowledge (TPACK), a leading conceptual framework for examining teacher knowledge for educational technology. Koehler, Mishra, and Shin conduct a systematic review of ways that have been used to measure TPACK. Hammond, Alexander, and Bodzin wrap up this section by discussing measurement issues associated with the development of value added models for TPACK on student achievement.

The second section examines the current landscape of educational technology and teacher knowledge research. Ronau and Rakes focus on teacher knowledge, conducting a systematic review of literature to develop the representativeness and relevance of the Comprehensive Framework of Teacher Knowledge (CFTK). Bell, Juersivich, Hammond, and Bell focus on the benefits and challenges of integrating dynamic representation software in mathematics, science, and social studies. Boling and Beatty conclude this section by concentrating on the challenges of preparing new teachers to integrate technology through the Cognitive Apprenticeship Model (CAM).

The third section considers the role of research in guiding practice. Lee and Manfra begin this section by discussing how vernaculars for TPACK arise in social studies. Pape, Irving, Bell, Shirley, Owens, Owens, Bostic, and Lee present principles of effective instruction in mathematics for the integration of classroom connectivity technology. Johnston and Moyer-Packenham compile three frameworks to present a model for examining preservice teacher knowledge of integrating technology in mathematics. Piro and Marksbury discuss the benefits and challenges of implementing WebQuests in the classroom through the lenses of CFTK and TPACK. Miller examines the role of knowledge of context in the effective implementation of technology in the study of mathematics. Slykhuis and Krall conducted a systematic review of literature to examine the use of educational technology to teach science concepts. Lyublinskaya and Tournaki developed a rubric to assess TPACK based on evidence from a year-long professional development program. Ronau and Rakes conclude the handbook by examining research design issues that have inhibited the field from constructing high quality evidence to guide future research and practice.

DUALITY OF TEACHER KNOWLEDGE FRAMEWORKS

This preface would not be complete without some discussion of the dual nature of teacher knowledge frameworks such as TPACK and CFTK. Theoretical frameworks of teacher knowledge are often used as models to guide and interpret studies by naming and describing the knowledge being represented. The same models are also often used as a guide to break apart components of the knowledge that they represent, measure those individual components, interpret the measures and the measures of the interactions of those parts, and then employed as a map to form these results into an overall outcome. This duality of purposes may lead to a particularly potent threat to validity as teacher knowledge research progresses to ways of measuring teacher knowledge and examining links between teacher knowledge and student achievement. For example, Mathematics Knowledge for Teaching (MKT) (Hill, Schilling, & Ball, 2004), one of the most prominent teacher knowledge frameworks in mathematics, has been used to name and describe the types of subject matter knowledge teachers need to teach mathematics and how that knowledge interacts with pedagogical knowledge and sometimes knowledge of students. Hill, Ball, Blunk, Goffney, & Rowan (2007) recognized, however, that the achievement measures created as proxies are not always representative of the targeted underlying constructs (i.e., achievement does not always equal knowledge). As a result of their studies, they recommended that studies proposing to measure teacher knowledge need to be concerned not only with content validity of the items developed, but also with convergent validity of the achievement measure with observational measures.

TPACK and CFTK are relatively new frameworks compared to MKT; they represent important advances to the field of teacher knowledge research, because they describe and define teacher knowledge not accounted for by other frameworks (i.e., TPACK describes the interaction of technology knowledge with pedagogical content knowledge; CFTK describes complex interactions of teacher knowledge). Measures for TPACK have begun to emerge, but the items developed have typically measured TPACK achievement or behavior as proxies for TPACK. The rigorous application of content validity considerations coupled with convergent validity considerations has not yet been applied to the measurement of TPACK. For example, although some studies have parsed TPACK into measures of its subcomponents (i.e., technological knowledge (TK), content knowledge (CK), pedagogical knowledge (PK), pedagogical content knowledge (PCK), technological content knowledge (TCK), and technological pedagogical knowledge (TPK)), the convergent validity between the subcomponents and the overall TPACK construct has not yet been explored. Similarly, the CFTK framework has begun to re-define conceptualizations of teacher knowledge; as this line of research matures, instruments will need to be developed to measure its constructs in valid, reliable ways and be able to interpret the measures in terms of the overall construct (i.e., concurrent and convergent validity). Such considerations are a step beyond the issues presented in this volume. We hope that this handbook challenges and supports this future research direction.

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