Introduction

In this introduction the starting point and the aims of the book are briefly stated, followed by the chapter summaries.

1. PREMISES

In the past decades, more rigid concepts of research gathered momentum in the social sciences, and subsequently in scientific approaches to teaching and learning. What is undoubtedly a gain per se may have unexpected and undesirable consequences for teachers and learners:

- Many important aspects of teaching and learning are beyond experimental research; others still wait to be investigated.
- In general, there is too much emphasis on Randomized Controlled Trials (RCTs), often considered as a panacea for all educational problems.
- On the other hand, important results from the social sciences are neglected or even considered as unscientific: for example, studies on intuition and teacher personality, as well as research into different ways to make ideas and learning stick.
- Standards-based education is not sufficiently aligned with evidence-informed teaching and learning.
- For educators and students alike it is often difficult to find their way through the maze of scientific results, that is to say, to select those procedures that are most appropriate for the learners in a specific context.
- There are too many guides and "cookbooks" that indiscriminately propagate, not to say preach, dozens of techniques and strategies

without helping teachers and learners to sort the wheat from the chaff.
- Even though many suggestions may be suitable for many learning contexts, what to adopt and adapt is the choice of the teacher. Otherwise the professionalism of educators is at risk, reducing them to puppets on a string.

2. AIMS

Effective teaching and successful learning are quite possible if we look at research through the eyes of educators who want to obtain the best results for all their learners. To do so, this book aims to:

- concentrate on the foundations of different approaches to research;
- enable teachers to understand the most important scopes and pitfalls of scientific research into education;
- look at the premises of effective teaching practices that lead to successful learning;
- focus on important techniques and strategies to apply during different parts of the lesson;
- exemplify teaching practices for different grades and various subject matters;
- take care of the accumulation of competencies in the longer term;
- help teachers to cope with standards, tests, and evaluation;
- strengthen teacher personality as a means to promote the joy of teaching and learning.

Using research to improve practice means choosing adequate tools and adapting them to a special learning context determined not only by goals, standards, and objectives, but also by unique teachers and learners. Many parts of this book are inspired by my experiences as a school teacher and a university professor specializing in empirical research on language teaching as well as in intercultural communication. My considerations about effective teaching and successful learning are based on a large amount of prior publications (mostly in German and English), particularly on De Florio-Hansen (2014a, 2014b, 2015).

3. STRUCTURE

In Chapter 1, the main features of scientific research are described in a succinct way, including recent developments and current accepted

knowledge. Science and research are defined so that their interrelationship becomes evident. The examples of three outstanding educational psychologists of the past century help (prospective) teachers and other education professionals to understand that the approaches of scientists often are different, even though they arrive at comparable findings. Furthermore, the results of Piaget, Vygotsky, and Bruner – in part closely related; in part in contrast to each other – form the basis of contemporary views of teaching and learning, not only in the English-speaking countries.

A closer look at education and educational research will lead to a better understanding of the shortcomings of certain teacher guides.

In Chapter 2, basic knowledge of scientific research is further developed, explaining and defining the most important types of research, such as descriptive and explanatory studies. After focusing on the fundamental differences between theories, hypotheses, and models on the one hand, and research design and methodology on the other, we will move forward to the main aspects of psychometrics indispensable for experimentation, such as RCTs, quasi-experiments, and correlation studies. All features are explained using examples from the field of education. The obsolete distinction between qualitative and quantitative research and other critical issues are problematized. The chapter is completed by a conversation between two undergraduate students who are preparing a presentation about Dewey's contributions to scientific inquiry and educational research.

Chapter 3 deals with the main features of newer scientific approaches to educational research influenced by evidence-based medicine. Starting with a discussion of similarities and differences between medicine and education, the role of treatments in both fields – drugs in the one case, pedagogical interventions in the other – is of particular interest. Essential features of evidence-based research, such as empirical evidence, grades of evidence, and the difference between effectiveness and efficiency, are illustrated in order to show the potential and the pitfalls of controlled experiments (RCTs). In this context a well-designed RCT, in the form of a natural experiment, is presented. It is argued that learning outcomes are not directly influenced but rather are stimulated by teaching; that is to say, student achievement is not the output of teaching, but the consequence of learning. Therefore findings of evidence-based research into educational issues should be considered in an unorthodox way. Results of evidence-based research are to be taken as an important source for teachers to reconsider their educational practices. It is for the expert, adaptive, evidence-informed teacher to decide whether to adopt and in

which way to adapt a certain intervention to his or her own educational context.

In **Chapter 4**, before looking at examples of meta-analytic research, the main features of this research design are defined and described so that teachers can benefit from the results. As the main findings of meta-analyses are indicated in an averaged measure of synthesized outcomes – the so-called effect size – a comprehensible explanation of this highly relevant term is given and exemplified. On the basis of this knowledge, two relevant meta-analyses are critically appraised in order to further inform teachers about the potential and the limits of meta-analyses in the complex field of education. The scholarly studies are first and foremost presented with the intention of helping teachers to make informed decisions about improving the learning of all their students. The limits of meta-analytic research lead to the advice to be cautious before putting evidence-based research findings into practice.

Chapter 5 deals extensively with John Hattie's mega-analysis, a synthesis of more than 800 meta-analyses of research on achievement.

The design and the main findings of Hattie's study are analyzed and critically examined. This critique refers partly to the methodological procedure of a mega-analysis per se, which potentiates the shortcomings of meta-analytic research. Hattie's unorthodox attitudes toward empirical and especially experimental research are detected and noted so that teachers and the whole education profession might be well aware of how to deal with Hattie's results. The merit of Hattie's enormous research endeavor is mostly seen in the teaching model that he presents in *Visible learning* (2009) and in more detail in *Visible learning for teachers*, a resource book that shows once more the curse of knowledge. An important, and perhaps the most criticized, outcome of Hattie's study is the low effect that he attributes to class size. In the *International guide to student achievement*, a useful handbook edited together with Eric Anderman (Hattie & Anderman, 2013), Hattie himself is eager to correct his previous views and to underscore the importance of small-sized classes.

N.B. In the following chapters I refer to the effect sizes indicated in Hattie's study of 2009: First, because effect sizes of different primary studies and meta-analyses are not comparable; second, because Hattie's ranking of 138 factors is widely known in the scientific world.

Chapter 6 presents a comprehensive teaching model, the MET (Model of Effective Teaching), based on experimental research – mostly on the detailed research findings of Hattie, Marzano, and Wellenreuther (2004, 2014). The MET is in some ways comparable to Hattie's model of Direct

Instruction, which draws explicitly on the DISTAR model of Siegfried Engelmann and implicitly on the Lesson Plan Design of Madeline Cheek Hunter. My own compilation, the MET, is however intended as a scaffold for practitioners. There is no claim that all thirty steps must be followed. Teachers may equally profit from important analyses of single teaching and learning strategies that will enable them to choose adequate interventions and translate them into locally adapted applications. Therefore, the thirty steps will be discussed on the basis of research findings and illustrated by examples referring to different grades and subject matters (see Chapters 7–11). The MET is intended to help teachers to question teaching traditions and personal habits so that they can make informed decisions to the benefit of their students. My overall aim, besides presenting newer research findings, is to strengthen the personality of teachers in order to avoid their de-professionalization.

Chapter 7 illustrates the steps of **planning and starting a lesson**, including several practical examples. **The planning phase** comprises five steps, the most important of which is the choice of challenging goals in accordance with the needs and interests of the students. In order to build on previous knowledge, teachers must know where their learners stand with regards to subject matter knowledge, skills, and related attitudes. Furthermore, they have to make efforts to gain insights into the world knowledge of their students based on maturation and the influences of students' families and wider living contexts. Both aspects – didactic knowledge and knowing about the world – are illustrated in this chapter. As there are great differences between learners regarding the aforementioned issues, teachers have to be prepared for alternative activities if students' misconceptions call for re-teaching.

Starting the lesson includes the following steps: giving the students a clear idea of the goals, the learning intentions, and the success criteria; making the value of the learning objectives transparent; confirming students' expectations regarding their ability to meet the goals; and building commitment and engagement in the learning tasks. To start well, teachers should think of a motivating and inspiring hook in order to focus student attention on the following lesson.

Chapter 8 deals with empirical research into **explaining, presenting, and modeling new content**. The premise is **classroom management and classroom climate**. No teaching or learning will be effective if the teacher is unable to create a favorable classroom atmosphere, which is mainly determined by efficient classroom management with clear rules and routines. Introducing content or skills through effective teaching means

comprehensible explanations or demonstrations of the content, enriched by illuminating examples related to students' lives. Teacher clarity is of utmost importance. In many cases, further illustration of the content through pictures, graphics, figures, and audio-visual examples taking recourse to the new media can be significant. The presentation phase is interrupted and followed by assertive questioning. These questions from the teacher and the students allow for checking if and how the students have understood the new learning content. During all steps, teachers have to display a positive attitude towards misconceptions and mistakes. If learning results turn out to be insufficient, teachers have to be prepared to repeat part of the lesson.

Chapter 9 shows how to conceptualize **guided and independent practice** on the basis of newer research. As important as the presentation of input may be, the following steps of practice are indispensable. Guided practice consists of graded tasks and worked examples including explanation of the solution steps. Whereas guided practice is closely supervised by the teacher, with formative feedback and short explanations for single students, independent practice is often accompanied by peer feedback and concluded by formative assessment through tests. Thoroughly planned, varied, and decontextualized tasks aim at the reinforcement and transfer of the content or skills to other relevant situations. The final step, the closure part, brings the lesson to an appropriate conclusion.

In **Chapter 10** we will look at the ample research findings regarding **cooperative learning and PBL used interchangeably for project- and problem-based forms of learning**. Dewey's thoughts and claims are illustrated as they are one of the foundations of a democratic education based on mutual support. Furthermore, "learning by doing" is another characteristic of cooperative forms of learning. Newer research illustrates that group cohesion contributes more than competition or individualistic learning to the success of overlearning as deliberate practice. Five major forms of cooperative learning are defined and exemplified. In order to embed learning content in the long-term memory and make it easily retrievable for appropriate application, deliberate practice is essential. To encourage teachers to integrate cooperative learning and PBL into their practice, selected examples are explained in detail.

Chapter 11 is dedicated to **feedback as formative (and summative) assessment**. From research findings, the following suggestions are deduced: Feedback should be informative and not generic. Praise and extrinsic rewards have to be avoided. Feedback is most successful when it is reciprocal, which is to say it should not be one-track but should lead to a

dialogue between teachers and students. Three different forms of feedback in the classroom – in my view, the most important aspect of teaching and learning in an institutional setting – are discussed on the basis of Hattie and Timperley's feedback model. The main questions are: How can teachers provide adequate feedback to their students? How can students give effective feedback to their peers? How can teachers elicit feedback about their teaching from the students? Important issues of reciprocal and informative feedback are exemplified.

In the **Concluding Remarks**, conjectures are made about possible relationships between standards-based and evidence-based teaching and learning. Important questions to be answered are: What does standardization of schools mean? What are educational standards? What are performance standards used for? Which standards may further teaching in such a way that student learning is initiated and improved? Is there a relationship between education systems that are based on performance standards and students' test scores in international assessment studies? How can educational standards be assessed? Are standards in accordance with significant results of evidence-based education? Provisional answers are meant as an opportunity for further debate.

1

Main Features of Scientific Research on Education

Before being able to see learning processes and their results through the eyes of the students (Hattie, 2009, 2012), educators and teachers should take a closer look at relevant findings of scientific research on education. Why is it necessary to spend a certain amount of time and effort in studying research when you, as a teacher, are more or less satisfied with the learning outcomes of your students?

In a complex field like education it is always useful to question habits and conventions in the light of newer and newest research findings. Furthermore, as part of the debate on accountability, we have to answer to ourselves as to whether we choose the best possible teaching and learning activities with regard to our individual learners.

The following statements and explanations are a succinct introduction to the main features of scientific research on education. The overall aim of these introductory remarks is to enable teachers in training and in service to appraise research findings. If an educator concludes that a research proposal may work better as usual practices, new strategies as well as whole intervention programs may be tried out. Don't forget that even highly recommended tools must be adapted to your specific teaching and learning context. Nevertheless they still might be revealed as inappropriate, for various reasons.

1.1. A CONFERENCE TALK

Sarah and Kate, both ELA high-school teachers, meet just once a year at their state's annual curriculum conference. During the year, they keep in loose email contact, exchanging ideas and sometimes teaching materials. Recently, they participated in the same webinar.

This time more than ever before, the focus of the conference is on evidence-based education. During the breaks Sarah and Kate come together in the hallway:

SARAH: You don't look very happy. Is there something wrong?
KATE: No, no, but I can't hear it anymore, evidence-based teaching, evidence-based learning, evidence-based everything . . .
SARAH: But don't you think it's a good thing that we are invited to question our teaching habits?
KATE: Sure, but you can't analyze the whole teaching and learning process through experimental research.
SARAH: That's true. But there are many aspects of teaching and learning that I considered in a certain way without questioning either the premises or the consequences. The results of scientific research showed me that I wasn't aware of certain details.
KATE: Don't misunderstand me. I'm not against research into education, not at all. What bothers me is the fact that experiments or quasi-experiments are considered a cure-all.
SARAH: I agree with you, sure. There are other types of research of equal importance. It depends on what you are looking for.
KATE: Without saying it openly, some scholars devalue older studies that didn't include rigid experimentation. What about great thinkers on education like Piaget, Vygotsky, Bruner, or Dewey?
SARAH: From my point of view their influence on teaching and learning is not contested at all; it continues. But there are strategies – for example, *reciprocal teaching* or *concept mapping* – that weren't in the focus of those great thinkers. In these cases, evidence-based research can be of help. Don't you think so?
KATE: Yes, but sometimes the results of evidence-based research are not reliable, and even when this is the case, I don't have the time to read all the details about the context in which the strategy or the tool worked well.
SARAH: You mean, an evidence-based result is nothing more than an invitation to consider the strategy as a possible means to improve teaching and learning?
KATE: Yes, that's why I'm in favor of research-based education that is influenced by the thoughts of great educationalists. They did not prescribe everything in detail, but suggested . . . how shall I put it? . . . a certain mindset. Furthermore, their work has proven its value over decades and even centuries.
SARAH: You are right. When I think about it, an amazing fact comes to my mind: Most of the authors that report results of recent evidence-based research quote ancient philosophers such as Socrates, Plato, and Aristotle to underline their new findings.

KATE: Oh, yes; therefore I think the expression "evidence-based education" isn't acceptable. We can't base our teaching only on the results of experimental research.
SARAH: I see . . .
KATE: In my opinion, research-based education consists of a mixture of useful older research and newer studies which still have to prove their practical benefits. Therefore I prefer the term evidence-oriented or rather evidence-informed teaching and learning.
SARAH: Let's go back and talk with others about our views.
KATE: Oh, no; I'm afraid I'm not an expert. During my teacher training, research was not the center of attention. Qualitative research, quantitative research, ok, but I don't know the exact difference between a theory and a hypothesis, and I have only vague ideas about research design and methodology . . .

1.2. SCIENCE AND RESEARCH

The word *science* is derived from Latin *scientia*, which means knowledge. You might object that not every type of knowledge is science. In fact, the knowledge you accumulated during your time at high school in a subject matter such as physics or history is not considered science, even though knowledge of school subjects is based on scientific results. If all knowledge was considered as science, every educated person would be a scientist. So what is the relationship between the two terms?

Science is a systematic endeavor that builds and organizes knowledge. The knowledge generated and accumulated through the systematic work and effort of scientists has to be in accordance with certain criteria. Scientific knowledge is supposed to offer explanations and predictions about different kinds of phenomena in a testable and replicable way.

Imagine the following situation: One of your colleagues has, several times in different classes – let's say in grade 9 and in grade 10 – tried using advance organizers to inform his or her students about the objectives of a lesson or a teaching unit. An advance organizer is a structured overview of the following text or content that aims at facilitating the students' learning processes. The U.S. psychologist D. P. Ausubel introduced this strategy into educational psychology in the 1960s.

Even though the positive outcomes of your colleague's intervention were higher in grade 10 than in grade 9, he or she is convinced that the positive