Chapter 10
Diffusing Innovative Pedagogies in Schools in Singapore: Case Studies on School Leaders' Diffusion Approaches and Their Rationalisations

Jun Song Huang

Abstract The scaling and diffusion of innovations has been widely studied with regard to the characteristics of innovations and factors influencing teachers' decision-making for adoption. However, little has been explored on why school leaders take a top-down or a bottom-up approach to diffusion. Through multiple case studies in Singapore, this paper identifies metaphors and repertoires that school leaders use to elaborate and rationalise their diffusion approaches. It establishes an empirical understanding of how school leaders in Singapore diffuse innovations and why they often take a top-down approach to diffusion. Findings suggest a need to help school leaders understand the diffusion of innovations as a process and the need to integrate top-down and bottom-up approaches.

10.1 Introduction

Studies show that innovations in areas such as Information and Communication Technologies (ICT), coupled with necessary pedagogical strategies, may engage students in deep learning (Jonassen & Carr, 2000; Koh, Huang, Lim, Chen, & Hung, 2008; Looi, Hung, Bopry, & Koh, 2004). In education research, innovating new pedagogical strategies has traditionally been the main focus, whereas the sustainable and scalable adoption of such innovations is only recently gaining attention (Christensen, Horn, & Johnson, 2008; Lim, Hung, & Huang, 2011; Toh, 2016).

The literature on innovation diffusion suggests that neither a solely top-down nor bottom-up diffusion approach is effective (Dudink & Berge, 2006; Fullan, 1994, 2007; Panuwatwanich, Stewart, & Mohamed, 2009). In a top-down approach, people (such as teachers) are often mandated to adopt innovations being implemented by their management. Fullan (1994, 2007) observes that the purely top-down

J. S. Huang (✉)
National Institute of Education, Nanyang Technological University, Singapore, Singapore
e-mail: junsong.huang@nie.edu.sg

approach consistently fails. Such a top-down enforcement of mandated adoption was found to hinder people's adoption (Fullan, 1994; Sarason, 1990), because they are likely to be under forced compliance (Festinger, 1957) and are less willing to make adaptations of the innovations for their needs (Honey & McMillan-Culp, 2000; Luehmann, 2002; Rogers, 2003). The top-down forced compliance in adoption is also critiqued by Alexander (2008). In advocating for coherent pedagogy, Alexander makes reference to the UK government's prescription of pedagogy in 1997. He argues that pedagogy is more than the act of teaching. It involves the understanding, belief and justification of the act. Compliance often closes debates and undermines teachers' agency (Eisenhardt, 1989), as well as their learning about the innovation and their adaptation and customisation of the innovation for their own use. Without teachers' agentic learning and adaptation, the adoption of innovations can hardly be sustained when top-down pressure is removed.

In contrast, the bottom-up approach occurs when there is no centralised control and people have the agency to make their own adoption decisions (Rogers, 2003)— similar to a virus infection. The scaling leverages on bottom-up communication, such as word of mouth, through which a body of innovation adopters grows over time. Fullan (1994) and Mathews (2007) both demonstrated that in a bottom-up system, without enough central control, innovation either took an extremely long time to reach a high adoption rate, or not at all, before being replaced by new innovations (Rogers, 2003; Valente, 1996). Hence, a solely top-down or bottom-up diffusion approach has limitations.

In practice, there is a strong top-down tradition in innovation diffusion. In the Singapore context, school leaders (e.g. school Principals, Vice Principals, Heads of Department) often use an implementation model of mandating to scale up innovative pedagogies. Looi, Lim, Koh and Hung (2005) critique that school leaders generally hold a belief that if the top-down mandate is upheld for a long enough time, innovation will eventually be adopted by teachers sustainably. However, this approach has proven to be ineffective. Lam, Yim and Lam (2002) and Biott (1992) point out that, when teachers are coerced to conform to a top-down implementation plan, even when supports are provided, they will not appreciate it. Hence, it is necessary to develop an empirical understanding on how school leaders scale up innovations in Singapore and how they rationalise their scaling approaches. This is particularly timely because Singapore's culture of innovating and diffusing new pedagogies is progressively shifting towards decentralisation.

The purpose of this chapter is to present a study conducted to understand school leaders' diffusion approaches and their rationalisations. It complements existing literature which examines innovation diffusion and implementation mainly from the researcher's perspective, for example, the investigation of the characteristics of innovation and factors influencing teachers' decision-making for adoption (Surry & Ely, 2002).

The following sections outline the context of the study and, through thematic analysis, present the findings on why school leaders use top-down approaches to diffuse innovations. A discussion on the participants' rationalisations of their scaling approaches is presented at the end of the chapter. Implications are drawn on how to help school leaders learn to diffuse innovations effectively.

10.2   Research Design

To achieve the research objective, multiple case studies (Stake, 2013; Yin, 2013) were conducted involving eight school leaders as participants.

10.2.1   Case Contexts

The cases were selected through purposeful sampling strategy (Yin, 2013) by maximising case differences in terms of the types of the organisations. There were four cases: two cases from primary schools, one case from a secondary school and one case from the headquarters of Singapore's Ministry of Education (MOE). All three selected schools are mainstream schools which do not have access to additional financial resources for innovation or diffusion. Two cases from primary schools were chosen because there are more primary schools than secondary schools in Singapore. Compared to their counterparts in secondary schools, teachers in primary schools usually teach more subjects (Lim & Khine, 2006), which leads to distinctive contexts for innovation and diffusion. Between the two primary school cases, one school is an average-performing all-boys school that is affiliated to a religious body, while the other is a relatively high-performing mixed gender school. Therefore the two are varied in terms of their diffusion contexts.

The MOE case was selected because the participants from the MOE department (Educational Technology Officers, i.e. Ed-Tech Officers) dealt with the diffusion of pedagogical innovations across schools, making the case unique in terms of the diffusion goal and context.

Each case involved two school leaders from the same school or the same MOE department. Hence, in total, there were four dyad cases. The study was conducted in the meeting room of the respective dyad's organisation (i.e. schools or MOE).

The summary of the contexts of the cases is presented in Table 10.1, followed by a brief description of the participants in each case.

The participants in Case One were the Principal (C1P1) and the ICT Mentor (C1P2) from a mainstream secondary school, diffusing iPads for learning. C1P1

Table 10.1   The contexts of the four cases

Case	One	Two	Three	Four
Participant 1	Principal (C1P1)	Vice Principal (C2P1)	Head of ICT (C3P1)	Ed-Tech Officer (C4P1)
Participant 2	ICT Mentor (C1P2)	Head of Science (C2P2)	Assistant Head (C3P2)	Ed-Tech Officer (C4P2)
Organisation	Mixed secondary school	All-boys primary school	Mixed primary school	Ministry of Education
Curricular innovation	iPad for learning	Holistic assessment	Design pedagogy	Pedagogical innovation

was in his late 40s and was appointed as the Principal of the school 6 months before the study. Prior to this appointment, he was the Vice Principal of another mainstream secondary school for 2 years. He used to be a science teacher and the Head of the ICT Department (HoD-ICT) in a secondary school and an Educational Technology Officer (ETO) in the MOE promoting education innovations to a cluster of schools. C1P2 was in his late 30s. Before his appointment as the ICT Mentor for the school, he was the appointed ICT Champion for the English Language Department. As the ICT Mentor, every year he mentors two teachers in the school by leading them through the process of adopting ICT tools, planning and carrying out and reviewing a lesson that engages ICT tools.

In Case Two, the Vice Principal (C2P1) and the HoD-Science (C2P2) from an all-boys primary school took part in diffusing holistic assessment as an innovation. C2P1 was in her late 40s. She held a Master's Degree in Education and was appointed as the Vice Principal in 2009. Prior to this appointment, she worked in the MOE headquarters for 7 years. C2P2 was in her mid-30s with a Master's Degree in Education. She had 9 years' teaching experience and 1 year of working experience at the MOE headquarters. During the period of this study, she had been covering the previous HoD-Science's duty for 3 years and had been recently appointed as the new HoD-Science.

In Case Three, the HoD-ICT (C3P1) and a Subject Head (C3P2) from a mainstream primary school participated in diffusing a student-centred design-for-learning pedagogy (in short, "design pedagogy"). C3P1 was in her mid-30s and had previously worked in the commercial sector before she joined the school 7 years before. As a noneducation service staff member, she did not teach any subjects. She was the Subject Head for 3 years before she was appointed as the HoD-ICT in 2010. C3P2 was in her early 30s and had 9 years' teaching experience. She was transferred from an elite school 3 years before and was appointed as the Subject Head for the ICT Department 2 years before. C3P2 thought highly of the current school because she felt that the approaches to innovation diffusion in the current school were well-structured.

Two Ed-Tech Officers (C4P1 and C4P2) from the MOE headquarters were participants in Case Four to diffuse innovation across schools. C4P1 was in her late 30s. Prior to her appointment at the MOE headquarters, she worked as a science teacher and HoD-Science in a local mainstream secondary school. C4P2 was in her late 20s. Prior to her MOE appointment, she worked as a science teacher and Subject Head in a local mainstream primary school. No specific innovation was discussed in this case; rather, the reflection centred on the diffusion of pedagogical innovations in schools in general.

10.2.2   Data Collection and Analysis

The author facilitated the joint reflection of the two participants in each dyad on their views of the diffusion process in a conversational style, in particular by reflecting with metaphors.

The dyads were also guided to compare innovation diffusion with metaphors (e.g. a virus infection), to create more opportunities for reflection. Lakoff and Johnson (1980, 2003) demonstrated that people often understand one conceptual domain in terms of another (e.g. "time is money"). These perceptual-based metaphors not only shape communication but also transform how people think and act within the domain. Hence, a person's conceptual metaphor provides an avenue to investigate how the person conceives of the domain conceptually.

In order to develop more in-depth understanding on the dyads' knowledge on innovation diffusion, the study aimed to identify and understand the gaps between the participants' conceptual metaphors and their conceptual understanding. Falck and Gibbs (2012) recognise that people's use of metaphors is guided and constrained by their experiences with regard to the source (i.e. the metaphor) and the target (i.e. the phenomenon being described using a metaphor). Hence, there may be gaps between people's conceptual metaphors and conceptual understanding. Engaging the dyads to reflect on these gaps helps to better reveal the dyads' conceptual understanding on innovation diffusion.

Each dyad's spoken reflection was transcribed verbatim. The dyad was used as the unit of analysis in data analysis because the two participants in each dyad case reflected together and they rarely challenged each other's views.

Under an interpretivist paradigm (Cohen, Manion, & Morrison, 2000), thematic analysis (Boyatzis, 1998; Braun & Clarke, 2006) was adopted as the main data analysis method. It is an inductive approach to identify, analyse and report the dyads' patterned responses, without trying to fit the data into a pre-existing model or frame. Thematic analysis was applied in three dimensions, namely, the dyads' scaling approaches, their conceptual metaphors on scaling and the rationalisation of their scaling approaches. This paper focuses on reporting the common thematic patterns across the cases. The nuances within the context of each case are considered when making speculations on the variations across the cases in terms of their diffusion approaches and alignment with the conceptual metaphors.

10.3   Findings

Thematic analysis was first adopted to categorise the scaling approaches and conceptual metaphors shared by each dyad. For example, the Case One dyad is identified as using a more bottom-up approach to diffuse innovation and conceptualise innovation diffusion accordingly. The dyads from Cases Two to Four implemented innovations from the top-down. The dyads' justification on the alignment and misalignment between their scaling approaches and conceptual metaphors were then analysed to identify common emergent themes.

Table 10.2 summarises the dyads' scaling approaches and their conceptual metaphors.

Table 10.2 Summary of the findings

Case	One	Two	Three	Four
Scaling approach	Encourage voluntary adoption	Mandate teachers to adopt	Mandate teachers to adopt	Mandate teachers to adopt
Rationalisation for scaling approach	"(Many teachers) just stay in their comfort zones, just do things that they are sure (of)"	"If a teacher (has) not used an innovation before, he will perceive that using it is risky and scary"	"At least when (teachers) use the innovation in their classroom(s), their students can still benefit from the innovation being used. It is better than not using the innovation at all"	"In schools, time is a luxury""(To) quit smoking is a choice by people, but teachers have no choice. It is their job"
Conceptual metaphor	Virus infection and evangelising: one influences another	Bicycle: school leaders set direction and drive the diffusion	Waterfall: leaders are like waterfalls which flourish teachers	Big boat and mini-boats: big boat sets direction; mini-boats are hooked to the big boat and follow the direction

10.3.1 Scaling Approaches

The dyads in Cases Two to Four took a top-down approach to scaling. For example, with the support of the Principal, the Case Three dyad developed an innovation, validated it through an action research and implemented it school-wide. Then, in department meetings, the dyad communicated to teachers the benefits of the innovation and the management's decision for implementation. They also created and monitored a teaching roster which scheduled each teacher's roll-out timetable.

In contrast, the dyad in Case One took a bottom-up approach to diffusion. The dyad encouraged teachers who were interested in the innovation to join a "core group" (i.e. learning community). The school provided resources and training for members in the core group to learn, invent and implement the innovation in their respective classrooms. The school used different communication platforms (e.g. departmental sharing time and school ICT sharing time) to showcase the core group members' successes so that more teachers could see the value of the innovation and would want to join the core group. This approach is primarily bottom-up and does not sufficiently leverage on top-down structure and arrangement to enhance and optimise teachers' agentic learning and adaptation. In a solely bottom-up approach, without enough central control, innovation takes an extremely long time to reach a high adoption rate, or not at all, before being replaced by new innovations. Therefore, to facilitate a more speedy adoption, the dyad in Case One could have done more to leverage on the top-down structure and resources to create opportunities for the "core group" of teachers to share with other teachers and recruit members.

10.3.2   Conceptual Metaphors

Consistent with their top-down approaches to diffuse innovation, bicycle (Case 2), waterfall (Case 3) and boat (Case 4) were used by the dyads in Cases Two to Four as conceptual metaphors (Allbritton, McKoon, & Gerrig, 1995) to elaborate the scaling of innovation. For example, the dyad in Case Two shared that "[a] school is like a bicycle. The Principal holds the bar [to set the direction], the Vice Principal peddles, Heads of Departments are like the chains to pass the demand to the teachers, and finally, teachers move forward as the wheels". Thus, innovation is scaled up when the Principal selects an innovation and the Vice Principal and Heads of Department roll out the implementation plan.

The metaphors (i.e. waterfall and boat) offered by the dyads in Cases Three and Four carry some inconsistency between the metaphors and ways in which the scaling of innovation was elaborated with the metaphors. The Case Four dyad shared that:

> MOE is like a big boat, and schools are like mini-boats that are hooked onto this big boat. The boats sail toward one common goal, which is to improve students' learning.

In the context of diffusing innovation in schools, the dyad articulated the relationship between the MOE and schools as a big boat and mini-boats, respectively, whereby "mini-boats" suggest schools' agentic roles in the diffusion process, with MOE as the "big boat" which leads and encourages them. The dyad then elaborated that most teachers and schools are "followers" who just need to "follow the direction charted by the big boat", because "they were scared that if they did not (follow), they would be scolded (by their leaders)". The further elaboration by the participants reveals that agentic learning and adaptation were not considered: schools and teachers needed to follow the MOE's directives; otherwise they would be "scolded". Similarly, the Case Three dyad shared a "waterfall" metaphor, "I see (a) school as a waterfall. Leaders are the water that flow through this eco-system and flourish teachers who are trees and flowers", suggesting a preference for a bottom-up approach. However, when elaborating the metaphor in relation to the scaling of innovation, the dyad mentioned that school Principals are to "set the pace and expectations", department heads are "empowered to implement" and "supports are provided to teachers" to adopt innovation, indicating a top-down view.

The Case One dyad regarded innovation diffusion as "a virus infection" and "evangelising", which are consistent with its bottom-up approach to scaling. The dyad shared that innovation diffusion is like a "virus infection; one person passes it to another (and) then passes it to another". To facilitate such an "infection", the dyad planned to put iPads in the staff lounge to create a physical hub to attract teachers' interactions. "Whoever is there can just pick one up and see how it can be used", and "people can talk about it among themselves". The dyad also wanted to incentivise teachers in the core group to "evangelise and reach out to other teachers".

In summary, for Case One, the metaphor (virus infection) and the diffusion approach were relatively consistent and represented a bottom-up approach for innovation diffusion. Case Two's diffusion approach and metaphor (bicycle) were also

relatively consistent but represented a top-down approach. Cases Three (waterfall) and Four (big and mini-boats) show some inconsistency between their metaphors and their diffusion approaches. Both cases used top-down approaches for diffusion, but their metaphors carried some bottom-up significance.

The differences across the cases, especially the distinctive difference in the diffusion approach for Case One, might be attributable to the organisational contexts and the participants' past experiences. C1P1 from Case One had previously had 3 years of experience as an officer at the MOE, performing a role similar to the two participants in Case Four. It might be the case that his experience at MOE helped him to conceive of innovation diffusion differently, whereas the Case Four participants, having had only about 6 months' experience as officers at the MOE, were only at the starting stage of a learning journey towards different approaches for innovation diffusion. The distinction of Case One might also be due to the school context. Compared to their counterparts in primary schools, teachers at secondary schools teach fewer subjects and are more specialised in the subject areas they teach. Hence, teachers at secondary schools may require more autonomy in inventing new pedagogies, which leads to a different innovation and diffusion culture in secondary schools.

This study requires a focus on how school leaders rationalise their diffusion approaches. Hence, how Cases Three and Four dyads justified the connections between their diffusion approaches and their conceptions of diffusion (e.g. metaphors) is presented in the next section. To help readers better appreciate the constraints and perceptions that school leaders have, the data is supplemented by the rationalisations shared by the dyads from Cases One and Two.

10.3.3   Rationalisation

The thematic analysis of the data revealed that the dyads made use of four repertoires to justify their approaches: perceived external constraints, perceived internal constraints, perceived capacity to manage top-down implementation and a static view on innovation diffusion.

10.3.3.1   Perceived External Constraints

The pressure to demonstrate the scaling outcome to the MOE and other schools was a key external constraint that the dyads perceived. Although the dyads knew that they needed to convince their own teachers to adopt the innovation, they felt a pressure to deliver outcomes quickly (e.g. high adoption rate) and did not have time to persuade teachers' voluntary adoption. For example, the Case Three dyad justified that they were under pressure to show quick or prompt diffusion results to MOE and other schools; "We are known among schools for our (innovation). MOE and other schools are looking at what we are doing. We need to quickly show results". When

the Case Four dyad was facilitated by the author to compare between evangelising and scaling of innovations, the dyad shared that, when evangelising, "I try to share my testimonials with people and try to convince them". But "evangelising is difficult. You need to spend a lot of time to work on people". However, when scaling innovations "in schools, time is a luxury".

10.3.3.2   Perceived Internal Constraints

School leaders used three perceived internal constraints, especially with regard to teachers' attitudes and perceptions, to justify their scaling approaches. First, the notion that teachers are time-constrained suggests that adopting an innovation means performing an "additional task" (e.g. adapting and using the innovation in their classroom) that demands their limited time. For example, when comparing between innovation diffusion and a "virus infection", the Case Three dyad mentioned that in a virus infection, "the infection is beyond your control". But, in innovation diffusion, "if you choose to adopt, you will have to put in a lot of effort (i.e., time) to implement it in your classroom". However, "teachers' workloads are full", and they "do not have time". Hence, "if we do not mandate, they will never adopt it".

The second constraint is related to how school leaders perceive teachers' attitudes towards innovation. The Case One dyad shared that people who are resistant to adopt innovations are those who "just stay in their comfort zones, just do things that they are sure (of)", and are "very narrow-minded". "They sit on the fence" or are "lazy to do it (adopting the innovation)". Therefore, "if I force you (the teachers) to use (the innovation) and if I give you enough support, and if you use it, you will have a good experience (in generating a positive outcome from the innovation), (and) likely you will continue to use it". In summary, the dyad believed that teachers may not choose to adopt the innovation if it were not compulsory but would find it beneficial if they used it; therefore mandating was useful.

The third constraint is regarding the perception of the innovation. The Case Three dyad compared innovation diffusion to "spreading rumours" and mentioned "in spreading of rumours, people have that curiosity, which needs to be addressed (satisfied)". "We are able to create the curiosity if the innovation is novel. As (our innovation) has been in this school for some time, there is no longer novelty". Therefore, the dyad chose to mandate teachers to adopt, as the innovation was perceived not to be novel.

10.3.3.3   Perceived Capacity to Manage Top-Down Implementation

The dyads were confident of their capacities to manage top-down implementation. The data suggests that the dyads gained confidence from three sources: teachers' trust in school leaders, teachers' obligations (as employees) and teachers' passion for students' learning.

For example, the Case Three dyad shared that "our teachers trust our school leaders. They are very *guai* (Singapore Colloquial Chinese, meaning 'they are very obedient about school leaders' decisions')". When comparing innovation diffusion to "persuading smokers to quit smoking", the Case Four dyad stated that to "quit smoking is a choice by people, but teachers have no choice. It is their job". The Case Three dyad also highlighted that "if teachers see the big picture that (the innovation) is preparing students for higher standards (of learning), then they will follow and try their best to make (the innovation) work".

10.3.3.4   A Static View on Innovation Diffusion

The data also revealed that the dyads might be holding a static view of innovation diffusion, in particular for each innovation's benefit. For example, the Case Three dyad shared that when teachers were mandated to adopt an innovation:

> … at least when they use the innovation in their classroom, their students can still benefit from the innovation being used. It is better than not using the innovation at all.

This sharing implies the view that an innovation has a stable effect on learning, just like how medicine has a predictable effect in treating patients with different health backgrounds. The view does not recognise the role of teachers in recontextualising an innovation for different classroom needs. Literature suggests that when teachers are under forced compliance, they are less likely to reinvent, even when support is provided by the management (Biott, 1992). Without teachers' agentive learning and adapting innovation for different classroom contexts, pedagogical innovations are not likely to be effective for learning or sustainably adopted by teachers.

10.3.4   Speculations

The four cases are characterised based on each dyad's scaling approach and alignment with the dyad's conceptual metaphor of innovation diffusion, as summarised in Table 10.3.

The data collected in this study did not directly capture the dyads' justification of the alignment or misalignment. To overcome this limitation, contextual factors are taken into consideration as far as possible to make speculations on the dyads' selection of scaling approaches and alignments with their conceptual metaphors.

Two speculations are made based on the interpretation of the similarities and differences of the contexts across the four cases. The first speculation seeks to understand why Cases One and Two have more alignment than Cases Three and Four. The second speculation is about why Cases Two to Four adopted top-down implementation approaches, whereas Case One adopted a bottom-up diffusion approach.

Table 10.3 Dyads' diffusion approaches and alignment with their conceptual metaphors

		Alignment with conceptual metaphor	
		Less	More
Scaling approaches	Top-down	*Case Three: Waterfalls* (Head of ICT and Assistant Head)	*Case Two: Bicycle* (Vice Principal and Head of Science)
		Case Four: Big and mini-boats (Ed-Tech Officers)	
	Bottom-up	–	*Case One: Virus infection* (Principal and ICT Mentor)

10.3.4.1 Speculation on Alignment

It is noted that the cases that have more alignment between scaling approaches and conceptual metaphors involved senior leaders (i.e. Principal in Case One and Vice Principal in Case Two) as the participants. The cases that have less alignment involved middle-level leaders (i.e. Head/Assistant Head of Department in Case Three and Ed-Tech Officers in Case Four).

It is possible to speculate that the case differences may be attributable to two factors. The first factor is the alignment between the participants' everyday professional roles and their roles in diffusing innovation. For example, Principals and Vice Principals (as in Cases One and Two) operate at the overall school level when performing their everyday professional roles. There is high alignment between their embodied experience (in performing their professional role) and the role they play in innovation diffusion, which is also at the overall school level. For Heads of Departments and MOE officers (as in Cases Three and Four), there was low alignment between the participants' embodied everyday experience (which is at department and individual levels) and the role they play in diffusing innovation (which is at school level or across schools). When a dyad has everyday experiences at the departmental level and is tasked to scale up an innovation at the school level, there is a gap between the dyads' embodied experiences and the task to perform. This gap might lead to the misalignment between the dyad's scaling approach (e.g. performing tasks at the school level) and the conceptual metaphor (e.g. experience at the department level).

The second speculation is that teachers expect high consistency from senior leaders like school Principals and Vice Principals. As senior leaders, Principals and Vice Principals need to show consistency in their thinking (which is revealed in their conceptual metaphors) and their actions in diffusing innovations. Leaders who say one thing but act in another way could be perceived by teachers as inconsistent, and thus their leadership is less respected. Additionally, the culture in East Asia suggests that middle managers respect hierarchical seniority and cultural norms (Hofstede, 2007; Tamney, 1996). Hence, Department Heads and MOE officers may simply accept the scaling approaches endorsed by senior leaders (such as school Principals) or be influenced by existing practices in their schools or MOE departments. As such, acceptance may not be subject to critical reasoning and examination, and misalignments could arise between what middle managers accept (from senior leaders

or school norms) and what they embody in everyday experience (at departmental levels).

If this speculation is reasonable, it is crucial to intentionally help middle managers gain embodied experiences at the school level and facilitate them to critically reconcile their experiences at individual, departmental and school levels. Such experiences and reflections may help develop alignment between their conceptual understanding (e.g. conceptual metaphor) and their diffusion approaches.

10.3.4.2 Speculation on Adopting Bottom-Up Approaches for Diffusion

Across the cases, only the Case One dyad adopted a bottom-up approach to diffuse an innovation. It is possible to speculate that the difference across the cases may be due to a few reasons, including the training that school Principals in Singapore receive prior to their principal-ship appointment, the type of school and the school Principals' autonomy.

C1P1's bottom-up conceptualisation of innovation diffusion may arise from his training prior to his principal-ship appointment. In Singapore, before a candidate is promoted from Vice Principal to Principal, he/she needs to complete a 6-month Leadership Education Programme (LEP). The programme is designed to embody the participant with a different experience. For example, the Creative Action Project, which is part of the LEP, attaches the candidate to a real school as an officer. He/she needs to envisage the school's progress over 10–15 years and implement a project that fulfils one aspect of the vision. Because the school has its own Principal, the project requires the candidate to gain support from the Principal and staff of the attached school in order to implement his/her plan. Hence, the candidate needs to influence rather than mandate the implementation of the project. C1P1 was appointed as a Principal 6 months prior to his participation in this study. The recency effect (Murdock, 1962) from his participation in the LEP might have influenced how he conceptualised and diffused the innovation.

Other factors may have add-on effects. One possible factor is the type of school. Compared to primary schools (as in Cases Two and Three), secondary schools (as in Case One) deal with more mature students and may prioritise independence and critical thinking; therefore, they might prefer influencing students from the bottom-up, rather than mandating from the top-down. This dynamic with students may influence the school's overall culture and approach. Another possible factor is school Principals' autonomy. Compared to Vice Principals (as in Case Two), Department Heads (as in Case Three) and MOE officers (as in Case Four), school Principals (as in Case One) enjoy more autonomy in their schools in dealing with constraints, shifting priorities and setting the pace for innovation diffusion. Therefore, Principals may be at liberty to take a more autonomous approach to diffusion through bottom-up approaches.

The speculations raised above do not mean to be exhaustive. Other speculations were also explored but considered less convincing. For example, the characteristics of the innovation may also play a part. In Case Two, the "holistic assessment" inno-

vation may require school-wide adoption to yield sufficient benefit for student learning. It may partially explain why the Case Two dyad adopted a top-down diffusion approach. However, such characteristics alone could not explain the differences across the cases. For example, design pedagogy (Case Three) does not need school-wide adoption as a condition to generate sufficient learning outcomes, yet the Case Three dyad adopted a top-down diffusion approach.

10.4 Conclusion and Discussion

This study used thematic analysis to understand how school leaders diffuse innovations and how they rationalise their diffusion approaches. The findings in this study should be interpreted under the limitation of the case study methodology and the cases being selected.

The findings suggest that the participants tend to favour top-down approaches to diffuse innovations. As sustainable and scalable diffusion of innovations requires integration of both top-down and bottom-up approaches (Fullan, 2007), the findings imply the necessity to help school leaders to shift from purely top-down approaches towards an integrated approach of innovation diffusion.

To examine how to facilitate this shift, the study also explored why school leaders often take top-down approaches to scale up innovations. Besides contextual factors such as the characteristics of innovation, this study also identified conceptual metaphors and repertoires that school leaders used to justify their top-down diffusion approaches. Speculations are made to highlight some possible important factors that affected the dyads' diffusion approaches and alignment with conceptual metaphors.

To help school leaders shift from top-down approaches towards an integrated approach, it is necessary to shift school leaders' conceptual metaphors and repertories. For this purpose, the discussion focuses on two aspects. The first aspect is on the dyads' conceptual constraints, as revealed in the data. Overcoming such conceptual constraints requires intentionally designed learning interventions. In a separate paper, Huang and Kapur (2015) introduced a learning intervention and reported how the participants learned and overcame the conceptual constraints using analogical reasoning (Gentner, 2003). Furthermore, Vosniadou (1989) and Brown and Clement (1989) both suggest that analogical reasoning is a viable approach to overcome misconceptions. The second aspect deals with the perceived contextual constraints revealed in the data. It is argued in the discussion section that overcoming conceptual constraints may help the dyads alter their perceptions on contextual constraints.

10.4.1 Conceptual Constraint: A Lack of Process-Oriented Thinking

Rogers (2003) suggests that diffusion is a process in which an innovation is communicated and adopted over time among members of a social system, for example, in a school. In the diffusion process, teachers need to develop attitudes towards the innovation, acquire knowledge that is necessary to evaluate the innovation and adapt and reinvent the innovation for sustained use in their own contexts. Hence, it is unrealistic to assume that innovation does not involve the process of diffusion or to assume that, as long as the innovation is used in classrooms, students will benefit from the innovation. Teachers' agency in learning about an innovation and adapting it for their own use is particularly important for sustainability—the sustained use of the innovation to yield continued benefits (Scheirer, 2005).

The dyads' rationalisation, in particular their static view of an innovation's benefit, reveals a lack of process-oriented thinking on innovation diffusion. This view is to regard innovation diffusion as a process, and how the innovation can evolve through the diffusion process to better suit students' learning outcomes, rather than just focusing on a perceived outcome. This can serve as a learning opportunity for school leaders who tend to use top-down approaches for innovation diffusion.

When teachers are under forced compliance, they are not inclined to reinvent. Without teachers heightening their knowledge on an innovation and reinventing the innovation for their own classroom needs, the innovation is less likely to yield optimised learning outcomes for students. Without observing optimised effects on students' learning, teachers will then be less likely to use the innovation sustainably. If teachers are mandated to use the innovation continuously, their trust in school leaders and their professional identity may be undermined as well.

In the process-oriented view on innovation diffusion, teachers develop their interests on a certain innovation, learn from each other's experiences in using it, adapt and reinvent it for their own use and share their experiences with each other. This in turn shapes the interest level of non-adopters. In this process, the innovation and the context in which the innovation is diffused reciprocally change at the same time. Underpinning the process is teacher agency. When the top-down approach is used alone, it undermines teacher agency and hinders the diffusion process. When the bottom-up approach is used alone, the reciprocal change process takes a long time to lead to the desired diffusion outcome. Integrating the top-down and bottom-up approaches respects teacher agency and optimises the reciprocal change process.

Hence, developing a process-oriented view on innovation diffusion is critical for school leaders to overcome their conceptual constraints related to top-down diffusion approaches. In a separate paper, Huang (2011) further argued that, for school leaders to develop a process-oriented view on innovation diffusion, they need to learn about innovation diffusion as a complex system. Readers may refer to the paper for the argument that innovation diffusion is a complex adaptive process. Learning through programmes such as the Creative Action Project that C1P1

received may have the potential to overcome the conceptual constraints. The training could give the trainees an embodied experience to influence school or system levels over time. Such embodiment is important to help overcome conceptual constraints.

10.4.2 Perceived Contextual Constraints: Could They Be Re-rationalised?

Many repertoires identified in the study (such as teachers' lack of time) are legitimate contextual constraints that school leaders should deal with when diffusing innovations. This chapter argues that these contextual constraints can be re-rationalised or re-prioritised when school leaders decide on diffusion approaches, as did the Case One dyad.

Firstly, some contextual constraints may be attributable to perception gaps. For example, the dyads in the study might have overestimated their capacities in managing the top-down implementation of innovation. This overestimation may arise from factors distinctive to the East-Asian culture (Hofstede, 2007), such as the societal acceptance of greater power and respecting hierarchies. The emphasis on the collective good (Dimmock & Walker, 2002) and the orientation towards harmony may have also contributed to the dyads underestimating teachers' agentive learning and adaptation at the individual level (e.g. "if teachers see the big picture…, then they will follow and try their best …").

The East-Asian culture provides an indigenous context in which school leaders in Singapore diffuse innovation. In Singapore's context, the culture also influences school leaders' overestimation of success when mandating the implementation of innovations. Without undermining the importance of the indigenous context, this chapter feels that there is a need to highlight the perception gaps it induces. Reflecting on these gaps is particularly important in light of a process-oriented view on innovation diffusion, which emphasises teachers' agency and adaptation in innovation diffusion.

Secondly, there may be a need to examine the goal of diffusion in the larger context of student learning and teacher professional development. The dyads acknowledged that innovations promote students' learning (e.g. "at least when they use the innovation in their classroom, their students can still benefit from the innovation being used. It is better than not using the innovation at all"). Often, the dyads also highlighted other goals (e.g. showing quick results, "MOE and other schools are looking at what we are doing. We need to quickly show results"). These goals may not always be in line with the goal of students' learning. For example, the process-oriented view on diffusion suggests that it takes time for teachers to reinvent and to optimise the learning benefit of the innovation, but showing quick results does not permit teachers taking time to reinvent. The data in this study suggests that

the dyads put the goal of showing quick results on a higher priority than the goal of students' learning.

Hence, it is arguable that developing a process-oriented view on innovation diffusion may help school leaders re-rationalise or re-prioritise the contextual constraints they perceive and to shift from top-down approaches of diffusion to approaches that integrate top-down and bottom-up approaches.

In summary, this paper identifies metaphors and repertoires that school leaders use to elaborate and justify their top-down diffusion approaches. It builds an empirical understanding on why school leaders in Singapore often take top-down approaches to diffuse innovation. Findings suggest a need to help school leaders develop a process-oriented view on innovation diffusion. Addressing this conceptual constraint may help school leaders deal effectively with the contextual constraints they perceive. This study complements existing literature by providing empirical findings that justify the need and significance for engaging school leaders in developing process-oriented thinking for innovation diffusion.

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Jun Song Huang is a Senior Research Scientist at the Office of Education Research at the National Institute of Education, Singapore. He was formerly the Head of Education Research Administration and Communication, Office of Education Research. Prior to that, he was Research Manager of the Learning Sciences Laboratory. His research interests are in agent-based modelling (ABM), analogical reasoning, complex adaptive systems (CAS), innovation diffusion and learning complex systems.