Foreword

In its landmark report *Education for Life and Work in the 21st Century*, the National Research Council (2012) described "deeper learning" as an instructional approach important in preparing students with sophisticated cognitive, intrapersonal, and interpersonal skills. The approaches recommended by advocates of deeper learning are not new, and historically these instructional strategies have been described under a variety of terms. Until now, however, they have been rarely practiced within the schools (Dede, 2014), resulting in the sad situation that students who excel in school may struggle in the real world. And students who struggle in school are likely to sink in the real world. Various "deeper learning" approaches are described below.

- Case-based learning helps students master abstract principles and skills through the analysis of real-world situations;
- Multiple, varied representations of concepts provide different ways of explaining complicated things, showing how those depictions are alternative forms of the same underlying ideas;
- Collaborative learning enables a team to combine its knowledge and skills in making sense of a complex phenomenon;
- Apprenticeships involve working with a mentor who has a specific real-world role and, over time, enables mastery of their knowledge and skills;
- Self-directed, life-wide, open-ended learning is based on students' passions and is connected to students' identities in ways that foster academic engagement, self-efficacy, and tenacity;
- Learning for transfer emphasizes that the measure of mastery is application in life rather than simply in the classroom;
- Interdisciplinary studies help students see how differing fields can complement each other, offering a richer perspective on the world than any single discipline can provide;
- Personalized learning ensures that students receive instruction and supports that are tailored to their needs and responsive to their interests (U.S. Department of Education, 2010; Wolf, 2010; Rose & Gravel, 2010);
- Connected learning encourages students to confront challenges and pursue opportunities that exist outside of their classrooms and campuses (Ito et al., 2013); and
- Diagnostic assessments are embedded into learning and are formative for further learning and instruction (Dede, 2012).

These entail very different teaching strategies than the familiar, lecture-based forms of instruction characteristic of industrial-era schooling, with its one-size-fits-all processing of students. Rather than requiring rote memorization and individual mastery of prescribed material, they involve in-depth, dif-

ferentiated content; authentic diagnostic assessment embedded in instruction; active forms of learning, often collaborative; and learning about academic subjects linked to personal passions and infused throughout life.

The chapters in this book demonstrate that new tools and media can be very helpful to many teachers who would otherwise struggle to provide these kinds of instruction for deeper learning (Dede, 2014). By analogy, imagine that you wish to visit a friend 20 miles away. You could walk (and some people would prefer to do so), but it would be much easier to use a bicycle, and it would be far easier still to use a car. In short, teachers who wish to prepare their students for the real world, as well as for further academics, don't have to use educational technology; they may prefer to walk. Realistically, however, many, if not most, teachers will be hard-pressed to get from industrial-style instruction to deeper learning without the vehicles of digital tools, media, and experiences.

In an extensive review of the literature on technology and teaching for the forthcoming American Educational Research Association (AERA) Handbook of Research on Teaching (5th Edition), Barry Fishman and I (in press) note the important distinction between using technology to do conventional things better and using technology to do better things (Roschelle et al., 2000). While there may be value in doing some types of conventional instruction better (i.e., more efficiently and effectively), the real value in technology for teaching lies in rethinking the enterprise of schooling in ways that unlock powerful learning opportunities and make better use of the resources present in the 21st-century world.

In our review, we consider how and under what conditions technology can be productively employed by teachers to more effectively prepare students for the challenges presented by a rapidly evolving world. We argue that technology as a catalyst is effective only when used to enable learning with richer content, more powerful pedagogy, more valid assessments, and links between in- and out-of-classroom learning. The examined the following technologies in depth:

- Collaboration tools, including Web 2.0 technologies and tools that support knowledge building;
- Online and hybrid educational environments, which are increasingly being used to broaden access to education but also have the potential to shift the way we conceive of teaching and learning;
- Tools that support learners as makers and creators, which have their deep roots in helping students learn to become programmers of computers (and not just users of them);
- Immersive media that create virtual worlds to situate learning or augment the real world with an overlay of computational information; and
- Games and simulations that are designed to enhance student motivation and learning.

This book provides examples of these and other powerful technologies to aid this type of instruction. If used in concert, these deeper-learning technologies can help prepare students for life and work in the 21st century, mirroring in the classroom some powerful methods of knowing and doing that pervade the rest of society. Further, they can be used to create a practical, cost-effective division of labor, one that empowers teachers to perform complex instructional tasks. In addition, these media can address the learning strengths and preferences of students growing up in this digital age, including bridging formal instruction and informal learning. And, finally, these technologies can provide powerful mechanisms for teacher learning; by which educators deepen their professional knowledge and skills in ways that mirror the types of learning environments through which they will guide their students.

At a time in history when civilization faces crises that we need the full capacity of people across the world to resolve, this volume provides an exemplary suite of practical ways to move forward with curricula, instruction, and assessments that are truly oriented to 21st-century life and work.

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