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Powerful Learning Environments: Unravelling Basic Components and Dimensions
De Corte, E., Verschaffel, L., Entwistle, N., & van Merriënboer, J. (Eds.). (2003). Amsterdam: Pergamon, 239 pages, ISBN: 0080442757. US$85.00 (hardcover)

1. Introduction

Powerful learning environments tend to be defined in terms of the outcomes they seek—the development of complex higher order skills, deep conceptual understanding, and metacognitive capabilities, such as self-regulated learning. Consequently, research in powerful learning environments tends to be interdisciplinary, drawing from a variety of fields, including psychology, instructional design, and instructional technology. *Powerful Learning Environments: Unravelling Basic Components and Dimensions*, edited by Erik De Corte, Lieven Verschaffel, Noel Entwistle, and Jeroen van Merriënboer, brings together a wide range of studies from a variety of researchers and practitioners. Its aim is to foster eventual integration of these theories, methodologies, and empirical findings to produce a significant contribution to instructional theory and methodology in general.

2. Chapter highlights

The volume is divided into four parts, each of which focuses on a different aspect of powerful learning environments. Part I introduces the main themes of powerful learning environments—instructional design, psychology, and technology—with four perspectives on the components and dimensions of these themes. Part II focuses on the identification and measurement of powerful learning environments. Part III presents three investigations into the design and application of technological tools used to support powerful learning environments. Finally, Part IV provides three studies on the role of peer tutoring and collaboration in promoting conceptual change and intentional learning in physics, mathematics, and reading.

2.1. Main themes of powerful learning environments

In the opening chapter of Part I, Jeroen van Merriënboer and Fred Paas explore the role of instructional design in powerful learning environments. Taking a cognitive view, they argue that

because people learn in a variety of ways, theories of instructional design must adopt an eclectic perspective on learning. This requires reconciling several fundamental perspectives on learning, which van Merriënboer and Paas summarize as the world of work (real-life tasks), the world of knowledge (knowledge elements), and the world of learning (cognitive processes). What these views share in common is the assumption that learning requires active mental action from learners. Therefore, van Merriënboer and Paas argue, complex learning demands closely interrelated instructional methods to achieve integrated learning goals. Having thus defined their requirements, they proceed to define a framework for the development of models and methodologies for powerful learning enviro\nments. Their framework consists of four components: learning tasks, supportive information, procedural information, and practice. These components, the authors argue, can be integrated to support complex learning while averting cognitive overload.

Next, Erik De Corte describes the use of powerful learning environments to support the transfer of previously acquired knowledge to new applications. He illustrates this with three experiments that show how learning environments can be designed to produce desired outcomes and lead to more effective downstream learning. The ability to reuse and repurpose previous knowledge in new situations is a key skill for lifelong learning. Thus, De Corte emphasizes that the learning environment should leverage students' past experience and should support processes that both stimulate and motivate future learning.

In Chapter 3, Erno Lehtinen examines the theoretical rationale for computer supported collaborative learning (CSCL). Critical to Lehtinen's thinking is a distinction he makes between cooperation and collaboration. Cooperation is a division of labor whereas collaboration entails mutual engagement. For collaboration to flourish in a CSCL environment, thinking must be made visible among the collaborators. By encouraging students to provide explicit explanations with their contributions, CSCL technology induces high levels of cognitive activity less frequently found in noncollaborative environments. Written communication is the primary means for making the thinking process visible, but technologies may be devised to provide other means, such as structured problem-solving procedures. Combinations of CSCL with face-to-face encounters may be more effective than face-to-face alone because of the increased demand CSCL makes on cognitive processes.

In Chapter 4, Carl Bereiter and Marlene Scardamalia present an argument in support of an immersive approach to preparing students for living and working in the knowledge age. Other than immersion, they contend, there are no known effective methodologies for effectively teaching thinking skills, communication skills, or other "soft" skills needed by knowledge-driven innovative organizations. Thus, Bereiter and Scardamalia distinguish what they call "design mode" education, which provides an immersive environment where knowledge is subject to continuous development and refinement, from the more doctrinaire "belief mode" education. Several design mode methods have already received attention: learning by design, project-based science, and problem-based learning. However, Bereiter and Scardamalia advocate a knowledge-building approach. This approach they feel provides a more immersive approach that engages students in work that matters to them and hence encourages development of the skills necessary for sustained success and lifelong learning.

2.2. Identification and measurement

Part II begins with a discussion of a large-scale program for developing and evaluating powerful learning environments in vocational schools in the Netherlands. As described by Monique Boekaerts and Alexander Minnaert, the interactive learning group system (ILS) innovation program has been underway

since 1995. Boekaerts and Minnaert discuss their experiences in measuring the components of the ILS innovation program. Although the results were not always as anticipated, their experience in conducting their studies leads to valuable insights.

In Chapter 6, Noel Entwistle, Velda McCune, and Jenny Hounsell present early results of their ongoing research in collaboration. Whereas in the previous chapter, Boekaerts and Minnaert encountered difficulties in securing teacher buy-in for the ILS, Entwistle, McCune and Hounsell made the decision to work with teachers in developing their collaborative approach. While this may have jeopardized the validity of their research findings, they feel it improved the prospects of program success.

Next, in Chapter 7, Jan D. Vermunt provides an excellent discussion of the characteristics and components of powerful learning environments. Vermunt examines the effectiveness of several kinds of learning environments and identifies three key characteristics of powerful learning environments. First and foremost, these environments support high-quality learning. Second, the teaching methods used in these environments must adapt in response to changes in student metacognitive and self-regulatory skills. Vermunt notes that while the importance of such adaptability is readily recognized, it occurs only seldom in practice. Third, the real-life problems used to induce learning become increasingly complex. Vermunt regards complexity as critical to defining powerful learning environments, and provides an interesting discussion of the topic.

2.3. Technology for powerful learning environments

Part III contains three investigations into the design and application of technological tools to support powerful learning environments. Jules Pieters, Renate Limbach, and Ton de Jong describe the SIMQUEST system for authoring simulation-based discovery learning environments. This is followed by a chapter by Mireille Bètrancourt, Pierre Dillenbourg, and Cècile Montarnal, who describe a "phenomenarium" for support of learning from external representations. They used interactive animation in a lesson on financial analysis. Bètrancourt, Dillenbourg, and Montarnal found that while animation appears to support learning, the value of interactivity seems less than definitive. One possible explanation for this finding is that the students experienced cognitive overload resulting from design characteristics of the tool itself.

In Chapter 10, Gijsbert Erkens, Gellof Kanselaar, Maaike Prangsma, and Jos Jaspers describe a collaborative environment for argumentative writing called T3C (Text Composer, Computer supported and Collaborative). The environment supports both collaborative task performance and deliberative interaction. It includes an outline tool for use in generating and structuring argumentative texts and a diagram tool that enables students to visualize claims graphically. The authors hypothesize and their experiment confirms that such tools should be particularly useful in online environments where students require technological facilitation in coordinating communication and tracking issues.

2.4. Peer tutoring and collaboration

Part IV consists of three studies on the role of peer tutoring and collaboration for promotion of conceptual change and intentional learning in diverse domains. The articles in this section focus on physics, mathematics, and reading. The chapter by Stella Vosniadou and Vassilios Kollias explores the use of CSCL model building to promote conceptual change. Vosniadou and Kollias note that conceptual change is necessary for learning in the sciences because scientific concepts, especially those of physics, often contradict the naïve conceptualizations of everyday experience. Enabling students to engage in

metacognitive activity provides them with greater control over the required conceptual changes. Vosniadou and Kollias used CSCL to help students adopt multiple perspectives and representations and to use various techniques, such as analogies, abstractions, and other mental models, to understand the conceptualizations of physics.

In Chapter 12, by Marcel Crahay, Geneviève Hindryckx, and Martine Lebè analyze interaction among students in a peer-tutoring situation for learning mathematics. They reject the commonly held notion that tutors rely predominantly on reactive strategies, responding only to students' errors. On the contrary, their results indicate that in peer-tutoring environments, tutors actively engage in proactive strategies.

The discussion of peer tutoring is continued in the final chapter, where Hilde Van Keer and Jean Pierre Verhaeghe investigate the effects of explicit reading strategies instruction and peer tutoring among primary school children. Their work provides evidence in support of the value of systematic reading strategies instruction and suggests that there is more value in cross-age tutoring than had been previously supposed.

3. Conclusion

Powerful Learning Environments covers a wide range of research topics. Owing perhaps to the interdisciplinary nature of the subject, the chapters at times seem only distantly related to one another. Perhaps the most distinctive characteristic of powerful learning environments is that they are, first and foremost, learning environments, not teaching environments. Their emphasis is not so much on what is learned, but on the development of learning skills themselves.

While it is the editors' intent that these chapters contribute to unraveling the components and dimensions of powerful learning environments, several chapters seemed instead to be relatively insular research contributions. This did not, however, detract from their interest or relevance. Because of its emphasis on the complexities of learning theory, lifelong learning, and CSCL, this volume will be of value to readers with an interest in theoretical foundations for advanced educational technologies.

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Open and Flexible Learning Series: Reusing Online Resources
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1. Introduction

Reusing Online Resources: A Sustainable Approach to E-Learning is the first volume in the *Open and Flexible Learning Series*. Five additional volumes have been published as follows: *Planning and*