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Science Education Reconceptualizing the Nature of Science for Science Education **A Framework for K-12 Science Education** Science Education for Everyday Life *Research and the Quality of Science Education Visualization in Science Education* **Science Education Through Multiple Literacies** *Handbook of Research on Science Education Urban Science Education for the Hip-Hop Generation* **Diversity and Equity in Science Education** The Language of Science Education **Toward a Scientific Practice of Science Education** *Second International Handbook of Science Education* Time for Science Education **Science Education and Culture** Science Education from People for People **Critical Voices in Science Education Research** *Science Education in the 21st Century Argumentation in Science Education Taking Science to School* Scientific Teaching **Contributions from Science Education Research Global Developments in Literacy Research for Science Education Chinese Science Education in the 21st Century: Policy, Practice, and Research** *Cases on Research-Based Teaching Methods in Science Education* Enhancing Science Education **Teaching Science Online** *Internet Environments for Science Education* Modelling-based Teaching in Science Education **Inquiry-based Science Education Science Education for Diversity** Theorizing the Future of Science Education Research **Science and Technology Education Promoting Wellbeing for Individuals, Societies and Environments** *Re-examining Pedagogical Content Knowledge in Science Education* **Science Education in Context** A History of Ideas in Science Education Science Education in Theory and Practice *Science Teaching* **Improving How Universities Teach Science Topics in Science Education**

This book is a collection of narratives from a diverse array of science education researchers that elucidate some of the difficulties of becoming a science education researcher and/or science teacher educator, with the hope that through solidarity, commonality, and “telling the story”, justice-oriented science education researchers will feel more supported in their own journeys. Being a scholar and teacher that sees science education as a space for justice, and thinking/being different, entry into this disciplinary field often comes with tense moments and personal difficulties. The chapter authors of this book break into many painful, awkward, and seemingly nebulous topics, including the intersectional nuances of what it means to be a researcher in the contexts of epistemic rigidness, white supremacy, and neoliberal restructuring. Of course these contexts become different depending on how teachers, students, and researchers are constituted within them (as racialized/sexed/gendered/disposable/valued subjects). We hope that within these narratives readers will identify with similar struggles in terms of what it means to desire to “do good in the world”, while facing subtle and not-so-subtle institutional, personal cultural, and political challenges. Too many universities remain wedded to outmoded ways of teaching. Too few departments ask whether what happens in their lecture halls is effective at helping students to learn and how they can encourage their faculty to teach better. But real change is possible, and Carl Wieman shows us how it can be done—through detailed, tested strategies. This edited volume provides theoretical and practical resources relating to the ‘STEPWISE’ curricular and instructional framework. ‘STEPWISE’ is the acronym for Science & Technology Education Promoting Wellbeing for Individuals, Societies & Environments. It is a framework for organizing teaching and learning domains in ways that prioritize personal and social actions to address ‘critical socioscientific issues’ — that is, controversial decisions by powerful individuals/groups about science and technology (and related fields) that may adversely affect individuals, societies and/or environments. The book contains chapters written by and/or with teachers who have used STEPWISE to guide their instructional practices, as well as chapters written by education scholars who have used a range of theoretical lenses to analyze and evaluate STEPWISE — and, in several cases, described ways in which it relates to (or could relate to) their practices and/or ways in which the framework might logically be amended. Overall, this book offers educators, policy makers and others with resources useful for arranging science and technology education in ways that may assist societies in addressing significant potential personal, social and/or environmental problems — such as dramatic climate change, preventable human diseases, species losses, and social injustices — associated with fields of science and technology. Christopher Emdin is an assistant professor of science education and director of secondary school initiatives at the Urban Science Education Center at Teachers College, Columbia University. He holds a Ph.D. in urban education with a concentration in mathematics, science and technology; a master’s degree in natural sciences; and a bachelor’s degree in physical anthropology, biology, and chemistry. This book argues that modelling should be a component of all school curricula that aspire to provide ‘authentic science education for all’. The literature on modelling is reviewed and a ‘model of modelling’ is proposed. The conditions for the successful implementation of the ‘model of modelling’ in classrooms are explored and illustrated from practical experience. The roles of argumentation, visualisation, and analogical reasoning, in successful modelling-based teaching are reviewed. The contribution of such teaching to both the learning of key scientific concepts and an understanding of the nature of science are established. Approaches to the design of curricula that facilitate the progressive grasp of the knowledge and skills entailed in modelling are outlined. Recognising that the approach will both represent a substantial change from the ‘content-transmission’ approach to science teaching and be in accordance with current best-practice in science education, the design of suitable approaches to teacher education are discussed. Finally, the challenges that modelling-based education pose to science education researchers, advanced students of science education and curriculum design, teacher educators, public examiners, and textbook designers, are all outlined. Students often think of science as disconnected pieces of information rather than a narrative that challenges their thinking, requires them to develop evidence-based explanations for the phenomena under investigation, and communicate their ideas in discipline-specific language as to why certain solutions to a problem work. The author provides teachers in primary and junior secondary school with different evidence-based strategies they can use to teach inquiry science in their classrooms. The research and theoretical perspectives that underpin the strategies are discussed as are examples of how different ones areimplemented in science classrooms to affect student engagement and learning. Key Features: Presents processes involved in teaching inquiry-based science Discusses importance of multi-modal representations in teaching inquiry based-science Covers ways to develop scientifically literacy Uses the Structure of Observed learning Outcomes (SOLO) Taxonomy to assess student reasoning, problem-solving and learning Presents ways to promote scientific discourse, including teacher-student interactions, student-student interactions, and meta-cognitive thinking This anthology contains 21 papers by prominent historians and philosophers of science, philosophers of education, science educators and science teachers. It is expansive in its subject matter, and detailed in its analysis. The common thread in all papers is the contribution that the history and philosophy of science makes to theoretical, curricular, and pedagogical issues in science education. This is a timely focus as, worldwide, there are increasing demands made on science curriculum writers and teachers to ensure that students come to know something of the `nature of science', or something about the `big picture' of science. This means knowing something of the history and methodology of science, its relations with world views, and how science articulates with social and cultural values and interests. The contributions show how historically and philosophically informed teaching of science can create this `big picture' knowledge about science, which in turn allows science to inform culture and social life. This book presents an international perspective of the influence of educational context on science education. The focus is on the interactions between curriculum development and implementation, particularly in non-Western and non-English-speaking contexts (i.e., outside the UK, USA, Australia, NZ, etc.). "Science education represents one of the most fundamental components of any well-designed public education program, as teaching science helps students understand critical thinking skills and evidence-based reasoning. However, the field of science education is not without its controversies, as the multifaceted and complex nature of science leads to differences of opinion on the merits of various teaching modalities. Chapter One of this book explains the tension that exists between individual learning styles, which can vary significantly among students, and the need to offer practical guidance to science teachers, who generally plan their curricula on a class/course basis. Chapter Two describes the lack of consensus on the meaning of STEM or STEAM education among educators and attempts to resolve this ambiguity by clearly defining the characteristics and objectives of STEM education. Chapter Three presents a study that includes a design and implementation of playful science projects in the elementary classroom that facilitate the learning of STEM concepts in formal contexts and promote positive emotions in students. Chapter Four discusses the tendency for teachers to experience negative emotions when conducting STEM education as well as the impact of a teacher's emotional state on student outcomes. Chapter Five explores the logical basis of Einstein's theory of general relativity and its meaning as derived by Einstein's inquiry process. Finally, Chapter Six expresses the importance of teaching science through inquiry by presenting a case study of a simple inquiry-based activity in a public senior high school in Japan"-- Two leading science educators provide a comprehensive, state-of-the-field analysis of current trends in the research, policy, and practice of science education. This book offers valuable insights into why gaps in science achievement among racial, ethnic, cultural, linguistic, and socioeconomic groups persist, and points toward practical means of narrowing or eliminating these gaps. Lee and Buxton examine instructional practices, science-curriculum materials (including computer technology), assessment, teacher education, school organization, federal and state policies, and home-school connections. Diversity and Equity in Science Education features a synthesis of the emerging body of research in the field of science education and its application to practice and policy, a description of effective practices for narrowing science achievement gaps among demographic subgroups of students, and an analysis of major science education initiatives, interventions, and programs that have been successful with nonmainstream students. "This book comprises a wide range of scholarly essays introducing readers to key topics and issues in science education. Science education has become a well established field in its own right, with a vast literature, and many active areas of scholarship. Science Education: An International Course Companion offers an entry point for students seeking a sound but introductory understanding of the key perspectives and areas of thinking in science education. Each account is self-contained and offers a scholarly and research-informed introduction to a particular topic, theme, or perspective, with both citations to key literature and recommendations for more advanced reading. Science Education: An International Course Companion allows readers (such as those preparing for school science teaching, or seeking more advanced specialist qualifications) to obtain a broad familiarity with key issues across the field as well as guiding wider reading about particular topics of interest. The book therefore acts as a reader to support learning across courses in science education internationally. The broad coverage of topics is such that that the book will support students following a diverse range of courses and qualifications. The comprehensive nature of the book will allow course leaders and departments to nominate the book as the key reader to support students – their core 'course companion' in science education." Seasoned classroom veterans, pre-tenured faculty, and neophyte teaching assistants alike will find this book invaluable. HHMI Professor Jo Handelsman and her colleagues at the Wisconsin Program for Scientific Teaching (WPST) have distilled key findings from education, learning, and cognitive psychology and translated them into six chapters of digestible research points and practical classroom examples. The recommendations have been tried and tested in the National Academies Summer Institute on Undergraduate Education in Biology and through the WPST. Scientific Teaching is not a prescription for better teaching. Rather, it encourages the reader to approach teaching in a way that captures the spirit and rigor of scientific research and to contribute to transforming how students learn science. Prompted by the ongoing debate among science educators over 'nature of science', and its importance in school and university curricula, this book is a clarion call for a broad re-conceptualizing of nature of science in science education. The authors draw on the 'family resemblance' approach popularized by Wittgenstein, defining science as a cognitive-epistemic and social-institutional system whose heterogeneous characteristics and influences should be more thoroughly reflected in science education. They seek wherever possible to clarify their developing thesis with visual tools that illustrate how their ideas can be practically applied in science education. The volume's holistic representation of science, which includes the aims and values, knowledge, practices, techniques, and methodological rules (as well as science's social and institutional contexts), mirrors its core aim to synthesize perspectives from the fields of philosophy of science and science education. The authors believe that this more integrated conception of nature of science in science education is both innovative and beneficial. They discuss in detail the implications for curriculum content, pedagogy, and learning outcomes, deploy numerous real-life examples, and detail the links between their ideas and curriculum policy more generally. Pedagogical Content Knowledge (PCK) has been adapted, adopted, and taken up in a diversity of ways in science education since the concept was introduced in the mid-1980s. Now that it is so well embedded within the language of teaching and learning, research and knowledge about the construct needs to be more useable and applicable to the work of science teachers, especially so in these times when standards and other measures are being used to define their knowledge, skills, and abilities. Re-examining Pedagogical Content Knowledge in Science Education is organized around three themes: Re-examining PCK: Issues, ideas and development; Research developments and trajectories; Emerging themes in PCK research. Featuring the most up-to-date work from leading PCK scholars in science education across the globe, this volume maps where PCK has been, where it is going, and how it now informs and enhances knowledge of science teachers' professional knowledge. It illustrates how the PCK research agenda has developed and can make a difference to teachers' practice and students' learning of science. With the increasing focus on science education, growing attention is being paid to how science is taught. Educators in science and science-related disciplines are recognizing that distance delivery opens up new opportunities for delivering information, providing interactivity, collaborative opportunities and feedback, as well as for increasing access for students. This book presents the guidance of expert science educators from the US and from around the globe. They describe key concepts, delivery modes and emerging technologies, and offer models of practice. The book places particular emphasis on experimentation, lab and field work as they are fundamentally part of the education in most scientific disciplines.

Chapters include: * Discipline methodology and teaching strategies in the specific areas of physics, biology, chemistry and earth sciences. * An overview of the important and appropriate learning technologies (ICTs) for each major science. * Best practices for establishing and maintaining a successful course online. * Insights and tips for handling practical components like laboratories and field work. * Coverage of breaking topics, including MOOCs, learning analytics, open educational resources and m-learning. * Strategies for engaging your students online. A companion website presents videos of the contributors sharing additional guidance, virtual labs simulations and various additional resources. This book reflects on science education in the first 20 years of the 21st century in order to promote academic dialogue on science education from various standpoints, and highlights emergent new issues, such as education in science education research. It also defines new research agendas that should be "moved forward" and inform new trajectories through the rest of the century. Featuring 21 thematically grouped chapters, it includes award-winning papers and other significant papers that address the theme of the 2018 International Science Education Conference. This book provides an overview of science education policies, research and practices in mainland China, with specific examples of the most recent developments in these areas. It presents an insiders' report on the status of Chinese science education written primarily by native speakers with first-hand experiences inside the country. In addition, the book features multiple sectional commentaries by experts in the field that further connect these stories to the existing science education literature outside of China. This book informs the international community about the current status of Chinese science education reforms. It helps readers understand one of the largest science education systems in the world, which includes, according to the Programme for International Student Assessment, the best-performing economy in the world in science, math and reading: Shanghai, China. Readers gain insight into how science education in the rest of China compares to that in Shanghai; the ways Chinese science educators, teachers and students achieve what has been accomplished; what Chinese students and teachers actually do inside their classrooms; what educational policies have been helpful in promoting student learning; what lessons can be shared within the international science education community; and much more. This book appeals to science education researchers, comparative education researchers, science educators, graduate students, state science education leaders and officers in the international communities. It also helps Chinese students and faculty of science education discover effective ways to share their science education stories with the rest of the world. Science Teaching argues that science teaching and science teacher education can be improved if teachers know something of the history and philosophy of science and if these topics are included in the science curriculum. The history and philosophy of science have important roles in many of the theoretical issues that science educators need to address: what constitutes an appropriate science curriculum for all students; how science should be taught in traditional cultures; how scientific literacy can be promoted; and the conflict which can occur between science curriculum and deep-seated religious or cultural values and knowledge. Outlining the history of liberal approaches to the teaching of science, Michael Matthews elaborates contemporary curriculum developments that explicitly address questions about the nature and the history of science. He provides examples of classroom teaching and develops useful arguments on constructivism, multicultural science education and teacher education. Contributing to the social justice agenda of redefining what science is and what it means in the everyday lives of people, this book introduces science educators to various dimensions of viewing science and scientific literacy from the standpoint of the learner, engaged with real everyday concerns within or outside school; develops a new form of scholarship based on the dialogic nature of science as process and product; and achieves these two objectives in a readable but scholarly way. Opposing the tendency to teach and do research as if science, science education, and scientific literacy could be imposed from the outside, the authors want science education to be for people rather than strictly about how knowledge gets into their heads. Taking up the challenges of this orientation, science educators can begin to make inroads into the currently widespread irrelevance of science in the everyday lives of people. Utmost attention has been given to making this book readable by the people from whose lives the topics of the chapters emerge, all the while retaining academic integrity and high-level scholarship. Wolff Michael Roth has been awarded the Distinguished Contributions Award by The National Association for Research in Science Teaching, for his contributions to research in this field. He has also been elected to be the Fellow of the American Association for Advancement of Science (AAAS) and Fellow of the American Educational Research Association. Filling a gap where there has been a lack of theorised, accessible and discipline-sensitive publications to assist STEM educators, this book provides an introduction to Legitimation Code Theory and demonstrates how it can be used to improve teaching and learning in tertiary courses across the sciences. While the great scientists of the past recognized a need for a multidisciplinary approach, today's schools often treat math and science as subjects separate from the rest. This not only creates a disinterest among students, but also a potential learning gap once students reach college and then graduate into the workforce. Cases on Research-Based Teaching Methods in Science Education addresses the problems currently facing science education in the USA and the UK, and suggests a new hands-on approach to learning. This book is an essential reference source for policymakers, academicians, researchers, educators, curricula developers, and teachers as they strive to improve education at the elementary, secondary, and collegiate levels. This book highlights recent developments in literacy research in science teaching and learning from countries such as Australia, Brazil, China, Finland, Germany, Hong Kong, New Zealand, Norway, Singapore, Spain, South Africa, Sweden, Taiwan, and the United States. It includes multiple topics and perspectives on the role of literacy in enhancing science teaching and learning, such as the struggles faced by students in science literacy learning, case studies and evaluations of classroom-based interventions, and the challenges encountered in the science classrooms. It offers a critical and comprehensive investigation on numerous emerging themes in the area of literacy and science education, including disciplinary literacy, scientific literacy, classroom discourse, multimodality, language and representations of science, and content and language integrated learning (CLIL). The diversity of views and research contexts in this volume presents a useful introductory handbook for academics, researchers, and graduate students working in this specialized niche area. With a wealth of instructional ideas and innovations, it is also highly relevant for teachers and teacher educators seeking to improve science teaching and learning through the use of literacy. Internet Environments for Science Education synthesizes 25 years of research to identify effective, technology-enhanced ways to convert students into lifelong science learners--one inquiry project at a time. It offers design principles for development of innovations; features tested, customizable inquiry projects that students, teachers, and professional developers can enact and refine; and introduces new methods and assessments to investigate the impact of technology on inquiry learning. The methodology--design-based research studies--enables investigators to capture the impact of innovations in the complex, inertia-laden educational enterprise and to use these findings to improve the innovation. The approach--technology-enhanced inquiry--takes advantage of global, networked information resources, sociocognitive research, and advances in technology combined in responsive learning environments. Internet Environments for Science Education advocates leveraging inquiry and technology to reform the full spectrum of science education activities--including instruction, curriculum, policy, professional development, and assessment. The book offers: *the knowledge integration perspective on learning, featuring the interpretive, cultural, and deliberate natures of the learner; *the scaffolded knowledge integration framework on instruction summarized in meta-principles and pragmatic principles for design of inquiry instruction; *a series of learning environments, including the Computer as Learning Partner (CLP), the Knowledge Integration Environment (KIE), and the Web-based Inquiry Science Environment (WISE) that designers can use to create new inquiry projects, customize existing projects, or inspire thinking about other learning environments; *curriculum design patterns for inquiry projects describing activity sequences to promote critique, debate, design, and investigation in science; *a partnership model establishing activity structures for teachers, pedagogical researchers, discipline experts, and technologists to jointly design and refine inquiry instruction; *a professional development model involving mentoring by an expert teacher; *projects about contemporary controversy enabling students to explore the nature of science; *a customization process guiding teachers to adapt inquiry projects to their own students, geographical characteristics, curriculum framework, and personal goals; and *a Web site providing additional links, resources, and community tools at www.InternetScienceEducation.org This state-of-the art research Handbook provides a comprehensive, coherent, current synthesis of the empirical and theoretical research concerning teaching and learning in science and lays down a foundation upon which future research can be built. The contributors, all leading experts in their research areas, represent the international and gender diversity that exists in the science education research community. As a whole, the Handbook of Research on Science Education demonstrates that science education is alive and well and illustrates its vitality. It is an essential resource for the entire science education community, including veteran and emerging researchers, university faculty, graduate students, practitioners in the schools, and science education professionals outside of universities. The National Association for Research in Science Teaching (NARST) endorses the Handbook of Research on Science Education as an important and valuable synthesis of the current knowledge in the field of science education by leading individuals in the field. For more information on NARST, please visit: http://www.narst.org/. Science Education Through Multiple Literacies explores how the use of project-based learning in elementary science education fosters a lifelong scientific mindset in students. The book provides educators with the teaching practices to help students develop an overall science literacy that aligns with Next Generation Science Standards. Editors Joseph Krajcik and Barbara Schneider and the book's contributors offer a comprehensive overview of the Multiple Literacies in Project-Based Learning (ML-PBL) approach to science learning, which interweaves scientific ideas and practices, language literacy, and mathematical thinking. ML-PBL supports the teaching of science by paralleling what scientists do: it engages students and their teachers in investigating real-world questions, constructing models, and using evidence to evaluate claims. The book presents compelling case studies of ML-PBL, how teachers use them, and how the teachers' enactment transforms the classroom into an environment that builds and supports academic and student SEL. Representing both urban and suburban schools, the case studies include classroom observations, student and teacher interviews, and student artifacts to illustrate how to make science relevant in students' lives. Krajcik and Schneider note that classroom enactment of ML-PBL requires intentional instructional practices and new ways of thinking about what it means to learn. Easing this challenge, they equip elementary science teachers with curricular resources including high-quality instructional materials, professional-learning exercises, and formative assessments. Science Education Through Multiple Literacies provides the necessary elements to transform science teaching and learning so that students learn the skills to navigate with confidence through our complex world. Science, engineering, and technology permeate nearly every facet of modern life and hold the key to solving many of humanity's most pressing current and future challenges. The United States' position in the global economy is declining, in part because U.S. workers lack fundamental knowledge in these fields. To address the critical issues of U.S. competitiveness and to better prepare the workforce, A Framework for K-12 Science Education proposes a new approach to K-12 science education that will capture students' interest and provide them with the necessary foundational knowledge in the field. A Framework for K-12 Science Education outlines a broad set of expectations for students in science and engineering in grades K-12. These expectations will inform the development of new standards for K-12 science education and, subsequently, revisions to curriculum, instruction, assessment, and professional development for educators. This book identifies three dimensions that convey the core ideas and practices around which science and engineering education in these grades should be built. These three dimensions are: crosscutting concepts that unify the study of science through their common application across science and engineering; scientific and engineering practices; and disciplinary core ideas in the physical sciences, life sciences, and earth and space sciences and for engineering, technology, and the applications of science. The overarching goal is for all high school graduates to have sufficient knowledge of science and engineering to engage in public discussions on science-related issues, be careful consumers of scientific and technical information, and enter the careers of their choice. A Framework for K-12 Science Education is the first step in a process that can inform state-level decisions and achieve a research-grounded basis for improving science instruction and learning across the country. The book will guide standards developers, teachers, curriculum designers, assessment developers, state and district science administrators, and educators who teach science in informal environments. This book provides a comprehensive overview of humanistic approaches to science. Approaches that connect students to broader human concerns in their everyday life and culture. Glen Aikenhead, an expert in the field of culturally sensitive science education, summarizes major worldwide historical findings; focuses on present thinking; and offers evidence in support of classroom practice. This highly accessible text covers curriculum policy, teaching materials, teacher orientations, teacher education, student learning, culture studies, and future research. In August 2005, over 500 researchers from the field of science education met at the 5th European Science Education Research Association conference. Two of the main topics at this conference were: the decrease in the number of students interested in school science and concern about the worldwide outcomes of studies on students' scientific literacy. This volume includes edited versions of 37 outstanding papers presented, including the lectures of the keynote speakers. Educational researchers are bound to see this as a timely work. It brings together the work of leading experts in argumentation in science education. It presents research combining theoretical and empirical perspectives relevant for secondary science classrooms. Since the 1990s, argumentation studies have increased at a rapid pace, from stray papers to a wealth of research exploring ever more sophisticated issues. It is this fact that makes this volume so crucial. This book reviews the current state of theoretical accounts of the what and how of science learning in schools. The book starts out by presenting big-picture perspectives on key issues. In these first chapters, it focuses on the range of resources students need to acquire and refine to become successful learners. It examines meaningful learner purposes and processes for doing science, and structural supports to optimize cognitive engagement and success. Subsequent chapters address how particular purposes, resources and experiences can be conceptualized as the basis to understand current practices. They also show how future learning opportunities should be designed, lived and reviewed to promote student engagement/learning. Specific topics include insights from neuro-imaging, actor-network theory, the role of reasoning in claim-making for learning in science, and development of disciplinary literacies, including writing and multi-modal meaning-making. All together the book offers leads to science educators on theoretical perspectives that have yielded valuable insights into science learning. In addition, it proposes new agendas to guide future practices and research in this subject. The International Handbook of Science

Education is a two volume edition pertaining to the most significant issues in science education. It is a follow-up to the first Handbook, published in 1998, which is seen as the most authoritative resource ever produced in science education. The chapters in this edition are reviews of research in science education and retain the strong international flavor of the project. It covers the diverse theories and methods that have been a foundation for science education and continue to characterize this field. Each section contains a lead chapter that provides an overview and synthesis of the field and related chapters that provide a narrower focus on research and current thinking on the key issues in that field. Leading researchers from around the world have participated as authors and consultants to produce a resource that is comprehensive, detailed and up to date. The chapters provide the most recent and advanced thinking in science education making the Handbook again the most authoritative resource in science education. In August 2003 over 400 researchers in the field of science education from all over the world met at the 4th ESERA conference in Noordwijkerhout, The Netherlands. During the conference 300 papers about actual issues in the field, such as the learning of scientific concepts and skills, scientific literacy, informal science learning, science teacher education, modeling in science education were presented. The book contains 40 of the most outstanding papers presented during the conference. These papers reflect the quality and variety of the conference and represent the state of the art in the field of research in science education. Reflecting the very latest theory on diversity issues in science education, including new dialogic approaches, this volume explores the subject from a range of perspectives and draws on studies from around the world. The work discusses fundamental topics such as how we conceptualize diversity as well as examining the ways in which heterogeneous cultural constructs influence the teaching and learning of science in a range of contexts. Including numerous strategies ready for adoption by interested teachers, the book addresses the varied cultural factors that influence engagement with science education. It seeks answers to the question of why increasing numbers of students fail to connect with science education in schools and looks at the more subtle impact that students' individually constructed identities have on the teaching and learning of science. Recognizing the diversity of its audience, the book covers differing levels and science subjects, and examines material from a range of viewpoints that include pedagogy, curricula, teacher education, learning, gender, religion, and ICT, as well as those of in-service and trainee teachers at all levels. The book's argument depends, as do most proposals in education, upon cer tain positions in the philosophy of education. I believe that education should be primarily concerned with developing understanding, with initiation into worth while traditions of intellectual achievement, and with developing capacities for clear, analytic and critical thought. These have been the long-accepted goals of liberal education. In a liberal education, students should come to know and appre ciate a variety of disciplines, know them at an appropriate depth, see the interconnectedness of the disciplines, or the modes of thought, and finally have some critical disposition toward what is being learned, to be genuinely open minded about intellectual things. These liberal goals are contrasted with goals such as professional training, job preparation, promotion of self-esteem, social engineering, entertainment, or countless other putative purposes of schooling that are enunciated by politicians, administrators, and educators. The book's argument might be consistent with other views of education especially ones about the training of specialists (sometimes called a professional view of education)-but the argument fits best with a liberal view of education. The liberal hope has always been that if education is done well, then other per sonal and social goods will follow. The development of informed, critical, and moral capacities is the cornerstone for personal and social achievements. What is science for a child? How do children learn about science and how to do science? Drawing on a vast array of work from neuroscience to classroom observation, Taking Science to School provides a comprehensive picture of what we know about teaching and learning science from kindergarten through eighth grade. By looking at a broad range of questions, this book provides a basic foundation for guiding science teaching and supporting students in their learning. Taking Science to School answers such questions as: When do children begin to learn about science? Are there critical stages in a child's development of such scientific concepts as mass or animate objects? What role does nonschool learning play in children's knowledge of science? How can science education capitalize on children's natural curiosity? What are the best tasks for books, lectures, and hands-on learning? How can teachers be taught to teach science? The book also provides a detailed examination of how we know what we know about children's learning of science--about the role of research and evidence. This book will be an essential resource for everyone involved in K-8 science education--teachers, principals, boards of education, teacher education providers and accreditors, education researchers, federal education agencies, and state and federal policy makers. It will also be a useful guide for parents and others interested in how children learn. This book addresses key issues concerning visualization in the teaching and learning of science at any level in educational systems. It is the first book specifically on visualization in science education. The book draws on the insights from cognitive psychology, science, and education, by experts from five countries. It unites these with the practice of science education, particularly the ever-increasing use of computer-managed modelling packages. This book provides a collection of applicable learning theories and their applications to science teaching. It presents a synthesis of historical theories while also providing practical implications for improvement of pedagogical practices aimed at advancing the field into the future. The theoretical viewpoints included in this volume span cognitive and social human development, address theories of learning, and describe approaches to teaching and curriculum development. The book presents and discusses humanistic, behaviourist, cognitivist, and constructivist theories. In addition, it looks at other theories, such as multiple intelligences theory, systems thinking, gender/sexuality theory and indigenous knowledge systems. Each chapter follows a reader-motivated approach anchored on a narrative genre. The book serves as a guide for those aiming to create optional learning experiences to prepare the next generation STEM workforce. Chapter “The Bildung Theory—From von Humboldt to Klafki and Beyond” is available open access under a Creative Commons Attribution 4.0 International License via link.springer.com This volume supports the belief that a revised and advanced science education can emerge from the convergence and synthesis of several current scientific and technological activities including examples of research from cognitive science, social science, and other discipline-based educational studies. The anticipated result: the formation of science education as an integrated discipline. The Language of Science Education: An Expanded Glossary of Key Terms and Concepts in Science Teaching and Learning is written expressly for science education professionals and students of science education to provide the foundation for a shared vocabulary of the field of science teaching and learning. Science education is a part of education studies but has developed a unique vocabulary that is occasionally at odds with the ways some terms are commonly used both in the field of education and in general conversation. Therefore, understanding the specific way that terms are used within science education is vital for those who wish to understand the existing literature or make contributions to it. The Language of Science Education provides definitions for 100 unique terms, but when considering the related terms that are also defined as they relate to the targeted words, almost 150 words are represented in the book. For instance, “laboratory instruction” is accompanied by definitions for openness, wet lab, dry lab, virtual lab and cookbook lab. Each key term is defined both with a short entry designed to provide immediate access following by a more extensive discussion, with extensive references and examples where appropriate. Experienced readers will recognize the majority of terms included, but the developing discipline of science education demands the consideration of new words. For example, the term blended science is offered as a better descriptor for interdisciplinary science and make a distinction between project-based and problem-based instruction. Even a definition for science education is included. The Language of Science Education is designed as a reference book but many readers may find it useful and enlightening to read it as if it were a series of very short stories. By allowing key scientists, researchers, professors, and classroom teachers of science to speak for themselves through their published writings about what is best and needed for the field, Dr. DeBoer presents a fascinating account of the history of science education in the United States from the middle of the 19th century to the present. The book relates how science first struggled to find a place in the school curriculum and recounts the many debates over the years about what that curriculum should be. In fact, many of what we consider modern ideas in science education are not new at all but can be traced to writings on education of one hundred years ago. The book is aimed at all those interested in science education: classroom teachers and science education leaders concerned about the historical justification of the goals and strategies proposed for the field. The book should be enjoyed not only by the researcher but also by anyone curious about just how curriculum is decided upon and implemented on a national scale. “This is without question the finest book of its kind on the market. It deserves to be widely read by current and future science teachers, supervisors, science education faculty in colleges and universities, curriculum developers, and program officers in funding agencies.” —The Science Teacher “Adds a significant dimension to the history of American schooling and curriculum.” —History of Education Quarterly