Handbook of Research in Science Education: Volume II

Just seven years after the Handbook of Research on Science Education was published, its editors rightly felt there was scope and need for an updated edition, given the intense pace of developments in all areas of Science Education. The result is the Handbook of Research on Science Education Volume II, which has quickly become an invaluable reference in the field, just as Volume I did.

Section I of the handbook analyses the paradigms and research designs in science education. Research paradigms are being classified into three broad categories: positivist/post-positivist, interpretivist, and critical theory. These paradigms are analysed through their philosophical background, examples, research and reports. Quantitative and qualitative research designs are addressed with a clear introduction to their role, validity and historical development within education research, providing a solid framework in which to situate science education research, with references to current discussions. Teaching practitioners can also benefit from an understanding of this context: science teachers most often come from a background in science, and qualitative methods from the social sciences can feel completely alien to them. This section of the handbook provides a useful methodological introduction that they would find useful to understand better how conclusions and recommendations from research can become relevant to their practice.

The rest of the handbook can be divided into two main parts: science learning and other socio-cultural aspects of learners are being dealt with in sections II and III; science teaching and the shaping of it through curriculum, assessment and teacher training are being covered in sections IV, V and VI.

Section II is devoted to research on aspects related to the students, beginning with a thorough overview of conceptual change, which is absolutely central to any educational process. It places current research in this field into an historical context in which it is seen as the third phase of a development which began in the 1970s.

Various areas of science education research are relevant to, and share objectives with, science communication as a field of research. The chapters on student attitudes and learning outside school in this section are two clear examples of this overlap and are highly relevant to researchers in both areas. This highlights the importance of collaboration and knowledge exchange between these all too often separate communities of scholars, particularly given that practitioners of these two fields often do collaborate and share good practice.

The handbook includes a comprehensive international perspective in many areas. Examples of this are the chapter on classroom learning environments and particularly the chapter on teaching learning progressions. The latter introduces a very enlightening approach where continental-European traditions on science education are described around their common use of the concept “didactics” as a descriptor of schools of thought and research in education in which aspects related to subject-specific content are central to the pedagogy and practice of teachers.
Section III offers a very comprehensive overview of research on the social aspects influencing education, such as race, ethnicity and indigenous minorities, gender, socioeconomic factors (urban/rural contexts), students with special needs, and linguistic diversity (students whose first language is not English). As such, the editors have to be commended for having been able to capture virtually all aspects of diversity and equality in such a specific discipline as science education. Even for those not directly involved with these areas of research, these chapters make for a very informative and eye-opening reading. Needless to say, this is a further area which makes the contents of this handbook relevant not only for researchers but also to practitioners.

Section IV begins with a thoroughly reviewed chapter from the first handbook on instructional methods and strategies, presenting them not as mutually exclusive alternatives, but as techniques to be implemented as part of the toolkit of a successful teacher. Significant updates with respect to the first handbook were deemed necessary following quick developments in both the theoretical frameworks and in social aspects regarding the purpose and role of scientific literacy, the latter being another issue this field of research strongly shares with that of Science Communication. The use of learning technologies in support of such instructional methods is extensively addressed in a separate chapter. Interestingly, learning technologies are viewed as a resource whose usefulness is yet to be proven, while face to face teaching is claimed to remain an “indispensable part of quality in university education” (p. 314).

Aspects of written and spoken communication within science teaching and learning are addressed in detail in a chapter dedicated to discourse studies.

Still within this section, a series of chapters follows that cover science education at elementary level and various subject-specific teaching issues, including a chapter about the growing awareness of the benefits of interdisciplinary science education as it provides “authentic contexts for learning” (p. 396).

Highly relevant to current teacher practice is the chapter on inquiry based learning, an issue which has been object of an intense and long-lasting debate, in which claims have included everything from this approach being deeply rooted in sound research to there not being any academic evidence at all. In this context, this chapter will prove very enlightening to both sides of the debate. A further chapter that ties into this debate is included in Section V where inquiry based learning is analysed in the light of the broader discussion about what the purpose of science education is in the first place.

Indeed, under the overarching theme of Curriculum and Assessment, Section V is devoted to this highly relevant issue that permeates not only the debate about inquiry based learning, but virtually all other areas of science education. Major themes of this section are assessment and evaluation, curriculum design and science education programming. Some chapters focus on more specific aspects within these themes. All chapters are relevant and best understood in the context of the question about the purpose of education.

The book concludes with a section on the never sufficiently emphasized topic of teacher training and preparation, covering areas that range from the very practical to research on science teachers’ professional development.

In conclusion, this is a very comprehensive, thorough and well-structured book that certainly honours its claim to be a “handbook”. It is indeed a valuable tool for researchers in Science Education, but as we have shown throughout this review the topics of most of its chapters and the comprehensiveness of the volume
as a whole make it equally relevant for teaching practitioners (as well as for scholars and practitioners of science communication). This emphasizes what the editors already identify as a pressing need, namely that the contents of this book get translated into a form that can be readily understood and used by teachers (p. xiii). That would provide a useful means to bridge the gap between research and practice, provided other obstacles, like the lack of time devoted to teacher training and professional development, were removed. It would indeed be unfortunate that once again such far-reaching and fundamental issues remain within the realm of academia.

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