

# Towards a Framework of Pedagogical Paradoxes: A Phenomenographic Study of Teachers Designing Learning Experiences and Environments With ICT in Singapore Classrooms

Wan Ying Tay, Boon Yen Chai, Nur Azarina Khamis, Samuel Tan, and Chew Lee Teo,  
hotaywanying@gmail.com, CHAI\_Boon\_Yen@moe.edu.sg, Nur\_Azarina\_KHAMIS@moe.gov.sg,  
Samuel\_TAN@moe.gov.sg, TEO\_Cheew\_Lee@moe.gov.sg  
Ministry of Education, Singapore

**Abstract:** This paper discusses how teachers reconcile tensions as they design learning experiences and environments with Information & Communication Technologies (ICT) in Singapore classrooms. Through applying a paradoxical lens, we describe conflicting demands and contradictory considerations that teachers face. Adopting a phenomenographical approach, we examine the narratives of 2 teacher participants documented in pre- and post- lesson conferences, classroom enactments and interviews, so as to tease out variations in the ways they experienced and mediated the paradoxical tensions. Based on the findings of these tensions, a pedagogical paradoxes framework is presented, illustrating the interplay between the different dimensions of the paradoxes. By surfacing these paradoxes, we hope to draw awareness to the challenges and reconciliation in the decision-making and rationalisation process that teachers as learning designers may experience. A heightened awareness can enable teachers to consciously negotiate the paradoxes in designing different kinds of learning experiences better tailored for their students.

## Introduction

Teachers are increasingly encouraged to leverage on the affordances of information and communication technologies (ICT) for designing learning experiences and learning environments for their students, with the aim of enhancing their learning (e.g., Beetham & Sharpe, 2013; Laurillard, 2012; Luckin, 2010).

In the case of Singapore, there are also keen efforts to encourage such practices. For example, in a programme aimed at spreading good instructional practices and supporting schools in developing and sustaining student-centric pedagogies with technology, Educational Technology Division, Ministry of Education (Singapore), partnered schools in deepening classroom learning by involving teachers from participating schools in designing learning experiences and environments. Besides participating in networked learning communities and working with teachers from other schools to develop their design, teachers also worked closely with a team of officers from ETD (ETOs) and a Research Partner (RP) from an Institute of Higher Learning (IHL). In the process, they participated in pre- and post- lesson discussions and engaged in reflection.

Review of the support process as well as analysis of transcripts of the discussions and teacher interviews suggests that in the course of designing learning experiences and learning environments for their students, teachers often came face to face with paradoxical tensions. While our 2 teacher participants might not be immediately aware of these tensions during their design, enactment and reflection process, they would, as our findings suggest, consciously or unconsciously, attempt to manage and reconcile these tensions.

Understanding what these paradoxical tensions may be and how best to reconcile and cope with them is important as they could influence classroom practice and consequently, student learning (Boling & Beatty, 2012). As Lewis (2000) aptly points out, by intentionally bringing these tensions to the fore and engaging in discussion about them, could help individuals better understand and negotiate them.

We first provide a review of the paradoxical tensions literature, discussing the nature of paradoxes as a constitutive feature. Guided by our findings, we address how a pedagogical paradoxes framework can help support teachers in reconciling these paradoxes as they approach designing learning experiences and environments for their students.

## Literature Review

### Understanding pedagogical paradoxes

In this paper, a paradoxical view is applied to help identify pedagogical paradoxes that are inherent in the learning design. It also helps us examine and describe the dynamic interrelationship between the each of the paradoxical

dimensions (Papachroni, Heracleous, & Paroutis, 2014). We focus primarily on pedagogical paradoxes which involve examining teaching and classroom practices, from the teachers' point of view.

In a framework proposed by Lewis (2000), he identifies the root causes of paradox, and how individuals react to them as they try to deal with and reconcile these paradoxes. This framework emphasises that paradoxes, while conflicting in its nature, should not be perceived as opposing, polarised elements; rather, they are "contradictory, yet interrelated" (p. 3). Thus when confronted with paradoxical tensions, individuals need not make a clear and distinct choice between two poles of the paradox (Eisenhardt, 2000; Westenholz, 1993). By viewing paradoxes as dynamically interrelated or even complementary elements, enables us to examine how teachers would try to reconcile or cope with them.

While paradoxes have mostly been described and discussed in organizational management literature, they have been deliberated upon by educators and scholars, one of them being Dewey (cited in Prawat, 1999). Dewey referred to them as epistemological duality (rather than paradox). He observed that there could be more than one duality, and that each duality may be nested upon another. In other words, it is not unusual to find that a teacher may have to approach various paradoxes all at once. Furthermore, we are also very much informed by literature exploring dilemmas and challenges that teachers face (e.g., Ball, 1993; Luehmann, 2008). Thus, above or beneath each single paradoxical dimension, we may find concentric circles or layers of other dimensions. Paradoxical perspective has also been adopted to examine instructional practices (e.g., Tay & Ng, 2014; Warschauer, 2007).

The central thesis of this paper is that, in teaching, the nature of paradoxes in classroom practice is often not made explicit and a teacher may or may not be aware of them, even as they make decisions based on these paradoxes. By surfacing these paradoxical tensions, it helps to bring greater awareness the challenges and considerations that a learning designer may encounter. The greater awareness enable teachers to consciously think through and mediate these tensions in deciding on the kind of learning interactions and learning activities or tasks that are appropriate for the learning experience. This might enable the teacher better negotiate the challenges and decisions in evolving different kinds of learning experiences better suited to the needs of the students.

Guided by our review of the literature, we focused on two main research aims: (1) to describe the different ways in which teachers experience and perceive tensions as they approach learning design; (2) to describe the different ways in which they attempt to reconcile these tensions.

## **Adopting a phenomenographic approach**

So as to describe the variations in the ways teachers experience and perceive tensions as they approach learning design and the ways in which they attempt to cope with and reconcile these tensions, we adopted phenomenographic approach as the guiding methodology for our study.

Phenomenography is the study of the different ways in which people experience, conceptualise and understand a phenomenon (Marton & Booth, 1997, Marton, 1981). It aims to draw a relation between the subject and the phenomenon. Notably, in a phenomenographic study, the investigation is not directed at a phenomenon as such, but at the variation in the ways individuals conceptualise, experience and comprehend the phenomenon. For the purpose of our study, which is to describe and examine the variation in which teacher participants experience paradoxical tensions while designing and enacting learning experiences and environments for their students, phenomenography serves well as a guiding methodology. It had allowed us to tease out the variations as teachers reflect into their teaching-learning experiences, diagnose the tensions they experienced in their learning design process.

Our study was conducted over a span of a year. During the year, teachers planned, designed and implemented their lesson design, with the support from the ETD officers (ETOs) and a research partner (RP) from an IHL. The data collected in this study include pre- and post- lesson conferences between teachers, ETOs and RP, lesson observations captured on video and audio recordings as well as semi-structured interviews conducted with the teachers. These interviews, which were about an hour long each, were conducted at the end of the study. Based on the preliminary findings from the pre- and post- lesson conferences and lesson observations, we mapped out the paradoxical tensions that emerged from the analysis of the data sets. During the interviews, we also requested for our two teachers to map out how they felt the lesson design was intended, i.e., whether they felt that it was tending towards (1) meeting long-term objectives, such as developing 21<sup>st</sup> century competencies, subject-based literacy and inquiry skills in their students, or short-term objectives, such as delivery of the curriculum and preparing their students for assessment; (2) engaging students in personal sense-making activities or collaborative, collective sense-making activities; (3) guiding/facilitating students in their learning (teacher control), or giving students the agency/autonomy in their learning; (4) having flexibility in the lesson design, or following as close as possible to what was being designed (stability).

We digitally recorded and transcribed verbatim the interviews with the teachers. Interview questions were designed in a semi-structured fashion, and the key questions aimed at teasing out their experiences of the tensions that emerged from implementing their lessons. These key questions included: What were the insights/problems you and your students experience when implementing the lessons? Do you think that the way that the lessons had been designed have made any difference to how your students learn? What were the challenges you faced when incorporating ICT into your lesson and how did you overcome them? In keeping with the phenomenographic methodology, analysis of the various data sets was done through constant comparison and iteration, which was carried out until no additional tensions were surfaced. This analytical procedure was conducted by each of the five co-authors of this paper and the analysis was cross-checked against one another.

## Description of the participants

Our participants were 2 Geography teachers from a secondary school in Singapore. They participated in this study as the schools in which they are teaching at were involved in the ETD programme (as mentioned in the introduction section). Teacher 1 is a very experienced Senior Teacher and has been teaching Geography for 26 years. As a senior teacher, she participated in the programme as she felt the need to constantly learn so that she could develop her fellow younger colleagues to the next level. While she has not been using ICT pervasively in her lessons, she is very open in learning new things and is adequately proficient in IT. Teacher 2 is also another very experienced Geography teacher, having taught for more than 15 years. She is the school's Head of Department (HoD) for ICT. She saw the benefits of having ICT-enhanced lessons for both teachers and students.

## Description of the lessons

The 2 teachers (Teacher 1 and Teacher 2) were involved in teaching the same topic on stratovolcanos in their respective classes. The pre-lesson conferences involved ETOs and RP sharing a lesson that leveraged ICT to facilitate students' learning about the characteristics of stratovolcano through GI approach that was designed and enacted in other secondary schools. Much focus was on how the design allowed students spaces for investigation, data gathering and the teaching - student interaction that facilitated the exploring of students ideas to further the inquiry-based learning. Both teacher 1 and teacher 2 raised questions and considerations about meeting the requirement of the curriculum, while at the same time, providing more flexibility in the lesson design and allowing more student agency and autonomy in monitoring and assessing their own learning. Finally, the teachers evolved a lesson experience that was ready to be enacted in their respective classrooms.

Teacher 1 was getting students to learn about the characteristics of stratovolcanoes of evidence-based inference through the process of geographical inquiry. The lesson required students to look through learning resources consisting of video recordings of various volcanoes as well as authentic data made available through the online application, ArcGIS. Students would then make sense of the data gathered which included the locality, shape, height, gradient as well as eruption video clips of the various volcanoes identified as learning resources and synthesised the data to arrive at a consolidated understanding of the characters that define a stratovolcano. The lesson was also planned as a group learning endeavour with each group of students working in two teams - one team would work on seeking and finding information such as gradient and shape, while the other looked at video online and identified information such as eruption patterns and locality. The whole learning experience was planned as a lesson of a single one-hour duration. However, in the actual enactment, the lesson took longer than planned and spanned a total of two hours (over two one-hour sessions). Teacher 1 shared that the lesson took longer than planned as there were initial unfamiliarity among students on how to work with the tools that were available to identify and extract useful information. The main challenge that the teacher faced was that of guiding her students to look at the correct set of data and focusing on what was relevant to the pre-planned learning outcomes rather than exploring other learning opportunities that emerged.

Teacher 2, a colleague in the same team, who was present during the design and enactment of Teacher 1's lesson, saw the value of the learning approach that the team was attempting. However, she felt too that it was too time-consuming and she also noticed there were also too many perspectives being explored. She then made the decision to refine the process by getting the same student to do both parts of data gathering and instead of working on a spread of data over 6-8 volcanoes, each student only looked at 2 -3 specific volcanoes. These volcanoes were commonly selected and allocated by the teacher. Teacher 2 then took the students through a structured inquiry with her playing a more central role in modelling and guiding students on how to analysis, understand and interpret the data. She guided students on thinking through what the patterns observed meant and how it linked to the concepts and big ideas. This, she opined, allowed her to shorten the learning process and freed up time for her to teach students the epistemic skills associated with the correct way of expressing their ideas and understanding in geographical language.

## Findings and discussion

This section reports findings from the analysis of pre- and post- lesson discussion amongst teachers, ETOs and RP, as well as interview transcripts and observations of classroom enactment of the lesson experiences. The findings reveal dimensions of paradoxical tensions that were present as teachers approached their design of learning experiences and learning environments for their students. The findings also suggest the various ways in which teachers could negotiate and mediate the tensions, taking into consideration their competencies, orientation and personal experiences.

### Dimensions of tensions experienced by teachers when designing learning experiences and environments with ICT

Based on the analysis of the pre- and post- lesson conferences and lesson enactment, we propose a pedagogical paradoxes framework. The illustration of the pedagogical dimensions is shown in Figure 1 and the description of each of the dimensions is given below.

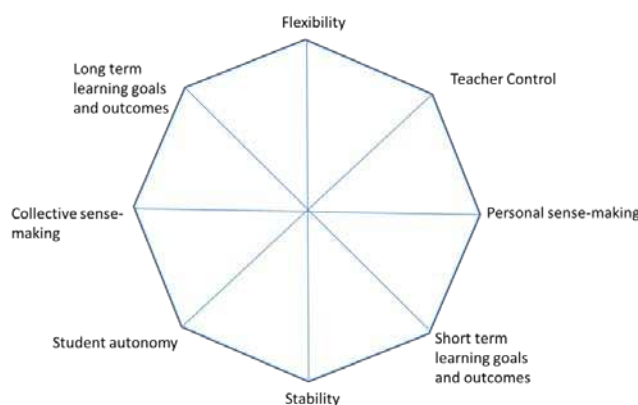


Figure 1. Illustration of the pedagogical paradoxes framework.

#### Collective sense-making and personal sense-making

This illustrates the teacher's decision in the nature of learning pedagogies to be adopted in a lesson. At one end of the spectrum is the view and design that the process of learning being very much a personal experience, with the individual taking the primary responsibility and making sense of information and knowledge that are generated. i.e., the learning activity is primarily designed as individual activity which involves cognitive learning processes. This dimension aligns well with existing literature, particularly those that explores the nature of learning in classrooms (e.g., Cook, Smagorinsky, Fry, Konopak, & Moore, 2002).

At the other end, learning is seen as a collective responsibility in a lesson, with teachers and students as a learning community taking collective responsibility in advancing the common understanding by working together to make sense of information and knowledge that are generated during the learning interactions. i.e., the learning activity is primarily designed as collaborative activity which involves socio-constructive learning processes.

#### Teacher control and student agency

This shows the thinking of whether the learning experience is one where the teacher takes centre stage, designing the learning experience to what the teacher is most comfortable with, being the authority and source of information, designing learning tasks/activities as one where teachers need to "teach" so that students "learn", having to make deliberate effort to articulate specific information and knowledge to students to ensure their learning. Students come ready to be instructed.

At the other end is the thinking of letting students profile and ideas lead the learning. Designing the learning experience to leverage on students ability, interest and skills with teacher playing the role of learning orchestrator and facilitator stimulating inquiry, supporting sense-making and scaffolding inductive and deductive learning. Teachers and students are partners in learning. Teachers act as the drivers of the scenario and lead the collective learning activities. The tensions that were surfaced at this dimension align with existing literature, particularly those that investigate how teachers balance teacher control and student autonomy (e.g., Drexler, 2010).

### Stability (fixed) and flexibility (adaptive)

On one end of the spectrum is stability. This involves designing learning experiences or environments that include a series of learning tasks and activities that are conducted in a more sequential manner with the content and interactions happening according to prescribed/planned steps. The learning tasks/activities lead to specific pre-planned learning outcomes.

On the other end of the spectrum is flexibility. This involves designing learning experiences or environments where teacher-student, student-student and student-content interactions lead the direction of learning. Teachers (and students to a lesser extent) have the possibility to change the learning scenario, activities and content on the fly as the sense-making process takes place in order to optimise the learning (opportunities) that takes place and maximise the achieved learning outcome.

### Short-term learning goals/outcomes and long-term learning goals/outcomes

For short-term learning goals, learning is about covering curriculum. Often, it would involve solving well defined problem, meeting fixed outcome and representation, focusing on factual knowledge and information transmission, and on practicing of or training up a certain skill.

For long-term learning goals, learning is to develop cognitive and meta-cognitive (and/or affective) competencies. Thus, this may involve designing activities which may engage students in solving authentic tasks/ill-structured problem, learning tasks that have multiple outcomes and representations, contextualised authentic application and/or extension of learning. Thus, it focuses on conceptual learning & process skills.

### Mapping of the paradoxes

During the interviews with the 2 teachers, they were asked to map the paradoxical tensions they felt best describe their lessons. Teacher 1's mapping of the pedagogical paradoxes of her lesson enactment is illustrated in Figure 2.

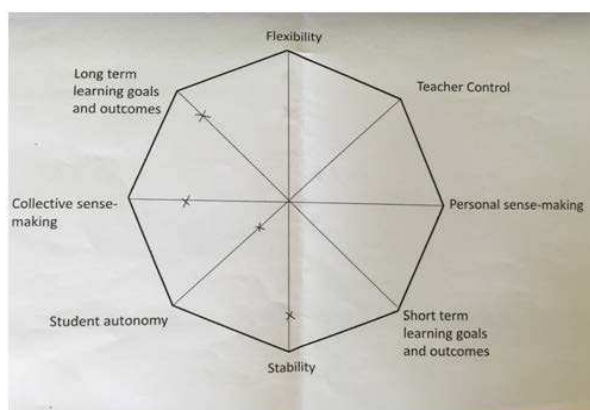


Figure 2. Teacher 1's mapping of pedagogical paradoxes of her lesson.

As could be observed from the mapping in Figure 2, Teacher 1's conception and the ways in which she negotiated the pedagogical paradoxes differed significantly in her two lesson enactments. In the interview, Teacher 1 shared that she felt quite "useless" during the first lesson as she was not doing her job as a teacher but merely facilitating the activities. Though learning was done through group discussions, Teacher 1 felt learning were still very much a personal enterprise as students learnt more through personal sense-making. She also felt the demands of having to constantly adapt to the learning that emerged in different groups of students. The demands, she felt, required a teacher to have a very strong and deep content and pedagogical knowledge.

For Teacher 2, as could be observed from her mapping of the pedagogical paradoxes in Figure 3 below, that she felt she had to negotiate in her lesson, she experienced and negotiated pedagogical paradoxes differently from Teacher 1. In explaining the thinking behind the design and enactment of her lesson, Teacher 2 observed Teacher 1's lesson that students were struggling with group work and were not able to understand how the data they gathered had to work together to help them inferred the required knowledge in relation to the big ideas. Hence, she decided to give each student fewer but more concrete examples so that each student could follow her guidance on looking at the data presented and linked these examples to the concepts they were to learn. Thus, her lesson was focused on providing a structured inquiry with her (as the teacher) explaining key concepts based on the data that was shared with the students.

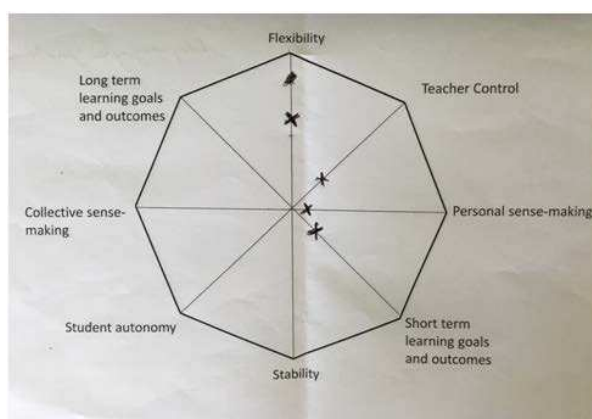


Figure 3 – Teacher 2’s mapping of pedagogical paradoxes of her lesson

Our interviews with the two teachers also suggest their encounters with the four dimensions of the pedagogical paradoxes. These are described with some of the interview excerpts in Table 1:

Table 1: Dimensions of tensions as experienced by teachers

Extract from transcripts	Dimensions of Tension
<p>Teacher 1: “Personal sense-making. Because they’re all given the free will to think of various ways. So actually it’s more about personal sense-making.... Because the software itself is a platform but the way the lesson is conducted has to be group work. It can’t be one to one.</p> <p>Teacher 2: “So the whole structuring of the lesson needs to be carefully thought out, and it’s not like we didn’t think it out in the beginning, the idea was there...different groups come together. But in essence, there are a lot of technical issues also la, so it takes up a lot of time.”</p>	<p>Collective Sense-making and Personal Sense-making</p>
<p>Teacher 1: “... I want to know the evidence of learning from my students. Like knowledge or skill... The knowledge target and the skill target. I must be like clear. Then once I have that, I will plan my lesson based on the evidence of learning. So... erm, what do I want to look at? There are so many things, I mean... depending on the topic.”</p> <p>Teacher 2: “So we have to use this kind of learning judiciously, we can’t, much as I would like to do it in everything, design such exciting lessons all the time. I can’t because of the limited time that we need to ensure that syllabus is completed. In terms of curriculum and syllabus, you must be very clear about the learning outcome. The next thing is you must be very clear about the skills, the skills that the kids should have. So you must know the concepts and content, followed by the skills.”</p>	<p>Long Term Learning Goals and Outcomes, and Short Term Learning Goals and Outcomes</p>
<p>Teacher 1: “Students will be able to come out with the answer very directly but the thing is it depends on the example, the data that we plant in. I realised that the volcanoes for example, there is some ambiguity, because the example that we plant in is not so clear-cut (and) not so straightforward. There is this blur area.”</p>	<p>Flexibility and Stability</p>

<p>Teacher 2:  “...it took on its own life when you give kids a voice in expressing what they have discovered, through their own exploration of the various volcanoes they around the world.”</p>	
<p>Teacher 1:  “... I feel that my role is just helping them to start the computer and giving them the instructions and after that they are on their own. But later on, following that, the data is so called collected, then the role of the teacher comes in. It requires a different set of questioning technique to actually make them see the patterns and to be able to make connections.”</p> <p>Teacher 2:  “...it’s more the strategic questioning and the skill of the teacher to question the child in such a way that it guides the child’s thinking and illicit out...but I feel that if a teacher isn’t that experienced and that strong in the content, she might not know the techniques of strategic questioning, so it’s very critical.”</p>	<p>Teacher control and Student agency</p>

As could be concluded from the findings above, teachers may come encounter paradoxical tensions when designing learning experiences and environments for their students. Their conceptions of the tensions varied depending on their years of teaching experience, position in the school and the ways in which they perceived the roles that teachers and students play.

## Conclusions and implications

Through illuminating and bringing to forth the different dimensions of pedagogical paradoxes of learning design, our study seeks to highlight the interplay of the challenges and considerations that teachers are confronted with. The pedagogical paradoxes framework that we present serves as an initial concept of the paradoxical tensions. It does not claim to be exhaustive and we note that there may be subsequent finer layers or concentric circles above or below these dimensions. Further study of other paradoxes or other dimensions of paradoxes could provide deeper depth to our understanding of the tensions and decision pivot that teachers as learning designers may go through. It is hoped that by surfacing these paradoxes, it brings greater awareness of the various conflicting demands and contradictory tensions that teachers may experience. Accordingly, having such an understanding of the tensions could also help in developing professional development programmes or support for both pre- and in-service teachers. For instance, it could serve as a focal point for discussion on key decisions to be taken in designing a learning experience.

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## **Acknowledgments**

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