

Developmental Trajectory Patterns of Chinese Teachers Employing New Teaching Strategies with Thinking Tools

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The purpose of this study is to examine the patterns of developmental trajectory of Chinese teachers when they introduced a new teaching strategy by using Thinking Tools. The authors selected eight primary school teachers who used TT strategy to reform traditional teaching methods in China. Trajectory Equifinality Modeling (TEM) was used to analyze the data. The authors found that there are three patterns of developmental trajectories among teachers. These patterns were developing thinking skills by supporting the students to judge and choose TT freely (Pattern 1), developing thinking skills related to daily life without judging and choosing TT freely (Pattern 2), and using TT to acquire knowledge efficiently (Pattern 3). This study explored whether (1) professional dialogue deepens the reflection of teachers, (2) social directions were different among the cities, and (3) changing of beliefs motivated teachers' inquiry on how to use TT to improve the higher-order thinking skills of students.

Keywords: Chinese Primary Education, Developmental Trajectory, Higher order thinking skills, Thinking Tools, Trajectory Equifinality Modeling

Introduction

With the development of globalization, educators in many countries highly appreciate developing students' higher-order thinking skills to contribute to the 21st century society. Higher-order thinking skills, such as analyzing, evaluating and creating, are thinking skills that differed from remembering, understanding or applying knowledge (Bloom, 1956; Anderson & Krathwohl, 2001). Therefore, teachers need to learn new strategies to improve students' thinking skills.

To nurture higher quality talents, methods to nurture students' thinking skills in primary school became a new topic in China. Some teachers in Japan have introduced thinking tools (TT) in learning activities to promote higher-order thinking skills. Accordingly, TT strategy was introduced to China in 2012 (Li, 2016). However, Chinese teachers encountered difficulties because this strategy was quite new to Chinese teachers. Understanding the process of how Chinese teachers incorporate TT in their teaching became important. To date, little research has explored the developmental trajectory of how teachers guided students thinking after introducing TT into classrooms. This research provides new knowledge on how to design the learning environment which supports teacher who introduce TT in their classes.

Teaching Reform Using TT Strategy in China

Teaching Strategy for Using Thinking Tools in Japan

With the goal of teaching higher-order thinking skills in elementary education, a teaching strategy using TT was examined in Japan. TT is equivalent to graphic organizers, which focus on developing specific thinking skills. Some

researchers insisted that some thinking skills, such as comparison, and multi-sided analysis, are types of generic skills found in all subjects (Taizan, Kojima & Kurokami, 2014). They analyzed the content of the Japan Academic Standards of Elementary Education and common skills across the subjects. To nurture common thinking skills across subjects, TT strategy were developed. These strategies were a combination of generic thinking skills and specific TT. For example, teachers matched Venn diagram with comparison, and Fishbone diagram with multi-sided analysis (Figure 1).

Through a follow-up survey in an experimental school, TT strategy made students' thinking visual and direct students to think about how to develop thought promoted students' higher-order thinking skills (Kurokami, Kojima & Taizan, 2012; Kansai University Elementary School, 2015). Consequently, TT strategy has spread to many elementary schools in Japan. While there were many successful cases, Kitamura (2013) pointed out that teachers had difficulty focusing on students' thinking when using TT.

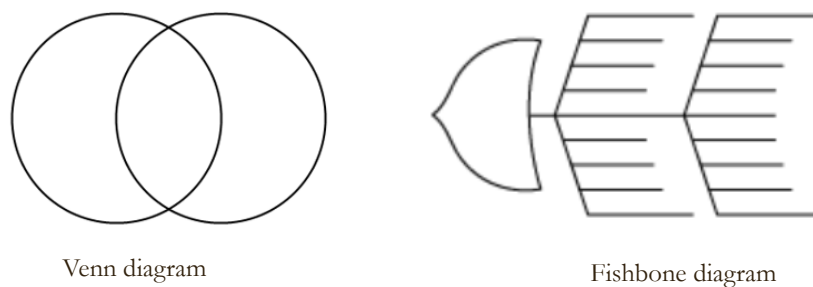


Figure 1. Venn diagram and Fishbone diagram

Introduction of TT Strategy in China

To improve and promote the quality of education, China's government created "China's Middle and Long Education Innovation and Development Plan from 2010 to 2020" (Ministry of Education of China, 2010). In this policy, one of the goals was to promote students' thinking skills beginning in elementary education. In 2016, China's government highlighted the importance of logical thinking and critical thinking in elementary education (Ministry of Education of China, 2016).

However, Chinese teachers encountered difficulties because they lacked the teaching strategies for improving students' thinking skills (Gegen, 2014). To achieve the policy of promoting thinking skills, a China-Japan collaborative research program was launched to introduce TT strategy to Chinese teachers in 2012. Chinese teachers in experimental primary schools and middle schools participated in the program in the cities of Guangzhou and Foshan in Guangdong Province, China (Li, 2016). Research groups in these experimental schools were formed to incorporate TT strategy into their lessons, and explore how to use TT (Li, 2016). The teachers tried to apply TT strategy in different subjects. Japanese expert teacher and researchers conducted workshops from 2012 to 2016 to help Chinese teachers understand using TT strategy in their classrooms. Chinese researchers also set up teacher trainings and supported teachers.

Teachers needed to gain insight into how to teach thinking skills to improve the quality of classes by themselves. Kishi (2017) discovered that Chinese teachers obtained six new viewpoints through analysis of workshop conducted by the Japanese researchers. These viewpoints are (1) designing the environment to deepen students' thinking, (2) paying attention to the relationship between teacher and students, (3) guiding students to think positively, (4) respecting students' personality, (5) having clear teaching goals, and (6) setting the topic (Kishi, 2017). Two consciousness surveys for teachers were conducted to identify how Chinese teachers used TT. These two surveys pointed out that some Chinese teachers tended to employ TT strategy in which students can remember knowledge efficiently while other teachers employed the TT strategy to make students think deeply (Miyake, Kishi, Kubota & Li, 2016, 2017). It is important to identify why only some Chinese teachers focused on students' thinking but others did not. According to Kishi, Kubota and Ito (2012), some teachers adopted a new practice without understanding basic concepts of the innovation. Therefore, Chinese teachers might encounter some difficulties when they used TT strategy in China.

Problem Statement

The studies discovered that some Chinese teachers could use TT to focus on students' thinking but did not show how teachers used TT strategy to focus on students' thinking. This called for clarifying the developing trajectory of how the Chinese teachers who could use TT focusing on students' thinking skills changed.

Development of Teachers' Trajectories

Factors that Influenced Developing Trajectory in Teachers

Developmental trajectory is influenced by the reflection and beliefs of teachers, and the social context. Firstly, teachers learned from experience through reflection. Reflection helps teacher look back on their teaching behaviors, notice problems, and create and choose alternative options to improve lessons (Schon,1983; Shulman and Shulman, 2004; Korthagen & Vasalos, 2005; Sato, Akita, Shimizu, kotama & Kitamura, 2016). Therefore, teachers' reflections were crucial to using new strategies better.

Furthermore, teachers' development was strongly influenced by their values and beliefs. Zhao and Frank (2003) identified that "teaching innovation was less likely to be adopted if it deviated too greatly from the exiting values, belief, and practice of the teacher". However, the belief of teachers was not easy to change because it was rooted in the life teachers lived and their long-term teaching experience.

In addition, developmental trajectory of teachers was also influenced by the social context of teachers involved when teachers tried to introduce teaching innovations into their classes. Shulman and Shulman (2004) indicated that teachers learned and developed "within a broader context of community, institution, polity, and circumstance". Lesson Study and professional dialogue were effective for teachers' growth in the community (Akita, 2008; Kihara, Terashima & Shimada, 2016). Lesson study benefits by helping teachers to reflect and noticed more problems than in person (Akita, 2008). Professional dialogue had great merit in making teachers understand deeply through the discussion with experts. These studies call for depicting the developmental trajectory of teachers within broader social context.

Through the analysis of the literature about the factors that influenced teachers' developmental trajectory, what factors caused teachers to change were clear. However, few case studies exist that examine how teachers changed when they used TT to nurture students' thinking skills, in China.

Patterns of Developing Trajectory

Developmental trajectory is a changing process in the long term when teachers attempted to use new strategies in their classes. For example, teachers might change as follows: used new strategy in the practice, recognized the outcome of teaching, then changed their beliefs (Guskey, 1985). Clarke and Hollingsworth (2002) indicated that teachers did not change in the same way, but with some patterns based on their choice making. Teachers' choice making formed their patterns when teachers had similar experiences since their choices were promoted or inhibited by social factors. (Marsico and Valsiner, 2018).

In the practice of using TT to nurture teacher-thinking skills in China, the teachers introducing this new strategy was easily influenced by the social context in China. The decisions teachers made may different since teachers used TT based on the unique, and complex situations and was based on practices that they never utilized in the past. To date, little research has explored the patterns of developmental trajectories of how teachers guided students' thinking after introducing TT into classrooms. In response to calls for research on the developmental trajectory of teachers, that depict teachers' patterns of developmental trajectories related to social context when they use new teaching strategies is essential, the authors examined the trajectory of teachers in China.

Research Objective

Based on the above, the specific research questions driving this study are:

- 1) Were there any patterns of developmental trajectories when Chinese teachers used TT strategy?
- 2) What kinds of the social factors influenced the developmental trajectories of Chinese teachers and why?

This study aims to expand knowledge of the patterns of developmental trajectories and how social factors influenced teachers. Examining the influence of social factors when designing learning environments using TT can provide valuable information when TT introduced into other areas in the future.

Research Methodology

This study was based on the framework of the Trajectory Equifinality Modeling (TEM). TEM is a new qualitative methodology of Cultural Psychology and has “two central features in its analytic scheme: time and the transformation of potentialities into actualities” (Sato, Hidaka & Fukuda, 2009). The “transformation of potentialities into actualities” means people choose some options from many alternative options. The chosen options became the developmental trajectory, and the unchosen options became the potential trajectory.

Trajectory Equifinality Modeling

To explore the trajectory of multiple decision-making, some basic concepts of TEM are illustrated as follows in Figure 2. *Equifinality Point (EFP)* is a given end state that can be reached by many potential means but is not a goal point. If EFP is reached, EFP transforms to a new point to pursuit. *Polarized Equifinality Point (P-EFP)* is a potential EFP to “neutralizing implicit value system of research”. *Bifurcation Point (BFP)* is a point which has alternative options. *Obligatory Passage Point (OPP)* is a point people inevitably experience through initial condition to EFP. While teacher go through the BFP or OPP, two kinds of social power influence people’s choice of options. *Social Direction (SD)* is the power of inhibition leading to EFP. *Social Guidance (SG)* is the power of promotion to proceed to EFP (Sato et al. 2009; Sato, 2017). By clarifying the trajectory of how people reach EFP, researchers can identify what kind of social factors inhibit or promote people and how they make decisions.

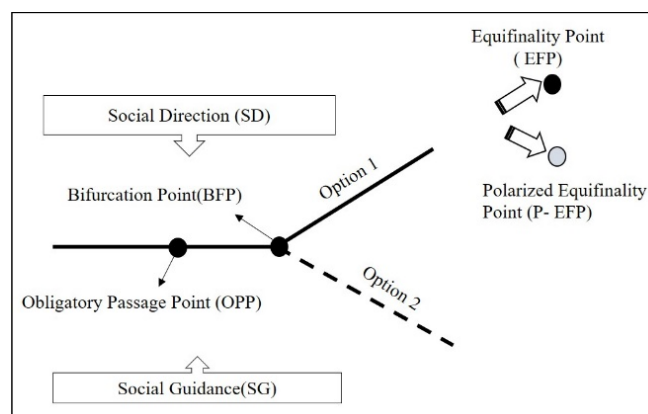


Figure 2. Concepts of TEM (Adapted from Sato, 2017; Marsico & Valsiner, 2018)

Applying Concepts of TEM in the Study

Based on research objectives, the authors utilized teachers “using thinking tools to teach lesson for higher-order thinking skills” as the *Equifinality Point*. “Using thinking tools to teach lessons for efficient knowledge acquisition” was taken as the *Polarized Equifinality Point* since it is the traditional educational goal in the Chinese society. Furthermore, the authors utilized the turning points in practicing TT strategy as *Bifurcating Point*, using the inevitably experience as the *Obligatory Passage Point*. Next, the authors examined the social power which inhibited teachers using TT for higher-order thinking skills as *Social Direction*, or social power which promoted teachers go to EFP as *Social Guidance*. The positioned in this study is shown in Table 1.

Historically Structured Inviting (HSI)

TEM chose research collaborators based on Historically Structured Inviting (HSI). HSI occurs when researchers invite collaborators who have the experience to talk about their research theme (Yasuda, Nameda, Fukuda & Sato, 2015). This study chose teachers who researchers thought could “use thinking tools to teach lesson for higher-order thinking skills” as collaborators. Furthermore, based on the 1/4/9 principle about number of collaborators, 1 or 2 person can clarify the specific process, 4 ± 1 person clarify the multiple experiences, and 9 ± 2 person clarify the

patterns of the development process (Yasuda et al., 2015).

Table 1
Concepts of TEM in this study

Concepts	Definition	Positioned in this study
Equifinality Point (EFP)	A given end state can be reached	Using TTs to teach lesson for higher order thinking skills
Polarized Equifinality Point (P-EFP)	A potential EFP	Using TTs to teach lesson for efficient knowledge acquisition
Bifurcation Point (BFP)	Bifurcating point to achieve EFP	Bifurcating points in practicing TTs to go to EFP
Obligatory Passage Point (OPP)	Inevitably experience through initial condition to EFP	Inevitably experience in practicing on using TTs to achieve EFP
Social Direction (SD)	the social power of inhibition lead to EFP	Social power inhibited teachers using TTs to achieve EFP
Social Guidance (SG)	the social power of promotion to proceed to EFP	Social power promoted teachers using TTs to achieve EFP

This study chose eight teachers to clarify the patterns of the developmental trajectories that occurred when using TT strategy because of its possibility to expand knowledge to support other Chinese teachers who use TT. These teachers were Teachers A, B, C, D, E, F, G, and H. They worked in four primary schools in Guangzhou and Foshan, Guangdong Province. Two teachers worked in one primary school. These teachers have the following features. First, the teachers have experienced TT more than two years and six months before March 2018. Second, teaching experience are from 3 years to 18 years. Third, teachers taught the four subjects of Math, Science, Chinese Literature, and English. Last but not least, they were from four primary schools in Guangzhou and Foshan in Guangdong Province. Guangzhou is the third largest city and has long history in China with most elitists families who expect their children to go to prestigious universities in the future. Foshan is the new and small city, with lower income families than in Guangzhou and a more local populace. The authors considered that the city environment may influence a teacher's usage of TT strategy because of the economical gap between a large and small city. The information of these eight teachers is given in Table 2.

Table 2
Information of Research Collaborators

Teacher	City	School	Subject	Teaching Experience	Thinking Tools' Experience
A	Foushan	NZ school	Math	9 years	3 years
B	Foushan	NZ school	Science	3 years	3 years
C	Foushan	GM school	Math	5 years	3 years
D	Foushan	GM school	Chinese Literature	5 years	3 years
E	Guangzhou	WD school	English	18 years	3 years
F	Guangzhou	WD school	Math	6 years	3 years
G	Guangzhou	BY school	English	12 years	2.5 years
H	Guangzhou	BZ school	Chinese Literature	17 years	5 years

Data Collection

To ensure that teacher remembered their experiences and to confirm which social factors influenced their usage, the researchers explained the theme of how teachers used TT strategy and explained TEM. TEM was defined in simple terms. After teachers understood and accepted the theme and TEM, researchers began interviews. To ensure that teachers were relaxed and would speak freely, the authors went to their schools and interviewed them in a secluded room without others present. Based on Trans-view interview process, the authors collected data three times (Table 3). Trans-view is an interview in which researchers confirmed the contents three times to establish agreements with researcher collaborators (Yasuda et al., 2015). Researchers drew TEM diagrams to show research collaborators when and how social factors influence teachers' behaviors. First, they asked teachers to talk about their experiences based on time if possible. The authors interviewed teachers three times and asked teachers about how they used TT strategy; what they reflected on and how they changed. The times for the first, second, and third interviews were about 60 minutes, 40 minutes, and 30 minutes, respectively.

Table 3
Information of Data Collecting

Teacher	First Time		Second Time		Third Time	
	Date	Time	Date	Time	Date	Time
A	March 30, 2017	60 minutes	July 6, 2017	45 minutes	August 5, 2017	30 minutes
B	March 30, 2017	70 minutes	August 13, 2018	55 minutes	August 15, 2018	30 minutes
C	March 30, 2017	83 minutes	July 13, 2018	40 minutes	July 16, 2018	30 minutes
D	March 30, 2017	60 minutes	August 5, 2017	47 minutes	August 10, 2017	30 minutes
E	March 29, 2017	97 minutes	July 2, 2017	45 minutes	August 5, 2017	30 minutes
F	March 29, 2017	94 minutes	July 22, 2018	40 minutes	July 23, 2018	30 minutes
G	March 29, 2017	60 minutes	June 12, 2017	40 minutes	July 6, 2018	30 minutes
H	March 29, 2017	69 minutes	August 5, 2017	40 minutes	August 10, 2017	30 minutes

Analysis procedure

To draw TEM diagrams, the authors analyzed the data using the following steps. First, the authors divided the data based on meaning, and wrote short titles for identification. The data was sorted by time, before drawing a TEM diagram that was shown to each teacher individually. Second, teachers read their TEM diagram and talked in more detail about how they used TT strategy and the social factors. Then, researchers drew TEM Diagram as in Diagram 2. Third, the authors showed the edited TEM again to teachers, and asked teachers for their opinions, before modifying it again. After finishing the personal TEM, the authors drew the comprehensive TEM diagram. The authors quoted content of the TEM in *italic* type, and cited the interview data with “”.

Results

Through TEM, the authors discovered that developmental trajectories among teachers was divided into three patterns based on the reflection contents and what options teacher chose. These three patterns of developmental trajectories among teachers were developing thinking skills by supporting students to judge and choose TT freely (Pattern 1), developing thinking skills related to daily life without judging and choosing TT freely (Pattern 2), and using TT to acquire knowledge efficiently (Pattern 3). Teachers A, B, C and D experienced Pattern 1. Teacher G experienced Pattern 2. Teachers E, F and H experienced Pattern 3.

Their interactions between social direction and social guidance influenced teachers made decisions and formed their developmental trajectories. The social direction was Traditional Teaching Way (SD1), evaluations of teachers in school (SD2), Authority of Teacher” (SD3) and Necessary Teaching Knowledge in China Academic Standards (SD4). The social guidance was lesson study (SG1), support from Chinese Researchers (SG2), Research Group in Schools (SG3) and Cooperation of Researchers, Schools and Municipal Board of Education (SG4).

Pattern 1: Developing Thinking Skills by Supporting Students Judgment and Choosing TT Freely

Pattern 1 described the trajectory where four teachers reflected on the purpose, focusing on students’ thinking, then supported students’ judgment and free choice, before reaching the goal of *using TT strategy to teach lessons for higher-order thinking skills* (EFP). These teachers were A, B, C, and D, who worked in NZ and GM schools in Foushan.

Teachers A, B, C, and D decided that “students write knowledge on TT will be OK” after they participated in the training workshops on using TT. This showed the negative effect of the Traditional Teaching Way (SD1). They reflected on *the lack of understanding about TT strategy* and *began to use it in class* (OPP1) after they did Lesson Study (SG1). Teachers from other schools, researchers, and the members of Municipal Board of Education visited lessons and discussed it in Lesson Study. In this way, they hoped to learn more about TT but chose different option to learn. Teachers A and B kept *learning in the community* because School NZ emphasized the importance of using TT strategy. Teachers C and D decided to *go to Japan to participate in international sessions* because few teachers knew about how to use TT and their principal encourage them increase their knowledge and skills in using TT in the classroom.

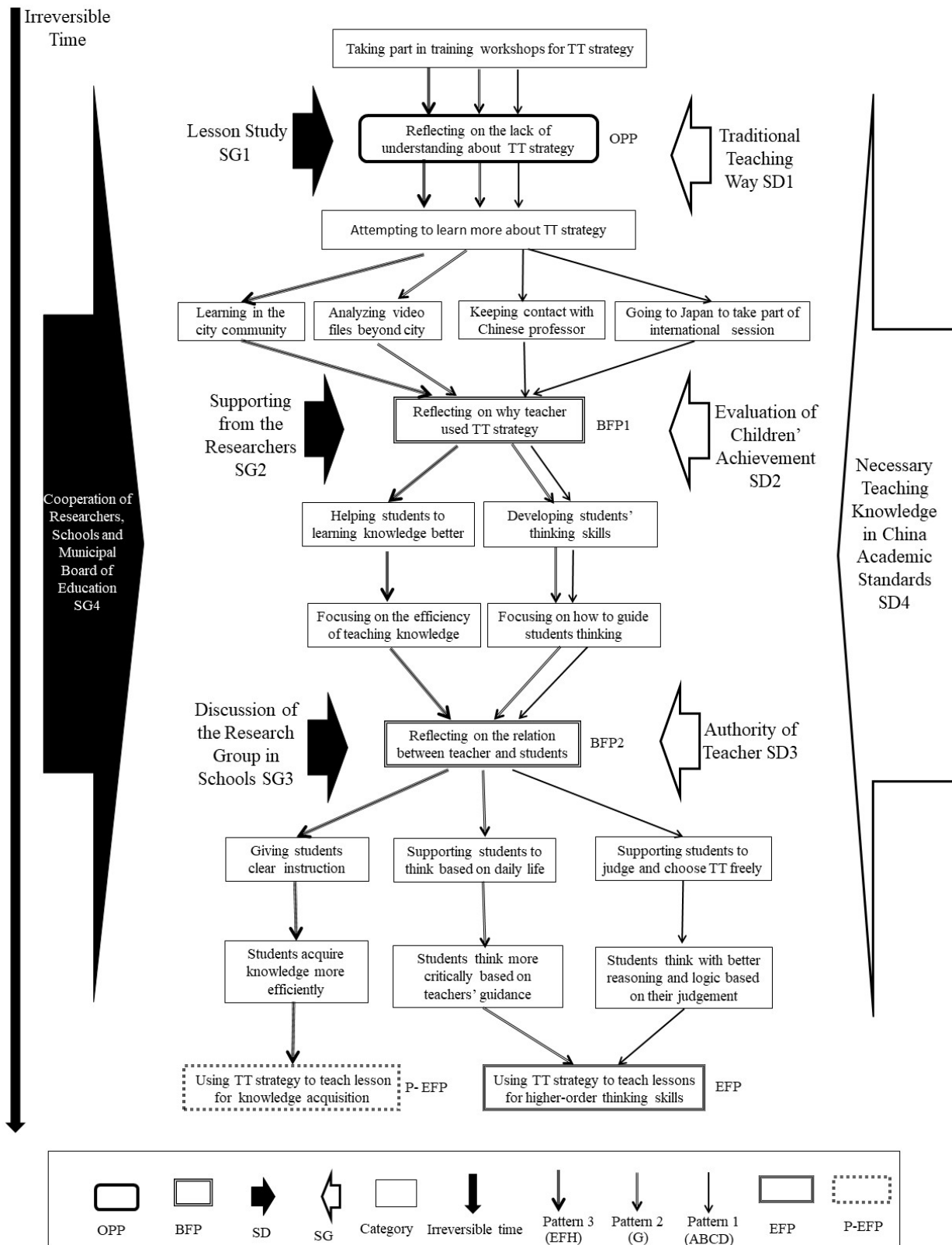


Figure 3. TEM of developmental trajectories among eight Chinese Primary Teachers

Next, Teachers A, B, C, D *reflected on the purpose of why they used TT strategy* (BFP1) and realized the importance of thinking skills. Then, they decided to *develop students' thinking skills* and *focused on how to guide students thinking*. They felt the pressure of Evaluations of Teachers in School (SD2) because of the importance of their ranking of test scores among classes every term. Owing to the Support from Chinese Researchers (SG2), particularly the solid comments from Chinese professor, Teachers A and B realized the purpose of using TT was not to teach knowledge, but to develop thinking skills of students.

Next, Teachers A, B, C and D reflected on *the relation between teacher and students* (BFP2) and noticed the need to *support student to make judgments and choose TT by themselves*. The Authority of the Teacher (SD2) inhibited them from supporting students' thinking as active thinkers. The four teachers realized that students were the subjects of using TT after the Discussion of Research Group in Schools (SG3). Therefore, they explained to students why they used TT and trained them on how to use TT. In this stage, the four teachers contemplated in depth over what thinking skills should be improved in the subject.

As a result, Teachers B and C consider improving student reasoning in Math and Science, while Teachers A and D focused on logical thinking based on evidence. Finally, these four teachers reached the EFP, using TT to teach lesson for higher-order thinking skills.

Pattern 2: Developing Thinking Related to Daily Life without Judging and Choosing TT Freely

Teacher G, who taught English in School BY in Guangzhou, experienced Pattern 2. She also reflected on *the lack of understanding about TT* (OPP1) and then began using TT in class after Lesson Study (SG1). She talked about experiencing failure after the activity of lesson study. "I could not accept why my lesson was so poor", she commented. She reflected on her problems and tried to learn about TT with a positive attitude.

To learn how to use TT, she listened the presentation of a Chinese professor and learned about what TT were (SG2). However, she still did not understand why TT should be used and how to use it in the knowledge acquisition class (SD2). Then, she discovered some video files from Chinese researcher (SG2). The video files collected video data showing an English teacher who worked in Fushan how used TT in the class. Teacher G noticed the merit of TT strategy and the importance of *developing students' think skills* (BFP1) by *analyzing this video files* time after time. Then, she began to focus on guiding students to think, expressing their thought in English by using TT. Teacher G designed a lesson using TT about overseas travel. She asked students to think by themselves and to make an overseas travel plan, before explaining their plan in English. The leaders of the School and Municipal Board of City Education praised this lesson and recommend that she participate in a teaching contest at the country level. In this teaching contest, Teacher G was reward in this teaching contest and experienced success.

Next, Teacher G *reflected on the relation between teacher and students* (BFP2) and decide to *support students thinking based on daily life*. Teacher G considered that students needed to think *more critically* in English. For example, she guided students to think about the topic of killing animals and talked about the change in students. In the beginning, students thought that animals dying had no connection with them. Through the survey activities, they realized that they ate meat of animals and their shoes were made from the skins of animals. Finally, many students gain multiple viewpoints such as they "felt sorry to animals", and "human should keep animals safe". Through this kind of activities, students were able to think about daily life from multiple-angle. At this point, Teacher G achieved the level of *"using TT strategy to teach lesson for high-order thinking skills"* (EFP)

Pattern 3: Using TT Strategy to Acquire Knowledge Efficiently

Pattern 3 described the developmental trajectory that used thinking tools to help students acquire knowledge efficiently. Teachers who experienced Pattern 3 were Teacher E and F who worked in WD school, and Teacher H who worked in BY school in Guangzhou. From TEM, the authors found the teachers reached the point of not "using TT to teach lesson for higher-order thinking skills". The goal they reached was "using TT to teach lessons for knowledge acquisition" (P-EFP). The trajectory they passed were as follows:

First, Teachers E, F and H reflected on *the lack of understanding about TT* (OPP1) after they began to use TT in class. Lesson Study (SG1) triggered them to recognize that the understanding about TT was not enough. Therefore, they continue to learn about how to use TT in the city community.

Second, Teachers E, F and H *reflected on the purpose of using TT* (BFP1) and clarified the goal of deepening the understanding of knowledge of students. For example, Teacher F noticed the danger of unclear utilization purpose in the early stage and examined how to use TT strategy after listening to the presentation of a Chinese researcher

(SG2). In relation to the social direction, the three teachers talked about not only Evaluation of Teachers in School (SD2), but also about the pressure from the parents of students and fierce competition among schools in Guangzhou. They mentioned “many parents hoped students do more knowledge practice to get high scores in entrance examinations”. Owing to the strong social direction, they had clear goal-setting and decided to help students to learn knowledge better. Then, they *focused on the efficiency of teaching knowledge*.

Third, they reflected on *the relation between teacher and students* (BFP2). With the increasing usage of TT, some students wanted to use TT by themselves. Teachers E, F and H considered that students did not need to use TT freely after the Discussion of the Research Group in Schools (SG3). For example, in Teacher E's class, students wanted to use TT in new ways. Teacher E allowed students to use TT in new ways but found it harder to control the result. Owing to the same experience, the other teachers, Teachers F and H gave students clearer instruction when they used TT. As a result, Teachers E, F and H achieved the point of “*using TT strategy to teach lesson for efficient knowledge-acquisition*” (P-EFP).

From the developmental trajectory, Teachers E, F and H, *reflecting on the purpose of using TT* (BFP1) was an important point because it clarified the goals in the teachers' thinking. They started to have clear goal-setting when using TT. However, Teachers E, F and H had goal setting but not changing of beliefs. Therefore, they did not support students' thinking but gave students clear instructions because it deviated from the teaching goal of knowledge acquisition. The teaching goal of knowledge acquisition was strongly influenced by the pressure from school competitions and parents of students. This illustrated the possibility that areas of Guangzhou may have had high social stress that inhibited teacher from using TT strategy to nurture thinking skills.

There were two social factors that influenced teachers' reflections and behaviors in all process. While the Chinese government called for nurturing thinking skills from primary schools, Necessary Teaching Knowledge in China Academic Standards (SD4) was not changed, in this educational situation in China, teachers had difficulty reforming teaching strategies. Cooperation with the Researchers, Schools and Municipal Board of Education (SG4) provided great support for teachers on how to learn and use TT strategy.

Discussion

From the developmental trajectories of three patterns above, Necessary Teaching Knowledge in China Academic Standards (SD4) and Cooperation of Researchers, Schools and Municipal Board of Education (SG4) were the social factors in the all trajectories. The Chinese government announced some policies to nurture thinking skills but the China Academic Standards was not changed. This illustrated the conflicts in the education of China. Ueno, et (2015) indicated that China did some type of reformations but knowledge-remembering are still the central teaching methods. Therefore, teaching innovation is not easy. Owing to the Cooperation of Researchers, Schools and Municipal Board of Education (SG4), the teaching innovation of using TT strategy to improve higher-order thinking skills of students could be introduced into China and support teacher inquiry with trial and error. Lesson Study (SG1) triggered all teachers to rethink deeply and *noticed the lack understanding of TT strategy*. Akita (2008) indicated that lesson study was an effective activity to promote teachers' reflection. This was consistent with the result in the early stage of using TT strategy.

However, it is not necessary that all of teachers use TT strategy to nurture higher-order thinking skills of students. In this study, the authors found that the developmental trajectories, of teachers of Pattern 1 and Pattern 2, reached EFP *using TT strategy to teach lesson for higher-order thinking skills*. However, teachers of Pattern 3 reached P-EFP *using TT strategy to teach lesson for knowledge acquisition with efficiency*.

Professional Dialogue Deepened the Reflection of Teachers

From the viewpoint of Social Guidance, the teachers of Pattern 1 (Teachers A, B, C and D) realized that the purpose of using TT strategy was improving thinking skills of students because of the solid advice of Chinese Professor. Sakamoto (2007) indicated that professional dialogue with experts was important when developing teachers' professional growth. The experts were people who had professional ability, such as professors, researchers, and facilitators.

However, Teacher G of Pattern 2, noticed the purpose of using TT strategy was developing thinking skills after viewing video materials. The case study involved a middle-school English teacher who used TT to nurture thinking skills. Teacher G analyzed video materials numerous times and found the way of using TT strategy could be to “let students think in English based on daily life”. In the developmental trajectory of Teacher G, she reflected on why she used TT strategy after she analyzed the video files supplied by the Chinese researchers. The video showed that

professional dialogue not only occurred between teacher and professional researchers, but also between teacher and video files with high quality. This differs from the opinions of Kihara et al. (2016). The authors considered that video files promoted the professional dialogue when Teacher G could not obtain solid support from her school. This indicated a new possibility to trigger teachers to reflect deeply.

Different Extent of Social Directions among the Cities

From the developmental trajectories of three patterns, the authors discovered that the usage of TT strategy were not strongly related to the schools and subject teachers taught, experience of teaching and using TT strategy. From the viewpoint of Social Direction, the authors found that social pressures among the three patterns. Teachers of Pattern 1 only felt the pressure of Evaluation of Students' Achievement (SD2) in school because they worked in the open and free environment in Foshan. However, teachers of Pattern 3 were greatly stressed from the Evaluation of Students Achievement (SD2) not only in school, but also in school competition, as well as pressure from parents in Guangzhou. This indicated the possibility that social directions were different between Foshan and Guangzhou. In conclusion, this study also shows the social pressure varied between different cities in China. This is a new finding in the studies of developmental trajectories of teachers.

An interesting development was that Teacher G of Pattern 2, who worked in Guangzhou, did not mentioned the pressure from school competition and parents of students. She reached EFP through the trajectory of analyzing the video files showing how Foshan teachers used TT strategy. This showed that the potential trajectory of teachers who worked in a city with strong social stress could understand TT better through video files in other cities.

Changing of Beliefs Motivated Teacher to use TT for Higher-order thinking skills

Korthagen and Vasalos (2005) identified the changing of belief is more difficult than the changing behaviors. In this study, while teachers reflect on why they use TT strategy (BFP1), teachers of Patterns 1 and 2 set clear teaching goal which using TT strategy to improve thinking skills of students and changed their belief through professional dialogue. Teachers of Pattern 1 changed with solid and long-term support. Teachers of Pattern 2 changed after viewing video files and experienced success. However, Teachers of Pattern 3 (Teachers F, G and H) set clear goal of why they used TT strategy but did not changed their beliefs because of the strong stress from school competitions and pressure from parents of students. The result of this study shows the changing of belief triggered teacher pursuit to use TT strategy to improve higher-order thinking skills. This finding is consistent with the opinions of Zhao and Frank (2003).

Conclusions and Future Perspective

The authors found there were three patterns of developing trajectories. These patterns were developing thinking skills by supporting student to judge and choose TT freely (Pattern 1), developing thinking skills related to daily life without judgment and choosing TT freely (Pattern 2), and Using TT to acquire knowledge efficiently (Pattern 3). This study explored (1) professional dialogue deepen the reflection of teachers, (2) social directions were different among the cities, and (3) changing of beliefs motivated teacher to inquiry how to use TT to improve the higher-order thinking skills of students.

To help Chinese teachers use TT strategy to focus on the thinking of students in the future, the authors proposed some suggestion to design learning environment as follows. Educator needed to (1) share the purpose of why to use TT strategy to teachers and the leaders of schools clearly when introducing TT strategy in the schools, (2) create environments to encourage professional dialogue to improve the changing of teachers' belief, such international communication, the solid and long-term supporting from professional researchers and supplying material files with high quality, and (3) considering the social and cultural features of cities when introduce TT strategy to a new city.

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