

Preface

As instructional psychology is becoming more specialized and complex and technology is offering more and more possibilities for gathering data, instructional researchers are faced with the challenge of processing vast amounts of data. Yet the more complex our understanding of the field of learning and instruction becomes and the more our theories advance, the more pronounced is the need to apply the structures of the theories to sufficiently advanced methodology in order to keep pace with theory development and theory testing. In addition to obtaining a good fit between theory and diagnostics, this task entails making the methodology and tools feasible (easy to use and easy to interpret). Otherwise, the methodologies will only be used by their developers. The development of useful systems has always been a goal for scientists and engineers serving professional communities in the fields of instructional design and instructional systems development.

The progress of computer technology has enabled researchers to adopt methods from artificial intelligence, graph theory, feature analysis, feature tracking, and applied statistics and to use computers to implement computer-based instructional systems. Researchers have now also succeeded in developing more effective tools for the assessment of knowledge in order to enhance the learning performance of students.

The editorial committee has selected a wide range of internationally known distinguished researchers who present innovative work in the areas of educational diagnostics and the learning sciences. The audience for this volume includes professors, students, and professional practitioners in the general areas of educational psychology and instructional technology. Accordingly, the four parts of this book resemble a complete transfer from theoretical foundations to practical application. The tools and their scope of use and practicability for assessment and descriptive and comparative analysis are introduced, tested, and critically discussed.

The book starts with contributions on the *elicitation of knowledge* and continues with *methods for the aggregation and classification of knowledge* and the *comparison and empirical testing of strategies*. It concludes with a diverse overview of best practice and transferable examples for the *application of results*.

Elicitation of Knowledge

The *first part* of the book is about the theoretical foundations and recent developments and tools for the investigation of knowledge. Without a sound theoretical basis, satisfactory research would not be possible due to the complex aspects of the knowledge construct. On the practical side, recent innovations provide many new opportunities for addressing knowledge empirically and, moreover, for complementing existing methods or even providing alternatives in many cases. The key focus in this part is on strategies for finding out what a person knows as opposed to finding out what he or she does not know (as is often the case in classical knowledge assessment and testing).

Aggregation and Classification of Knowledge

The *second part* concentrates on the aggregation and classification of the different kinds of data on knowledge. Additional integrated tools for assessment and analysis are also introduced. Some of the existing tools already have functionality for aggregation, while the interfaces of others can be used with them. Accordingly, the second part also describes data interfaces between different knowledge assessment tools.

Comparison and Empirical Testing of Strategies

Once the data on knowledge has been aggregated, different methods and tools for comparison are available for use, ranging from applied graph theory to computer linguistic models. Possibilities for comparing and empirically testing similarities and differences between individual and group knowledge go far beyond simple frequency measures. The *third part* of the book will help readers apply these methods to their research. Therefore, there will be an emphasis on the practical application of the methodologies and on the interpretation of the results.

Application of Results

The *fourth part* will help readers structure the results from their own research and apply them to their field. Best practice examples and basic interpretation patterns help orchestrate the findings in practice. Thus, emerging development perspectives for the fields in question are also introduced.

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Freiburg, Germany

Dirk Ifenthaler, Pablo Pirnay-Dummer,
and Norbert M. Seel

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Ifenthaler, D.; Pirnay-Dummer, P.; Seel, N.M. (Eds.)

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