Learning Futures of the Future School: Designing Knowledge Creation Spaces in Singapore

Hyo-Jeong So
hyojeong.so@nie.edu.sg
Assistant Professor
Learning Sciences & Technologies
National Institute of Education, Nanyang Technological University
Singapore

ABSTRACT

In this paper, I argue that our discourse about future schools necessitates the clear articulation about the envisioned educational goals and the multiple approaches for reaching such goals to overcome the paradox of future schools. This paper presents the facets of future schools from the perspective of historical legacy and disposition, and highlights the criticality of understanding the interplay of architectural, technological and pedagogical design in future schools. The case of the Future School program in Singapore is presented as an illustration of the systematic effort to transform schools with technology. Designing knowledge creation paces is put forth as a productive way to envision educational goals and future school environment.

Keywords: Future school, Knowledge creation, Singapore schools

THE PARADOX OF FUTURE SCHOOLS

Over the past few years, there have been enormous interests about the design of future schools or the classroom of the future in both the general public domain and the research community. This trend toward the imagination and expectations about future schools apparently reflects our dissatisfaction with the current educational system and learning environment, coupled with the increasingly complex nature of knowledge and skills required in the 21st century learning. Despite the growing interests about future schools, however, the process toward the actualization of our ideas into the concrete design of future schools has not yet seen much improvement. I view that the fundamental reason for such a distance between the idealization and the realization of future schools lies in the unavoidable *paradox of future schools*, that is, the conceptualization of the future based on the discourse about the present. Often times, our discourse about future schools departs from the reflection about the past and the present school structures. However, when our idea about future schools is primarily rooted in or limited by the image of the present schools, it is likely to lead to high resemblance between the present and the future, which is contradicting our vision toward the transformation of the current schools. Similarly, Bereiter (2002) cautions the danger of *surface resemblance* in futuristic education: "it deals in surface resemblances: Imagine what the future will look like on the surface; then make education mimic that surface" (p.224). On the other hand, what is equally important is to avoid a danger to easily fall into "utopian thinking" when our discourse of future schools becomes too idealistic. It is apparent that both directions, surface resemblance and utopian thinking, are not desirable.

In this paper, I argue that our discourse about future schools necessitates the clear articulation about the envisioned educational goals and the multiple approaches for reaching such goals to overcome the paradox of future schools. To support this position, I will discuss the facets of future schools from the perspective of historical legacy and disposition and put forth the knowledge creation approach, as a productive way to envision educational goals and school environments. Further, the case of the Future School program in Singapore will be presented as an illustration of the systematic effort to transform schools with technology. Throughout the paper, I will discuss a couple of issues that we need to consider to bring back the idea of the school of the future to the school of the present. On the whole, the main goal

of this paper is to provoke our thinking toward future schools by identifying the fundamental challenges at the structural, technological and pedagogical levels.

THEORETICAL DISCUSSION

Facets of Future Schools: Historical Legacy and Disposition

Clearly, the classroom of the present is a genealogical object that reflects its historical predecessors (Schratzenstaller, 2010). One of the main historical legacies of the past schools is the structural architectural design that reflects the value of conformation, efficiency and standardization. Often described as the factory model (Callahan, 1962), the current classroom has been designed to accommodate universal schooling and standardized curricula. From the historical analysis of schooling, Collins and Halverson (2009) present the framework of three eras of education from *Apprenticeship* to *Universal Schooling* to *Lifelong Learning*. As compared in Table 1, the three eras of education are distinguishable in several aspects, including their cultural, pedagogical and societal dimensions. In the apprenticeship era, education was largely the responsibility of parents that help their children learn practical skills. The transformation from the traditional apprenticeship to the universal schooling era was driven by the industrial needs that value mass schooling and the mastery of standardized skills. Subsequently this change led to the shift of responsibility for education from parents to the state (government). In the lifelong learning era fueled by the knowledge and technology revolution, it seems that the voice from individual students and parents are valued to move away from the tight control of the state and further to promote inter-generational, participatory and pervasive culture of learning. From this historical disposition, we learn that the structure of the future schools is likely to have considerable influences from the structures of its predecessors, coupled with the societal needs to transform education.

<Table 1>. Comparison of the Three Eras of Education (Collins & Halverson, 2009)

	1st era: Apprenticeship	2nd era: Universal Schooling	3rd era: Lifelong Learning
Responsibility	Parents	The Sate	Individuals and Parents
Expectations	Social reproduction	Success for all	Individual choice
Content	Practical skills	Disciplinary knowledge	Learning how to learn
Pedagogy	Apprenticeship	Didacticism	Interaction
Assessment	Observation	Testing	Embedded assessment
Location	Home	School	Anywhere
Culture	Adult culture	Peer culture	Mixed-age culture
Relationships	Personal bonds	Authority figures	Computer-mediated interaction

The Interplay of Architectural, Technological, and Pedagogical Design

When reforming the classroom of the present to meet the challenges of the 21st century learning, we need to consider the complexity of "design". By design, here I primarily focus on three aspects, namely architectural, technological, and pedagogical design. First, the *architectural design* refers to the spatial and material arrangement of objects. The criticality of the physical environment design has been well emphasized in the literature that certain spatial arrangement can either encourage or inhibit certain human behaviors and discourse patterns. Recognizing the intimate relationship between the spatial design and human interaction, Schratzenstaller (2010) contends "even the best technological or pedagogical ideas cannot be used to their full effect if they are not architecturally integrated into the classroom" (p.35). Given that the types of interaction that we are advocating in the discourse of future schools include more self-directedness, collaboration, flexibility, and participation, the architectural aspect of learning environments should be designed to support such patterns of interaction.

Second, the *technological design* means the arrangement and utilization of technological tools and artifacts, both physical and virtual. The challenge from the technological design perspective is to embed technological tools into the core practices of school. Currently, we are flooded with the diverse range of technological tools. Yet the integration of those tools into the core practices of teaching and learning has been challenging. Of course, there are multiple reasons to explain such a difficulty of technology integration in schools, but one critical reason to consider is the inherent "incompatibility" between

schools and technology (Collins & Halverson, 2009). Since a culture of teaching arises in response to the stability of school and classroom structures, the use of sophisticated technologies that often require dramatic changes to the stable structure is incompatible with core practices of teaching and learning .

Lastly, the *pedagogical design* is the planning and enactment of teaching and learning practices, emphasizing changing roles, identity and agency of teachers and students in future environments. Mäkitalo-Siegal et al, (2010) argue that in contrast to the prevalent belief that teachers will be playing a role as a facilitator, teachers' role will be becoming more important than ever given the complexity of the future learning environment. Indeed, teachers in the future classrooms need to be skillful at "orchestration" (Dillenbourg & Jermann, 2010), that is, how to effectively coordinate multiple variables, such as more complex forms of activities as well as more diverse arrangement of physical and virtual tools than the conventional approaches in the present schools. The changing role of students is another critical factor in the future environment. Recently, the importance of peer learning culture has been increasing with the power of social media and participatory media culture. Further, there has been growing reorganization of the importance of informal learning spaces and the efforts to bring rich outside resources back to the classroom. All these changes imply that the scope of the pedagogical design should be broadened to accommodate multiple learning spaces and rich learning opportunities beyond the four walls of the classroom.

While the three aspects of designing future schools above are discussed separately, there is a critical need to recognize and unpack the intimate interplay of space, technology and pedagogy, and then to translate such deep understanding into the concrete design practices of future schools. In discussing the design of social infrastructure for creating learning environments with technology, Bielaczyc (2006) emphasizes the dimension of socio-techno-spatial relations, which refers to the configuration of student-teacher relations and the organization of physical and virtual spaces. As a simple example of socio-techno-spatial relations, when the pedagogical goal for students is to develop deep understanding about the application of scientific concepts through collaborative learning, students need to be provided with authentic technological tools like what real scientists are using, and then physical spaces should be arranged in a way to support easy collaboration among students and easy access to various authentic tools.

FUTURE SCHOOLS IN SINGAPORE

Systematic Transformation of Schools with Technology

In Singapore, the use of technology has been one of the important goals for transforming education, with the implementation of both top-town and bottom-up approaches. The ICT (Information and Communications Technology) reform initiatives in Singapore are often characterized by its systematic nature that includes strategic movement, iterative reviews, and restructuring (Toh & So, 2011). The current ICT policy is based on a tiered structure approach that focuses on the systematic scaling up of innovative ideas in schools (Koh & Lee, 2008). As depicted in Figure 1, under the "Edvantage Porgramme" by the Ministry of Education and Infocomm Development Authority of Singapore (IDA), 15-20 percent of schools are selected as LEAD ICT schools that function as test-beds for innovative ICT use. Another 5 percent of schools are selected as future schools to be the leader of transforming pedagogy with technology and to become the agent for spreading innovative ideas to the rest of schools. The main difference between the LEAD ICT schools and future schools is within the scope of ICT integration. While the LEAD ICT schools aim to integrate ICT in at least one subject area at one level (e.g., ICT integration in Primary 3 science), the future schools employ a "whole school approach" for a seamless and pervasive integration of ICT across multiple subjects at all levels. The critical component in this tiered approach is its explicit consideration for scalability issues through various channels of teacher communities.

Future School Program

Since 2008, under the FutureSchool@Singapore program, eight schools have been selected as future schools and have implemented various projects that leverage innovative technologies and pedagogical ideas. As presented in Table 2, each school has distinctive themes about how to transform their schools into future schools. Each future school is funded through the Interactive Digital Media (IDM) in education program by the National Research Foundation to conduct school-based research and development. The current status of the FutureSchool@Singapore program can be considered as a

transitory period from “seeding” ideas to “spreading” innovations. As the first batch of the five future schools is closing their project, the next step is to spread innovative ideas to the rest of schools.

EduLab is a recent initiative to address the issue of scalability and sustainability by building strong teacher professional learning communities (PLC) through close school partnerships. The core idea underlying EduLab is to provide a “living lab” where teachers can experiment with new technologies and pedagogical ideas prior to implementing in their own classrooms (MOE, 2012). A co-evolutionary approach is also used by partnering future schools with other schools that lag behind in its ICT integration. Further, the EduLab at the Academy of Singapore Teachers (Edulab@AST) program has been established to empower schools and teachers by leveraging existing teacher networks. AST as an institution solely dedicated to train in-service teachers is expected to become a central hub to showcase and share innovative ideas experimented in future schools and then to train teachers to equip with necessary skills and knowledge for successful ICT integration.

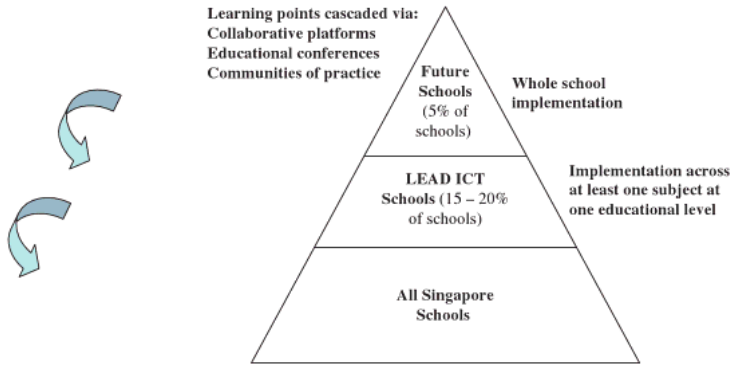

Figure 1. Tiered Approach for Scaling and Sustaining Innovative Practices in Schools (from Koh & Lee, 2008, p.87)

<Table 2>. Eight Future School projects in Singapore

School Name	Research & Development (R&D) Theme
Crescent Girls' School	Empowering the learners, connecting with the future
Hwa Chong Institution	Collection of technological-based initiatives to facilitate global learning opportunities and create diverse learning environments for multidimensional learning.
Jurong Secondary School	Designing innovative learning environments and new educational technologies for constructivist learning
Canberra Primary School	Empowering the future today - Creators in the 21st century and beyond
Beacon Primary School	Exploring the impact of an IDM (Interactive Digital Media)-enriched curriculum in a technology-enhanced learning environment for the holistic development of primary level pupils.
School of Science & Technology (secondary)	Towards pervasive pedagogical practices and learning in the 21st century
Nanchiau Primary School	Building blocks for developing 21st century competencies
Ngee Ann Secondary School	Developing new models for the use of ICT in assessment

Initial Success and Challenges

The future school program in Singapore is an illustration of the systematic effort to transform schools. The initial success of the program can be contributed to (a) its explicit effort to address the issue of scalability and sustainability, (b) the emphasis on empowering teachers through teacher communities, and (c) the synergistic effect from the close partnership across multiple actors (e.g., MOE, higher education researchers, industry, etc). As in any other education reform efforts, the future school program has faced several challenges in its trajectory from design to implementation. With a reference to the three

types of design (architectural, technological and pedagogical) discussed earlier, I summarize some fundamental challenges and issues to consider for designing future learning environments:

- *Technology-driven vs. Pedagogy-driven*: Often times, thinking about future schools is technology-driven, with a hope that technology will revolutionize teaching and learning. The tight coupling of technological and pedagogical design is fundamentally important to design the situation where students can develop deeper understanding with the mediation of technological tools.
- *Evidence of school transformation*: There is a critical need to develop a holistic way to trace and evaluate the transforming process of schools at the meta-level. Lessons learned and common challenges need to be clearly articulated and shared to inform the rest of schools on the similar trajectory.
- *Architectural design challenge*: As mentioned earlier, there is a high relationship between the spatial design and human interaction/discourse. Yet most schools use existing building structures and facilities without much modification.
- *Assessment*: The ways of assessing learning in mainstream schools remains mostly unchanged at the macro level, and the transformation of assessment is often beyond schools' control.

TOWARD DESIGNING KNOWLEDGE CREATION SPACES

One of the common themes across several future schools is the conceptualization of schools as "knowledge creation spaces". Borrowing the idea of knowledge building or knowledge creation by Bereiter (2002), knowledge creation in this context does not necessarily mean that students create totally new knowledge. Instead, knowledge creation refers to the process of learning where students are assimilated into the authentic process of working *with* knowledge or conceptual artifacts. This view of knowledge is fundamentally different from the "knowledge as a container" metaphor that dominates the current school culture and practices. Designing such knowledge creation spaces is a difficult endeavor that requires collaboration across diverse areas of expertise. Turning the imagination about the classroom of the future to the classroom of the present will necessitate the clear articulation of our envisioned educational roles and the changing roles of schools, coupled with the gradual evolution by design experiment.

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