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INTRODUCTION

The book you have in your hands is a compilation of international pre-service teacher and higher education studies aiming at improving our understanding of knowledge integration and describing current practices with a lens on teacher training and learning processes, the integration of knowledge from various domains or of different types, and the application of theoretical knowledge. A total of seven countries from three continents are represented in this edited volume through the authors' institutional affiliations: Australia, Austria, Finland, Germany, Sweden, Switzerland, and the United States. From such diverse contexts, the volume draws upon a variety of educational and scholarly perspectives that can be of interest to researchers, teacher educators and lecturers in education and educational sciences, faculty board members, and (student) teachers as well as both undergraduate and graduate students of pedagogy, education, and educational psychology.

The book comprises sixteen selected contributions that have undergone a double-blind review process and a scoring system indicating which submissions were eligible for the edited volume. The book is structured around four major themes: (1) theoretical conceptions linking knowledge integration and professional development (Chapters 1 to 4); (2) methodological contributions and instruments for assessing knowledge integration (Chapters 5 to 7); (3) research on knowledge integration (Chapters 8 to 13); and (4) good practices for fostering knowledge integration in pre-service teacher education (Chapters 14 to 16). The studies take diverse theoretical perspectives and were conducted with qualitative and/or quantitative research methods.

PART 1: THEORETICAL CONCEPTIONS LINKING KNOWLEDGE INTEGRATION AND PROFESSIONAL DEVELOPMENT

The first theme includes four mainly theoretical contributions that engage with the concept of knowledge integration. These contributions find common ground in presupposing that integrating knowledge from multiple domains or of different types is an integral part of professional development, professionalism, and competence.

In Chapter 1, Thomas Lehmann clarifies how knowledge integration across multiple professional domains can be understood against the background of various empirical studies on (pre-service) teachers' acquisition and use of professional knowledge. On the basis of both theory and different methods for assessing knowledge integration, he distinguishes two forms: (1) knowledge integration as constructive learning and

(2) knowledge integration as knowledge application. Following this notion, Chapter 1 discusses how these distinct but related forms of knowledge integration pertain to teachers' professional competence.

In Chapter 2, Karsten Krauskopf, Carmen Zahn, and Friedrich W. Hesse integrate two lines of research which focus on complex knowledge domains: technology implementation for classroom teaching and learner heterogeneity. In doing so, the authors display how complex domains can be cognitively integrated to form a common coherent knowledge base. The chapter ends with suggestions for pre-service teachers' professional development regarding theory and future research, as well as teacher training.

David D. Barker, Matthew S. Winsor, J. Vince Kirwan, and Theodore J. Rupnow (Chapter 3) present a model for grasping the dynamic interactions involved in (pre-service) teachers' knowledge integration in terms of applying subject-matter knowledge, knowledge of learners, and knowledge of pedagogy. They elaborate on their model and on specific analytical procedures that can be derived from the model using two distinct examples from a case study with two fifth-grade teachers.

In Chapter 4, Katrin Klieme, Thomas Lehmann, and Florian Schmidt-Borcherding argue that pre-service teachers and educational science students need to integrate disciplinary knowledge of pedagogy and education and knowledge of research methods to develop professionalism. This extends the typical consideration of content knowledge (CK), general pedagogical knowledge (PK), and pedagogical content knowledge (PCK) proposed by Shulman. The authors present two approaches: the research training environment (RTE), which is typically found in the US, and research-based learning (RBL), which is more common in European higher education. Subsequently, the authors discuss the conduciveness of the two approaches to students' integration of research methods and disciplinary knowledge as well as possible operationalizations of knowledge integration for future research.

PART 2: METHODOLOGICAL CONTRIBUTIONS AND INSTRUMENTS FOR INVESTIGATING KNOWLEDGE INTEGRATION

The second theme contributes to the question of which methods and/or instruments can be applied in conducting research on knowledge integration or evaluating higher education practices with regard to students' knowledge integration.

In Chapter 5, Stender and Brückmann classify previous approaches to measuring the different realms of science teachers' PCK. To this end, they first review the Refined Consensus Model (RCM), which distinguishes various realms of pedagogical content knowledge (i.e., collective, personal, and enacted PCK). The authors then present a structured compilation of methods which can certainly serve as an aid for deciding how to measure various components of PCK.

Pablo Pirnay-Dummer (Chapter 6) introduces an approach to measuring, visualizing, comparing, and clustering (pre-service) teachers' knowledge and knowledge integration – the latter in terms of an interrelated representation of

knowledge that stems from the multiple domains and disciplines involved in competent teaching. The approach and the T-MITOCAR software to be used for the analysis are based on (mental) model theory and computer linguistics. The chapter ends with a discussion of applications for teacher training.

Chapter 7, by Thomas Lehmann, Katrin Klieme, and Florian Schmidt-Borcherding, describes the development of the SILTE questionnaire, which incorporates two short scales to measure students' self-reported Separative and Integrative Learning in Teacher Education. The chapter presents the results of a study on the factorial and construct validity and the reliability of the two scales. It discusses further investigations on as well as potential uses of the questionnaire in future research and in teacher education.

PART 3: RESEARCH ON KNOWLEDGE INTEGRATION

The third theme brings together a series of contributions that present empirical research on knowledge integration in pre-service teacher education and higher education.

In Chapter 8, Hendrik Lohse-Bossenz, Andrea Westphal, and Miriam Vock present a study in which 355 student teachers, all studying at a German university, rated the intensity of the attention paid to pedagogical-psychological knowledge and pedagogical content knowledge at different stages of their university-based teacher training in educational foundation courses on the one hand and in subject-specific didactics courses on the other. Amongst other insights, two central findings are that (a) there are subject-specific differences in the degree to which pre-service teacher education courses incorporate distinguishable knowledge facets, and (b) certain knowledge facets are addressed differently at different stages of pre-service teacher training.

Helene Zeeb, Eileen Spitzmesser, Alisa Rödiger, Timo Leuders, and Alexander Renkl (Chapter 9) delve into the idea that relevance instructions (i.e., an explanation which points out why knowledge integration is important) encourage pre-service mathematics teachers' knowledge integration in terms of their ability to apply both pedagogical-psychological knowledge and pedagogical content knowledge. The authors present the results of two experiments in which they examined whether relevance instructions enhance the integration of knowledge from the different professional domains. The main results show that repeated relevance instructions stimulate the use of integrative learning strategies and foster the integrated application of the different knowledge types.

In Chapter 10, Hans-Petter Gottein reports on a quasi-experimental, longitudinal study which examined the effect of a specific learning environment on Austrian pre-service geography teachers' knowledge application. The learning environment aimed to close the gap between knowledge and action and, to this end, implemented a change strategy based mainly on the concept of subjective theories. By way of both qualitative and quantitative data analysis, the author identifies differences between

an experimental group and two control groups, suggesting that student teachers can benefit from specific instructional strategies in terms of putting different types and facets of their professional knowledge into action.

In Chapter 11, Diane Salmon, Eun Kyung Ko, Ruth Freedman, and Jill Zifkin describe how the curriculum model “Adaptive Cycles of Teaching” (ACT) can be used for a coherent coordination of pre-service teacher learning and professional development in field settings. The authors conducted a qualitative case study on the effects of ACT. In concrete terms, they investigated how five undergraduate elementary student-teachers from the US integrate knowledge of instruction and knowledge of student learning through a coding and analysis of lesson reflections. The findings lead Salmon and colleagues to conclude that the ACT design pattern can be conducive to pre-service teachers’ knowledge integration when they reflect on and analyze their practice.

Chapter 12, by Jonathan Lilliedahl, Tom Wikman, and Sven-Erik Hansén, also approaches the question of coherence within teacher education. In particular, the authors illustrate a conceptual framework which describes how knowledge integration in pre-service teacher education might be comprehended and investigated through the lens of coherence. Subsequently, they reexamine the data of three prior studies which evaluated Swedish teacher education programs in order to identify different aspects and facets of coherence.

Norbert M. Seel (Chapter 13) takes a mental model perspective to portray the relationship between game-based learning in teams and team members’ knowledge integration in higher education – the latter in terms of creating shared mental models which integrate knowledge from different perspectives and parties. The chapter reports on a case study with a total of 25 undergraduate education students, who worked in five teams within a collaborative game-based learning environment (EPICS). On the basis of different types of analyses, the study provides insight into whether and how shared mental models develop as regards the common understanding of taskwork and decision making within a serious educational game and into how shared mental models change over time with regard to their structural similarity and accuracy.

PART 4: GOOD PRACTICES FOR FOSTERING KNOWLEDGE INTEGRATION

Finally, the fourth theme includes good educational practices for fostering students’ knowledge integration in academic teacher training.

In Chapter 14, Matthew S. Winsor, David D. Barker, and J. Vince Kirwan further explore their teacher education model (which is presented in Chapter 3) and present the “BraIn MaP for Instruction” model. The authors illustrate how their models can affect pre-service teacher training as regards knowledge integration, using their (US) secondary mathematics teacher education program as an example. The chapter also reports on how their students potentially integrated different types of teacher knowledge and connected theoretical and practical knowledge.

Sandra Moroni and Gisela Bürki's contribution (Chapter 15) elaborates on pre-service teachers' knowledge integration with a particular focus on research and writing skills. This is useful because research skills are an important requirement for adequately evaluating one's own teaching and writing skills are essential for teachers in various professional contexts. Following the knowledge integration approach, the authors illustrate an innovative teaching model for the simultaneous and incremental development of both types of skills in their secondary teacher training (level 1) at a Swiss university of teacher education with a focus on a specific seminar.

Chapter 16, by Ruth Reynolds, Suzanne Macqueen, and Kate Ferguson-Patrick, presents an Australian perspective on teacher educators' and pre-service teachers' work towards knowledge integration. The authors elucidate a pre-service teachers' final year course which encouraged them to develop an overall view of teaching that integrates multiple perspectives, including disciplinary study, pedagogy, experiential practice, and community issues-based involvement.

Overall, the work included in this book sheds light on various ways to (re)think knowledge integration in higher education, particularly for pre-service teacher training. According to this perception, it may be asserted that the chapters together (a) contribute to a deeper understanding of knowledge integration as a diverse concept and (b) support scholars, lecturers, and faculty staff in helping their students to build a coherent professional knowledge base and be more competent to manage challenges in future practice. Moreover, each chapter may inspire future research, which is certainly needed to validate the various kinds of conclusions that are drawn in and can be drawn from this book.