Foreword

In 2009, the National Science Foundation in the USA commissioned a group to consider the future of education and the role that technology might play. A series of workshops were conducted with leaders in a variety of disciplines that resulted in the publication of “A Roadmap for Education Technology” (Woolf, 2010). In that report, seven grand challenges were identified that describe opportunity areas where new and emerging technologies could have a significant impact. The first of these grand challenges was called personalizing education in that report.

Personalized education involves learning and instruction that actively and dynamically accommodates each student’s relevant traits (e.g., learning style, motivation, personality, etc.), level of understanding (e.g., prior knowledge, experience, and performances), and learning situation (e.g., at home alone, in school with others, at work, etc.). There is a long history of interest in and experience with personalized education dating back to such luminaries as Confucius and Socrates. The apprentice model of training that has been practiced for centuries is inherently personalized to the needs of the apprentice. Modern industrial society has seen the introduction of mass educational models that grouped students together and delivered the same material and lectures to all those present regardless of individual differences and levels of understanding. While this model has brought literacy and educational opportunities to the masses, it has pushed personalized learning and instruction to the background.

Attempts have been made to introduce more personalized learning in the last fifty years, especially in response to Bloom’s (1984) challenge to find ways to create within the context of the mass model of education something that could approach the improvements possible through individual tutoring. This challenge occurred just when technology was becoming available to support individualized learning on a large scale. The result was an explosion of so-called intelligent tutoring systems (ITSs) in the 1980s and 1990s. The typical ITS involved and instructional computing system designed on the basis of (a) knowledge about human learning and problem solving, (b) a cognitive task analysis of the knowledge domain, (c) an instructional model containing relevant knowledge and tasks, and (d) a capability to dynamically model a learner (see, for example, Psotka & Mutter, 1988). In the 1990s, ITSs were implemented in many domains and met with some success, especially in well-defined problem solving areas where it was feasible to create a hierarchical array of knowledge and learning tasks along with an associated array of common errors and misconceptions.

More recently, there has been renewed in supporting personalized and adaptive learning. For example, Mathan and Koedinger (2005) describe aspects of metacognition that suggest that an adaptive tutoring system that modeling an intelligent novice might be more effective in some cases than one that only provided dynamic feedback based on the difference between the student model and an expert model. Pirnay-Dummer, Ifenthaler and Spector (2010) have developed a dynamic, online assessment technol-
ogy that can provide feedback based on an expert model, an intelligent novice model, a peer model, an instructor model, or a model of the learner at a prior stage of development. In short, we now have what educational technologists thought they had in the 1980s – we have the tools and technologies to promote personalized learning.

This volume provides substantial evidence that such tools and technologies can have a significant impact on learning and instruction, if society and various learning institutions have the will and wherewithal to adopt them. The contributors to this volume address such topics as

- mining Web resources to support adaptive e-learning,
- providing intelligent, real-time feedback to learners,
- promoting metacognitive skill development through self-testing,
- measuring and monitoring metacognitive skill development, and
- adaptive mobile learning.

The reader of this book will find examples of innovative research, summaries of research findings, and descriptions of tools and technologies to support adaptive learning. Bloom’s two-sigma challenge remains an open challenge. Perhaps it is wrong to think of responding directly to that challenge as many of the contributors to this volume think of learning and instruction somewhat differently than did Bloom. One way to capture these differences is to categorize the new efforts to create intelligent and adaptive tutoring systems reflected in this volume as representative of empowered learning – the key notion in empowered learning is to target the critical metacognitive abilities required for a learner to sustain the learning experience beyond the boundaries of a particular learning environment. I do believe that was Socrates’ goal when he tutored the various youth of Athens.

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REFERENCES


