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# BOOK REVIEW

**Internet Environments for Science Education**
M. Linn, E. Davis & P. Bell (Eds.), 2004.
London: Lawrence Erlbaum Associates
$39.95 (paperback); 412 pp.
ISBN 0 8058 4303 5 (pbk)

"This book offers a road map for reforming the educational enterprise to produce lifelong science learners who continue to make sense of science for personal and professional goals throughout their lives," write the editors in the introduction chapter of *Internet Environments for Science Education*. It is intended for "teachers, professional development leaders, curriculum designers, cognitive researchers, technologists, policy makers, science educators and natural scientists" and offers "the opportunity to work together to convert students into lifelong science learners one inquiry project at a time." The contributors in this edited volume draw upon over 25 years of research on technology and inquiry learning in (particularly secondary level) science education.

Forming a tightly knit whole, the 14 chapters are clustered into four parts: 1. Starting points; 2. Curriculum design patterns for knowledge integration; 3. New partnerships; and 4. Next steps. The first part begins by introducing inquiry learning and the role of technology therein, exemplified through brief descriptions of this group's research on inquiry and technology in science education since the 1980s. Led by Marcia Linn, professor of cognition and education at UC, Berkeley, this team of highly reputed editors and authors has worked together on such well-known projects as: the knowledge integration environment (KIE); the web-based inquiry science environment (WISE) project; and the science controversies online: partnerships in education (SCOPE) project. Rooted in these and other projects are the team's visions on learning, instructional design and research approach, which are respectively delineated in the subsequent three chapters.

The second part of the book contains four "design narratives," portraying the iterative refinement of four projects, respectively designed to stimulate learner reflection and critique; debate and argumentation; collaboration; and investigation in Internet-laboratories. The studies reported in this section were all carried out under highly favorable conditions—in the classroom of an award-winning teacher who had a history of collaboration with the research team. Each chapter concludes with design principles derived from the project experiences.

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The third part of the book contains four additional project descriptions. These were situated in more diverse contexts and generated principles to guide the local adaptation of four innovations. The first chapter describes the implementation of the web-based inquiry science environment (WISE) by seven teachers in one school and centers discussion around the comparison of two markedly different teachers. Thereafter, the customization of two related WISE projects is described, along with the nature of the partnerships between researchers and the four teachers. After a chapter describing a project that built on the debate theme by exploring contemporary controversies in science, this part concludes with a description of the partnership activities that supported the design, implementation and revision of an inquiry project on deformed frogs by six teachers in one middle school.

For many readers, the "goodybag" is located in the last part of the book. Here, the findings from this ground-breaking research are synthesized into design principles. They are organized under four meta-principles, which have previously been described in Linn and Hsi (2000): (i) make science accessible; (ii) make thinking visible; (iii) help students learn from others; and (iv) promote autonomy and lifelong learning. For each meta-principle, a set of pedagogical principles has been defined (e.g. "use multiple visual representations from varied models"). And for each pedagogical principle, specific principles are given along with supportive evidence and illustrative learning environment features addressing the need. For example, linked to the pedagogical principle, "connect to personally relevant problems" is the specific principle, "case studies that highlight the human face of a controversy can promote the salience and relevance of the topic to students." This is supported by evidence presented earlier in this volume ("when students recognize that events can connect to people like them, they become more motivated to understand the problem") as well as an example ("the 'Cycles of Malaria' project features a case study of a boy who becomes infected with malaria to put a human face on an unfamiliar disease; teachers connect malaria and AIDS"). The book concludes with reflections on the constituent elements of the research program and discussion of future directions.

This book was intended to offer contributions to a broad audience, with the recognition that some elements would be more meaningful to certain reader groups than others. In this regard, the chapter recommendations provided by the editors in the introduction are very useful. While it is possible that "teachers, professional development leaders, curriculum designers, cognitive researchers, technologists, policy makers, science educators and natural scientists" can all find something of interest, I find this book's content coverage and writing style most suited to a readership strongly interested in research, and submit that practitioners and policy-makers who do not share an affinity for this angle are less likely to appreciate it.

For those interested in design-based research, *Internet Environments for Science Education* offers a highly valuable contribution. The growing momentum for this type of approach has been marked by the appearance of several journal special issues (*Educational Researcher*, 2003; *Journal of the Learning Sciences*, 2004) as well as books that aim to illustrate (Van den Akker et al., 1999) or help guide (Van den Akker et al., in press) design research. But aside from *The Jasper Project* (Cognition and Technology Group at Vanderbilt, 1997), this is the only other volume I have encountered that showcases diverse aspects of one excellent set of design studies. The four part structure—featuring theoretical foundations; initial design; extended implementation; and synthesized design principles—proves powerful and exemplary.

For those studying inquiry learning and related instructional design, this book offers an outstanding collection of resources to those sharing the vision developed within this team. It does, however, speak less to readers seeking guidance for implementation of inquiry learning outside of the initial design contexts (described in part two), or without extensive support structures (described in part three). Like other colleagues in the field who call for further research to step outside the "successful and innovative 'boutique' projects that may impact a handful of highly motivated teachers" (Barab & Leuhmann, 2003, p. 464) our authors address the need to establish more scalable innovations. To a limited extent, they do so in this book; they have also discussed this issue elsewhere, for example, in a recent special issue of *Science Education* (Linn et al., 2003), that specifically addresses the limited diffusion of project-based curricula such as those described in *Internet Environments for Science Education.* While briefly acknowledging constraints such as availability of computers in classrooms or newly established curriculum frameworks that leave little time for inquiry, guidance for coping with practical barriers and dilemmas to implementation of inquiry learning (cf. Anderson, 2002) is not provided. It is not without irony that, from a practical standpoint, many of the ideas presented in this book may be more usable by those haling from other countries—particularly where schools enjoy higher degrees of curricular autonomy and where "covering the syllabus" does not refer to exam-driven cramming of standardized content.

Given the quality of work and wealth of knowledge and experience within this team, it may be hoped that future research and publications will more aggressively address the implementation perspective. Being inspired by their passion for producing lifelong science learners, this would seem to me a fitting step toward inquiry learning for all. In the meantime, I highly recommend *Internet Environments for Science Education* to those interested in learning about some of the most innovative, carefully considered and thoughtfully researched technology-enhanced inquiry learning projects in our time.

Additional information is available at http://www.internetscienceeducation.org/.

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