THF Discussion Paper

Discussion Paper Series No. 2/2018

TSLN @20 SYMPOSIUM SERIES: IN RETROSPECT AND GOING FORWARD

Understanding TSLN pedagogic shifts: A view from a ten-year research programme

Dennis Kwek
Assistant Dean, Research Communications,
NIE Singapore

The HEAD Foundation

Introduction

Since Singapore's independence in 1965, the city state has undergone significant developments to her culture and economy, finance and politics, schooling and education, partly as a result of unprecedented regional and global social, cultural and economic forces, but also because of the very quick recognition post-independence that this small nation with no natural resources must rapidly develop a tight coupling between economy and education in order to survive. Gopinathan (2015) points out that Singapore is an exemplar of a developmental state, one that privileges economic development as a means of ensuring political legitimacy and building resources for infrastructure. Central to this idea is a strong belief that without economic growth, the state will not survive. Education and economy are therefore the twin engines in which to propel Singapore into the future, and this has been a stable and coherent discourse and policy driver to shape, and reshape, schooling, economy and society. Deemed a "post-postcolonial" nation, Luke et al (2005, p. 8) point out that the rapid educational reforms in Singapore, in many ways successful as evidenced by international assessment benchmarks, have led to continuous policy questions about "how to take schooling and education in Singapore to the 'next level'", whatever that may be. Indeed, while system-wide educational reforms in general have had less than stellar results (Cohen & Mehta, 2017; Elmore, 1996), Singapore's educational reforms over the last 5 decades have been consistent, long-sighted, intentional attempts to align education to the needs of the economy. Importantly, as Cohen and Mehta (2017, p. 3) point out, systemic reform success is often contingent on how fast such reforms could "mobilise broad support within education, outside it, or both", and in Singapore, reform initiatives are strongly supported by schools, the teaching fraternity, and parents.

In the last two decades, Singapore's educational policies have begun to shift focus from infrastructural, organisational and economic considerations to initiatives that seek to engage at the level of the classroom and pedagogy. In 1997, then-Prime Minister Goh Chok Tong set out an agenda for "Education for the Future" which he called "Thinking Schools, Learning Nation" (TSLN). His first words in the speech were that "a nation's wealth in the 21st century will depend on the capacity of its people to learn" (Goh, 1997). Without compromising on fundamentals and the high standards that the Singapore system had achieved, he pointed out that we needed to "fire in our students a passion for learning, instead of studying for the sake of getting good grades in their examinations". He wanted students to shift away from a prevalent focus on examination results, towards having the desire and disposition to continue discovering new knowledge well after they leave school. The TSLN initiative pushed the system towards student-centred, active learning with the aim of generating independent, self-directed learners. This ambitious vision for Singapore education was further developed by Prime Minister Lee Hsien Loong in 2004, when he, like his father the late Mr Lee Kuan Yew, spent a significant amount of air time during National Day Speeches, talking about education (Lee, 2004). Prime Minister Lee said that "We've got to teach less to our students so that they will learn more". The "Teach Less, Learn more" (TLLM) initiative was

fleshed out in 2004 and 2005, emphasising a principal change in pedagogy and mindset. This included an increased focus on the quality of learning rather than quantity, more engaged student learning, more differentiated instruction, more guiding, mentoring, formative assessments, a focus on innovation and enterprise, and as before in TSLN, less emphasis on tests and examinations. Taken together, TSLN and TLLM represented fundamental paradigm shifts in the core business of teaching and learning and had far reaching implications across the entire system.

CORE 1 Research Programme (2004-2008)

It is in this policy context that the Centre for Research in Pedagogy and Practice (CRPP) at the National Institute of Education (NIE) was set up in 2003, tasked with answering empirical and descriptive questions around "the core practices of schooling, the contexts where knowledge, practice and identity are shaped, and the material consequences of students' life pathways" (Luke et al, 2005, p.9). Central to CRPP was the CORE 1 Research Programme, which aimed to provide "a critical social science evidence base for educational innovation. It's overt 'bias' in design and philosophy is on everyday classroom pedagogy, on the intellectual and discourse work of teachers and students in classrooms" (Luke et al, 2005, p. 9). With the principal focus on classroom pedagogy, CORE 1's research design included:

- A rich description of pedagogy and pedagogical shifts
- Complex, multiple research methodologies and analytical approaches
- A broader conceptualisation of educational outcomes to include not just conventional assessment measures, but student work, teacher and student beliefs, values and attitudes

The design was manifested in six distinct panels representing unique lines of research, with 4 of them interlinked through nested sampling. While details can be found in Luke, et al (2005), these 4 panels are worth brief mention. Panel 2 used cross-sectional surveys of 4000 teachers and 16000 students to investigate their attitudes, motivations, strategies and practices. A subset of the schools and classrooms from Panel 2 were then observed, with 1200 primary and secondary lessons from over 56 schools collected. In-situ classroom coding of these lessons were conducted, focusing on the classification and framing of knowledge in the classroom, drawing from Bernstein (1996), Lingard et al (2002), and Newmann & Associates (1996). 400 lessons from Panel 3 were then transcribed and used in Panel 4 to investigate linguistic, interactional and activity structures of Singapore lessons across a range of subjects (English, Mathematics, Science, Social Studies, Mother Tongue). Simultaneously, Panel 5 collected 10800 teacher tasks and student work from the 1200 lessons to analyse the intellectual quality of assessment work. Data collection for Panels 2 to 4 were conducted in 2004, at the cusp of TSLN and TLLM, and therefore provided a baseline with which to understand pedagogical shifts in the subsequent years.

The CORE 1 study found that in 2004, across Primary 5 and Secondary 3 lessons in English, Mathematics, Science, Social Studies and Mother Tongue, the focus was predominantly on basic factual knowledge, with content knowledge being presented by teachers as truth, and students accepted that as a given. Textbooks and worksheets were frequently used, and the mode of teaching was largely whole-class lecture or answer checking. Teachers dominated in classroom talk, with students largely compliant but engaged. Teachers were seen as the source of authoritative knowledge and assessment tasks were provided with high levels of clarity and organisation. However, the emphasis of such tasks were on knowledge reproduction and student work were mostly in the form of short answers in response to closed questions. The overall pedagogical picture could be explained by the fact that the primary and secondary classrooms sampled were one year before the high-stakes national examinations in Primary 6 and Secondary 4 respectively, and this was intentional: if pedagogical shifts that were in line with TSLN were to manifest, they should occur across all ten years of primary through secondary schooling. However, the entrenched focus on preparing students for the high stakes examinations occurred even in Primary 5 and Secondary 3, with the pedagogy and assessments employed largely to prepare students for the important pen-and-paper national examinations.

CORE 2 Research Programme (2009-2014)

Given the findings, there was strong interest in continuing the large-scale baseline study into classroom pedagogy, and the Ministry of Education (MOE), which funded CORE 1, continued to fund the CORE 2 Research Programme which began in 2009. Data was collected from Primary 5 and Secondary 3 classrooms in 2009 but this time in English and Mathematics. In 2010, over 62 schools, comprising 2100 teachers and 16895 students participated in CORE 2 Panel 2's surveys and student assessments, with a subset of 31 schools participating in Panel 3's classroom observational component. 625 lessons were video- and audio-recorded, with intensive coding conducted every 3 minutes of these lessons; over 300 pedagogical indicators were coded in each 3 minute 'phase'. Panel 5's focus on assessment resulted in the collection and analysis of 385 teacher tasks, 2897 student work, as well as 115 teacher interviews and 209 teacher surveys around their assessment practices. Cumulatively, while the range of subjects had diminished, it was replaced by an analytical depth that allowed for complex statistical analyses to be conducted. Crucial to CORE 2 was the expansion of pedagogical focus from knowledge classification and framing to a comprehensive conceptualisation of the disciplinarily of English and Mathematics. This meant focusing on, for example, the specific types of teaching practices that help students understand the nature of English as a literacy practice, and Mathematics as a means to solve problems.

The CORE 2 findings showed that the structure of classroom interaction has remained largely similar to that found in CORE 1, with teachers conducting largely whole-class lectures and answer checking interactions, asking closed questions and students providing short responses. As an example, Table 1 shows the focus of Secondary 3 Mathematics to be predominantly on procedural knowledge (80%) and factual knowledge (41%) in the phases coded, with a focus on conceptual knowledge in 27% of all the phases coded. In Secondary 3 English, the dominant focus is on factual (63%) and procedural (57%) knowledge. Both subjects did not have a substantive focus on metacognitive knowledge, which is knowledge about when and how to use particular strategies for learning or problem solving. In other words, in Mathematics classrooms for example, teachers were not seen to teach students different problem solving strategies and how to choose between them, but rather, they focused mostly on solving problems in an efficient algorithmic way.

CORE 2 Panel 3	S3 Mathematics 2010 (N=2991)	S3 English 2010 (N=3247)
N=351 (lessons) N=6238 (phases)	% Occurrence in all phases	% Occurrence in all phases
Factual Knowledge	41.0%	63.0%
Procedural Knowledge	80.0%	57.0%
Conceptual Knowledge	27.0%	6.0%
Epistemic Knowledge	5.0%	2.0%
Metacognitive knowledge	3.0%	2.0%

Table 1: Knowledge Focus in Secondary 3 Mathematics and English (CORE 2 Panel 3, 2010)

This is not to say that students were learning by rote or by 'drilling' in a reductive manner. Rather, Mathematics pedagogy is centred around deliberate practice to develop core mathematical understanding and competency. Analysis of hundreds of samples of student worksheets and teacher tasks in CORE 2 has shown that Mathematics teachers constructively work with students in classrooms on problem solving activities. In analysing the relationships between problems, the CORE 2 researchers found evidence of a deliberate structure in how problems were laid out in lessons. Typically, students were exposed to problems that may be repetitive in nature initially but moved on to problems that were more varied in terms of the procedures required to solve them, and then were pushed towards more conceptually complex problems that required them to apply what they had learned in novel ways. Such pedagogy helps students to understand mathematical problem

solving quickly, and is essential for the national examinations in Secondary 4. This examination pressure is not only felt by students, but by teachers who said that the national examinations had a large influence on how they teach, limited the willingness and opportunities to try new practices, and pressured them to teach in ways contrary to their professional beliefs, as evidenced from the CORE 2 teacher surveys.

The findings in 2010, 6 years after TLLM and 13 years after TSLN, brings to the fore a key tension between policy efforts to change pedagogy, and resistance to such changes due to accountability and assessment imperatives. This tension has resulted in two distinct, but co-existing pedagogies which are hybridic and emblematic of attempts to shift from a predominantly traditional form of learning and teaching to forms suggested by TSLN in particular. On the one hand, there is a dominant 'Performative Pedagogy' that focuses on factual and procedural transmission and the acquisition of knowledge and skills, prepare students for high stakes testing, has extensive use of traditional instructional strategies, with few opportunities for dialogic, sustained teacher-student substantive interactions in the classroom. There is also a rare but present 'Knowledge-Building Pedagogy' where teachers focus on conceptual understanding, self-regulation, disciplinary or domain-specific expertise, and use authentic, knowledge-building tasks that not only focus on disciplinarity but engages in student learning in substantive ways. Such tasks require or encourage students to do knowledge work – generate, represent, communicate, deliberate, justify knowledge claims, apply to new problems or contexts. The Knowledge Building Pedagogy also employs high leverage instructional strategies, what John Hattie calls Visible Learning (Hattie, 2008), such as checking of prior knowledge, flexible scaffolding, feedback, monitoring, understanding talk, dialogic practices.

These two pedagogies co-exist, and importantly, are pragmatically driven - teachers appear to know when to use one and when to use the other. This reflects highly on their pedagogical repertoires and capacities. In a recent CORE study which we conducted in lower primary-level Mathematics classrooms, we saw far more Knowledge-Building Pedagogy at work, possibly because it was further from the high-stakes years. But closer to the high-stakes examinations, the pressures impacted upon their practices and consequently, their professional identities. Teachers therefore face a tension between two pedagogical responsibilities they have to exercise. They have to practice a form of responsible teaching, institutionally speaking - cover the curriculum, prepare students for examinations, be accountable for examination results especially to parents. But teachers as professionals want to practice another kind of responsible teaching, where they are committed to student-centered learning, facilitated by teacher professional learning, strong pedagogical content knowledge, strong teacher collaborations, passionate ideals about what schooling and education should be for the child – engaged learning, lifelong passion for learning, and holistic forms of education.

This tension exists because both TSLN and TLLM acknowledged that we need to maintain high standards and that examinations are important, yet at the same time are trying to shift the system towards a progressively future-oriented form of teaching and learning.

CORE 3 Research Programme (2015 to Present)

The continued interest in the CORE Research Programme stems from its analytically rigorous and large-scale baseline ambitions, as well as a continued focus on classroom pedagogy and assessment. However, a drawback of CORE 1 and 2 was that it took the research team about 3 to 4 years from data collection to reporting of the findings to the funder, MOE. Policy and curriculum review cycles are shorter than the research life-cycle; by the time rich, detailed findings were available for policy decision-making, their relevance and utility were diminished because policy formation had already begun, or occurred, and research could not directly inform policy decisions. This led to a major redesign of the CORE Research Programme where, while the focus remained on the instructional core of classroom practices – teachers working with students in the presence of subject content – there was a need to conduct rigorous, yet relevant, research that could inform policies. This meant an 18-month research trajectory from data collection to reporting initial findings, and a comprehensive schedule of classroom observations across a range of school subjects. This included not just the recurring subjects of English and Mathematics, but also other subjects such as Social Studies, Citizenship and Character Education, Arts, Music, Physical Education and so on. These subjects are scheduled for data collection and analysis such that the findings are aligned to curriculum review processes.

In 2015, we collected classroom observational and interview data from teachers and students in Primary 5 and Secondary 3 Science classrooms. 10 schools were involved, over 90 lessons were video-recorded and coded, along with student focus group discussions, teacher interviews and the collection of teacher tasks and student artefacts. Table 2 shows the knowledge focus in Science classrooms. The emphasis on factual knowledge remains strong in both Primary 5 and Secondary 3 lessons but what is clear is that the focus on conceptual knowledge is almost equally strong (49% for Primary 5, 46% in Secondary 3). Procedural knowledge in Secondary 3 is more frequent compared to Primary 5 largely due to the nature of scientific experiments where students had to learn procedures to conduct modes of inquiries. When we compared our 2015 data to the Core 1 Science data collected in 2004, the shifts in knowledge focus becomes obvious especially in terms of a decrease in factual knowledge and an increase in conceptual knowledge. In interactional terms, teachers still continued to ask closed questions (49% in all phases coded) but there were more open questions as well (14.2% in all phases coded), and students responded with largely short (47.3%) and medium (20.6%) responses. However, metacognitive knowledge remains rare, as seen in Table 2.

Core 3 Science P5 & S3 (2015/2016)				Core 1 Science P5 & S3 (2004)
Knowledge Focus	% Occurrences in all Phases			
	P5 (N=569)	S3 (N=485)	Total (N=1054)	Total (N=274)
Factual Knowledge	59.0%	46.0%	53.0%	88.0%
Procedural Knowledge	39.0%	61.0%	49.0%	47.0%
Conceptual Knowledge	49.0%	43.0%	46.0%	18.0%
Epistemic Knowledge	4.0%	4.0%	4.0%	NA
Metacognitive Knowledge	4.0%	4.0%	4.0%	NA

Table 2: Knowledge Focus in Primary 5 and Secondary 3 Science (CORE 3, 2015)

In 2016 to 2017, we entered Primary 5 and Secondary 3 Social Studies classrooms and like Science, the last time we visited such classrooms was in 2004's CORE 1. Similar to Science, while the interactional patterns remained the same (mostly closed teacher questions and short student responses), we saw some movements towards open teacher questions and medium and extended student responses especially in Primary 5 where the subject is not examinable. When compared with CORE 1, we saw a decline in factual knowledge (93.7% dropped to 60.5%) with a corresponding increase in procedural knowledge (13.6% in CORE 1 to 39.2% in CORE 3) and conceptual knowledge (16.5% to 62.0%). The increase in procedural knowledge can be attributed to the Secondary 3 Social Studies syllabus which was revised to cover issues investigations, source-based case studies and structured-response question assessments.

A number of reasons for the pedagogical shifts between 2004 and recent years can be discerned, based on our analysis of the interview data and policy documents. Drawing on Cohen (2010), the Singapore education system has a strong, coherent and aligned "instructional infrastructure" comprising:

- A common curriculum framework with clear and high standards. The 21st Century Competencies framework and the Desired Outcomes of Education (MOE, 2010) provided underlying principles that cut across school subjects

- Textbooks, curricular materials and common assessments that are tied to the curriculum framework. Textbooks used in schools have to be approved by MOE, allowing for alignment and coherence between curriculum and school materials

- Teacher education, both pre-service and in-service, that is tied to the curriculum framework

- Teachers have access to well-designed curricular materials and resources to set academic tasks that are aligned to the curriculum and assessment, as well as a common professional discourse to talk about teaching and learning

Another reason is that teachers have been increasingly provided with opportunities for professional learning. More school-based professional learning communities, and networked learning communities, are organised to facilitate collective peer learning. There is increased autonomy for teachers and schools to tinker with pedagogical improvements, and curriculum specialists, pedagogical experts, and researchers from NIE work together to help develop teacher capacities. For example, in the period of 2013 to 2016, over 56% of NIE projects have MOE officers as co-researchers, and 248 schools have been involved in 55 NIE projects. This speaks to the level of commitment to education research, and the increasing research-practice partnerships that are crucial to drive pedagogical improvements in schools (Greany & Maxwell, 2017).

The Next Level

What, then, should Singapore consider for the 'next level' of her education system? Here, we propose a few directions based on our CORE Research Programme's work with schools and teachers:

1. The high-stakes examinations continue to impose a downward pressure on teachers and the system to adhere to what works in achieving good examination outcomes. This generates a continuous tension between performative and knowledge-building pedagogies. But this tension can be debilitating, or it can be creative in generating new pedagogical innovations that might bridge these two pedagogies in ways that allow students to gain strong foundations necessary for these examinations, yet help them acquire the disciplinary and 21st century competencies needed for the future workforce.

2. To enable this to happen requires schools and teachers to have more autonomy, capacities, resources and time to design authentic learning tasks for their own students, including enhanced abilities for curriculum and assessment designs.

3. There is also a need to understand student learning not just from within the classrooms and individual subject domains, but outside the classroom – in co-curricular activities, school-based applied learning and lifelong learning programmes, and even outside of schools where forms

of informal learning occur at home, among peers and in communities. This will allow for a deeper understanding of the impact of schooling and education.

4. Stringfield and Teddlie (2012, p. 286) point out that "the goals of schooling are longitudinal" and that "school effects must necessarily be regarded as a longitudinal set of processes" (p. 386). It is obvious that the impact of Singapore schooling are long-term and goes beyond achieving academic results. CORE's recent research are largely cross-sectional and if we are to continue carefully documenting pedagogical shifts, we then need to also understand how these shifts might lead to educational outcomes that may be better for students, and the nation as a whole.

Two pedagogical questions then arise:

- What 'sticks' when students are increasingly exposed to different performative and knowledge-building pedagogies across their school years and subjects? What kinds of knowledge, values, dispositions and beliefs will they remember as they enter adult life, and what will they discard or forget?
- What improvement processes and mechanisms can help schools effect strong, sustainable and impactful pedagogical innovations that will lead to long-term outcomes that are important and valuable to their students in their adult lives?

Research has much to contribute towards answering these questions, and it is an ambition, and indeed hope, of the CORE Research Programme to continue to provide the "critical social science evidence base for educational innovation" in Singapore schools that can help to bring our system to these next levels.

References

Bernstein, B. (1996). *Pedagogy, symbolic control and identity*. London: Taylor & Francis.

Cohen, D. (2010), Teacher quality: An American educational dilemma. In M. Kennedy (Ed.), *Teacher assessment and the quest for teacher quality: A handbook* (pp. 375-402). San Francisco: Jossey-Bass.

Cohen, D.K. & Mehta, J.D. (2017). Why reform sometimes succeeds: Understanding the conditions that produce reforms that last. *American Educational Research Journal, 54*(4), 1-47.

Elmore, R. (1996). Getting to scale with good educational practice. *Harvard Educational Review, 66*(1), 1–27.

Goh, C.T. (1997). *Shaping our future: Thinking schools, learning nation*. Speech by Prime Minister Goh Chok Tong at the opening of the 7th International Conference on Thinking, Singapore, June 1997.

Gopinathan, S. (2015). *Singapore chronicles: Education*. Singapore: Straits Times Press.

Greany, T. & Maxwell, B (2017). Evidence-informed innovation in schools: Aligning collaborative research and development with high quality professional learning for teachers. *International Journal of Innovation in Education, 4*(2-3), 147-170.

Hattie, J. (2008). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement*. London: Routledge.

Lee, H.L. (2004, August 22). *Our future of opportunity and promise*. Address by Prime Minister Lee Hsien Loong at the 2004 National Day Rally at the University Cultural Centre, National University of Singapore, 22 August 2004.

Lingard, R., Ladwig, J., Mills, M., Bahr, M., Christie, P., Gore, J., Luke, A. (2002). *The Queensland school reform longitudinal study*. Brisbane: Education Queensland.

Luke, A., Freebody, P., Shun, L. & Gopinathan, S. (2005). Towards research-based innovation and reform: Singapore schooling in transition. *Asia Pacific Journal of Education, 25*(1), 5-28.

Ministry of Education. (2010, March 9). *MOE to enhance learning of 21st century competencies and strengthen art, music and physical education*. Retrieved from http://www.moe.gov.sg/media/press/2010/03/moe-to-enhance-learning-of-21s.php.

Newmann, F., & Associates. (1996). *Authentic achievement: Restructuring schools for intellectual quality*. San Francisco, CA: Jossey-Bass.

Stringfield, S. & Teddlie, C. (2012). School effectiveness research, 1932 to today, including a call for future research. In C. Day (Ed.), *The Routledge International Handbook of Teacher and School Development* (pp. 379-388). London: Routledge.