Chapter XIII
Systemic Innovations and the Role of Change-Technology: Issues of Sustainability and Generalizability

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ABSTRACT

There has been increasing interest in issues of sustainability and scalability concerning educational innovations and reforms. In Singapore, the Ministry of Education in the first IT MasterPlan for Education has equipped all schools with adequate IT infrastructure and teacher training. After seven years into this investment, the "take-up" of technology for learning has been generally at the basic level. Three challenges lie ahead in the effective integration of IT into the curriculum for meaningful student learning: (1) how can schools embrace technology where school practices, curriculum, pedagogy, teachers' and students' beliefs are aligned to its effective use; (2) how can the process of change be facilitated systematically in schools such that these changes leverage on IT as a catalyst to enhance learning; and (3) how can policy-wide initiatives be set in place to enable schools, teachers, and teacher-training institutes to be fully aligned in order to enact systemic innovation change? This chapter discusses these issues as part of the research efforts arising from the Learning Sciences Lab (LSL).

BACKGROUND AND MOTIVATION

In the past year, centers for the science of learning (e.g., www.learnlab.org, http://life-slc.org/) have been launched in the United States. These centers funded by the National Science Foundation seek to produce knowledge on effective ICT-enabled educational practices, through varying research foci such as capacity building and technologies that facilitate pedagogical changes. Besides pursuing research to understand how learning occurs in formal settings, informal settings, and even at the implicit level such as at the neurological plane, most centers are also concerned with the sustainability and scalability of effective educational practices.

The background to such efforts in the U.S. and elsewhere is that the investments in learning and how technology engages learning through innovations have not been widespread. A quick sweep across the world indicates that only a small percentage of teachers embraces technology effectively and uses it as a means for deep or engaged forms of learning. In other words, the numerous conferences, journals, and manifold dissemination of "how technology enables learning" do not measure up to the scale of implementation in practice.

There is thus a united call for greater reform—how we can be more effective as researchers in seeking transformation in ICT-enabled pedagogy which are more pervasive in our schools. What are some of the conditions and issues faced, and how can we leverage on the current successes to chart future directions? We recognize that technology is only one tenet in the complex system of education that would include societal needs, policies, curriculum, pedagogy, practices, epistemic beliefs, skills, and others. It is not just a technological enabler in learning, but the only one tenet that affords the catalytic effect to trigger change due to its ability to be adapted and enacted across cultures and contexts. For the purpose of this chapter, the term *change-technology* will refer to technologies with such catalytic effect, differentiating it from the general usage of the word technology.

In Singapore, the Ministry of Education has invested millions of dollars into the IT MasterPlan for Education. In the first MasterPlan for Education, all schools have been equipped with the appropriate networked-based IT infrastructure to enable IT-based learning in the schools. After five years into this investment, the take-up of technology for learning has been generally at the basic level, with only a small number of schools experimenting and innovating with the use of IT in teaching and learning. The real challenge in going ahead still lies in whether the IT adoption in schools leads to meaningful engaged learning. Thus, there are three challenges that need to be addressed: (1) how can schools in Singapore embrace technology where school practices, curriculum, pedagogy, teachers' and students' beliefs are in full alignment to the effective use of technology; (2) how can the process of change be facilitated systematically in schools such that these changes leverage on IT as a catalyst to enhance learning; and (3) how can the larger scheme of things such as policy-wide initiatives (at the Ministry level), community-parental concerns, be set in place to enable schools, educational professionals, and practitioners to be fully aligned in order to enact this innovation for sustainability?

This chapter describes the efforts of the Learning Sciences Lab (LSL) in the National Institute of Education in tackling the challenges and issues faced concerning systemic innovation in schools which are enabled by technology. The aim of this chapter is to describe and understand some of the challenges underlying sustainability and scalability in technology innovations in the context of LSL's efforts. LSL is