

# Reflections among Chinese Primary Teachers When Using Thinking Tools

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**Abstract:** The purpose of this study is to examine reflections among Chinese primary teachers when using thinking tools. The authors selected 8 primary teachers who used thinking tools to design lessons to achieve teaching goals based on the context of their lessons. These teachers attended a seminar conducted by the China-Japan Collaborative Research Program. Trajectory Equifinality Modeling (TEM) was used to analyze the data. The authors found that there are three Types of teachers who utilize the process of using thinking tools (TT). These Types are teachers who use TT (1) to deepen the understanding of knowledge, (2) to develop students' thinking skills, and (3) to improve reasoning. Goal-directions in their reflections influenced how teachers used thinking tools.

**Keywords:** Reflection levels, Usage Types, Thinking tools, Mediated action, Trajectory Equifinality Modeling, Chinese Primary Education

## INTRODUCTION

There has been a concerted effort in educational fields to nurture reflective thinking in teachers. Reflective thinking provides an opportunity to step back and think of the best strategies to achieve educational goals. There is a big challenge of how to improve teachers' reflective thinking in the shift from teaching students to obtain more knowledges, to developing children's thinking skills (Sato, 2016). Therefore, examining how to improve a higher reflection level of teachers is becoming more important in the current education.

### Teacher's Reflection levels

Schon (1982) pointed out the importance of reflection in the action in teaching practice. This research indicated that teachers need to pay more attention on what occurred in the lesson and then modulate their strategies. Korthagen, F (2001) distinguishes 5 phases, called the ALACT Model. These stages are (1) action, (2) looking back on the action, (3) gaining awareness of essential aspects, (4) creating alternative methods of action, and (5) trial. After that teacher start a point of a new cycle in a certain period. This model shows how teachers can learn in their experimental learning.

In this model, awareness of essential aspects is the key to make changing in lessons. However, the awareness of essential aspects depends on what the

teacher reflected and the reflection level. Lee (2005) pointed out there were three levels; the recall level (describing one's experience), the rationalization level (identifying "why it was") and the reflectivity level (suggesting alternative way to teaching). Korthagen, F & Vasalos (2005) indicated that there were 6 levels in teachers' reflections. They were environment, behavior, competencies, believes, professional identity and mission. These reflection levels were from outside to inside, low level to high level.

### Reflection on Mediated actions

Teaching is the activity where teachers and students interact in the classroom within many kinds of cultural tools (Vygotsky, 1978). These cultural tools could be language, chalk. To develop students' thinking skills, new tools were used.

These new tools were mediational means. Teachers act with goals relating to developing learning and teaching. When teachers started to use one kind of tools, their actions were influenced by subject (teacher), tools, students and purposes (Wertsch, 1991). Therefore, when teachers look back on how they used the tools, the angle of mediated action was necessary.

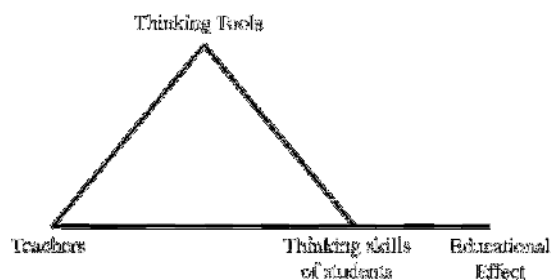


Figure 1. Mediated Action of Using TT

Based on the Vygotsky's model of a complex mediated (Jaworski.B, 2008)

Most teachers' actions are based on their lesson plans. However, it was difficult to predict how students think in lessons that improve thinking skills, because the situation in the lessons was more dynamic, uncertain, and complex than the knowledge-remembering classes. Suchman (1987) identified that people should pay more attention to the situated actions than plans. The authors considered that teachers' reflection also was situated in the context of what occurred in the classroom.

With the concern of developing students' thinking skills, how to improve teachers' reflection level became more important than before. Teachers may not be able to promote students' thinking skills, if the teacher did not reflect deeply on their teaching practices (Choy, Oo, 2012). This study called for high level reflection in the practice of nurturing students' thinking skills.

### Practise of Using Thinking Tools to Develop Thinking Skills

With the development of globalization, many countries highly value how to develop children's thinking skills to nurture higher quality talents to contribute to the society in the 21st century.

To achieve the new teaching goals, additional new tools used in the class, such as thinking tools (TT) are needed. Thinking in a complex process in heads and could not be observed. In Japan, using thinking tools, which would "show one's thinking visually" in class, was found to have educational benefit (Kurokami, 2012; Kansai University Elementary School, 2015)). Thinking tools can be special graphic organizers which focuses on training using various thinking tools. Students can learn by writing or talking about their thoughts using thinking tools under teachers' guidance.

To improve and promote the quality of education, China's government made a policy called "China's

Middle and Long Education Innovation and Development Plan from 2010 to 2020". In this policy, one goal is to promote thinking skills.

To help reach this goal, thinking skills has been introduced into schools in some cities in China. However, it is not easy to introduce thinking tools into a new educational environment because teachers must shift traditional knowledge-teaching to thinking-training teaching. Miyake, Kishi, Kubota & Li (2016) indicated that Chinese primary school teachers used thinking tools based on the educational environment of Chinese primary school. However, the usage Types by Chinese primary teachers have not been researched.

In the practice of using thinking tools, teachers' actions were mediated by thinking tools compared with traditional lessons. In the shift from traditional knowledge-teaching to thinking-training teaching, how teachers reflected on using thinking tools was important during a certain period.

Therefore, the two research questions examined in this paper are as follows:

- (1) What did Chinese primary teachers reflect on when they used thinking tools?
- (2) Were there usage differences related to reflection levels among Chinese primary teachers? If so, why?

## METHODS

### China-Japan Collaborative Research Program

To achieve the policy of promoting thinking skills, in 2012, a China-Japan Collaborative Research Program was formed to use thinking tools in class to develop children's thinking skills. Some thinking tools were introduced to improve thinking skills in primary schools, in Guangzhou and Foshan in Guangdong Province.

### Trajectory Equifinality Modeling

To determine the usage Types in Chinese primary teachers, this study used Trajectory Equifinality Modeling (TEM) to analyze the data. Trajectory Equifinality Modeling is a new qualitative approach which can clarify the process of people's multiple decision-making during a certain period based on time (Yasuda, Nameda, Sato, 2015). TEM uses concepts to analyze data (Table1).

Table 1. Concepts of TEM in this study

Concepts	Definition	Positioned in this study
Equifinality Point (EFP)	Goal achieved	Teacher used thinking tools to achieve teaching goal based on context
Polarized Equifinality Point (P-EFP)	Could not be achieved but possible point	Teacher did not use thinking tools to achieve teaching goal based on context
Bifurcation Point (BFP)	Bifurcating point to achieve EFP	Bifurcating point after teachers used thinking tools
Obligatory Passage Point (OPP)	Necessary point to achieve EFP	Necessary point after teachers use thinking tools
Social Direction (SD)	Helpful social factors for achieve EFP	Helpful social factors for using thinking tools
Social Guidance (SG)	Harmful social factors for achieve EFP	Harmful social factors for using thinking tools

The authors utilized “Teacher used thinking tools to design lesson” as the Equifinality Point. To define the usage Types among Chinese primary teachers, this study chose eight Chinese primary school teachers, as research collaborators, who could use thinking tools to design lessons for nurturing thinking ability. These teachers (HE, DE, LO, MO, SH, LU, LA, and GA) worked in four primary schools in Guangzhou and Foshan, Guangdong Province, China. Two teachers worked in one primary school. They were teachers of English, mathematics, Chinese literature and science.

They took part in the training workshops and used thinking tools for more than two years and six months before March 2018. The information of these eight teachers are given in Table 2.

Table 2. Information of Chinese primary teachers

Teacher	City	School	Subject	Teaching Experience	Thinking Tools' Experience
HE	Guangzhou	WD school	English	18 years	3 years
DE	Guangzhou	WD school	Math	6 years	3 years
MO	Guangzhou	BY school	English	12 years	2.5 years
LO	Guangzhou	BZ school	Chinese Literature	17 years	5 years
SH	Foshan	NZ school	Math	9 years	3 years
LU	Foshan	NZ school	Science	3 years	3 years
GA	Foshan	GM school	Math	5 years	3 years
LA	Foshan	GM school	Chinese Literature	5 years	3 years

### Analysis procedure

The authors interviewed 8 teachers 3 times. First, the authors interviewed teachers about how they used thinking tools, what they reflected on and how they changed. Second, the authors drew a TEM diagram and showed it to each teacher individually. Teachers read their TEM diagram and talked in more detail about their reflection and path. Third, the authors showed the edited TEM again and modified it.

After finishing the personal TEM, the authors drew the comprehensive TEM.

## RESULTS AND DISCUSSION

Through analysis of the data, the authors found that there are three changing Types in the experience of these teachers. These Types are using TT to acquire knowledge, nurture positive thinking attitudes, and improve reasoning.

### Type A : Acquiring-knowledge teachers

Type A is the Type of using thinking tools to deepen the understanding of knowledge teachers. Teachers who used this Type were HE, DE, MO and LO, who worked in WD and BY schools in Guangzhou.

HE, MO were English teachers. HE guided students to write keywords on TT and speak in English. However, MO guided students to write key sentences on TT to analyze textbook and write compositions. DE was Math teacher. She used TT to compare the conceptions. LO was a Chinese Literature teacher who also used TT in teaching conceptions.

From the TEM, the authors found that the point that teachers reached was not “Teachers can use TT to design lessons for developing students’ thinking skills”. The goal they reached was “teachers used TT to design lessons for students’ active-learning” (E-EFP). The teachers of Type A experienced five reflections before they reached the point of “teachers used TT to design lessons for students’ active-learning”. The processes were as follows.

Firstly, they reflect on “the gap between the lessons’ vision and students’ response” (OPP1) after they took part in the training class of thinking tools. For example, HE used Fishbone a Type of TT in class, but students were confused. Therefore, HE apologized to students. MO also was not successful in the lesson and wondered why the lesson failed and started to research how to use TT independently.

*MO: I could not understand why I did the less on so bad after my first open lesson. After the lesson, I researched how to use TT deeply.*

*1<sup>st</sup> interview data of MO: 239-240 lines*

Secondly, the teachers of Type A reflected on the great difference between excellent students and

students who performed poorly (BFP1). It was more difficult when using TT to discuss in groupwork because students who performed poorly had little knowledge and had difficulty using knowledge to participate in groupwork. However, owing to the social guidance of “The role in groupworks” from Chinese researchers (SG1), open lessons triggered them to make lessons better (SG2). Through Discussions in the research groups in schools (SD3), they used two methods, (1) allow excellent students to help the other students, (2) let some students do simply and easy work during groupworks. Thirdly, the teachers of Type A reflected on the purpose of use TT. This was an important point because it clarified the goals in teachers’ thinking. For example, DE noticed the danger of unclear utilization purpose in the early stage and then examined how to use TT when teaching important knowledge through “the discussions in research groups in schools” (SG3). They clarified the goal of deepen the understanding of knowledge (BFP2).

Fourthly, the teachers of Type A reflected on “how to guide students focus on thinking” (OPP2) after they clarified that the goal was to deepen the understanding of knowledge, as the social direction was “students’ passive thinking habit” (SD3). To guide students focused on their thinking, HE/DE/LO used PMIQ sheets to let students reflect on what they did learn and thought. MO gave a case of killing-animals to show how did she guide students thoughts about social phenomenon critically. The case of MO was given as follows.

*MO: I asked children to write a composition after we finished a unit about the relation between human and animals. Many students **gained new thinking angles** about people and animals. They felt sorry, shame and angry to animals when they knew the shoes and clothes were made by animals.  
1st Interview data of MO:181-191 lines*

Finally, the teachers of Type A evaluated students’ change. They found “students expressed their

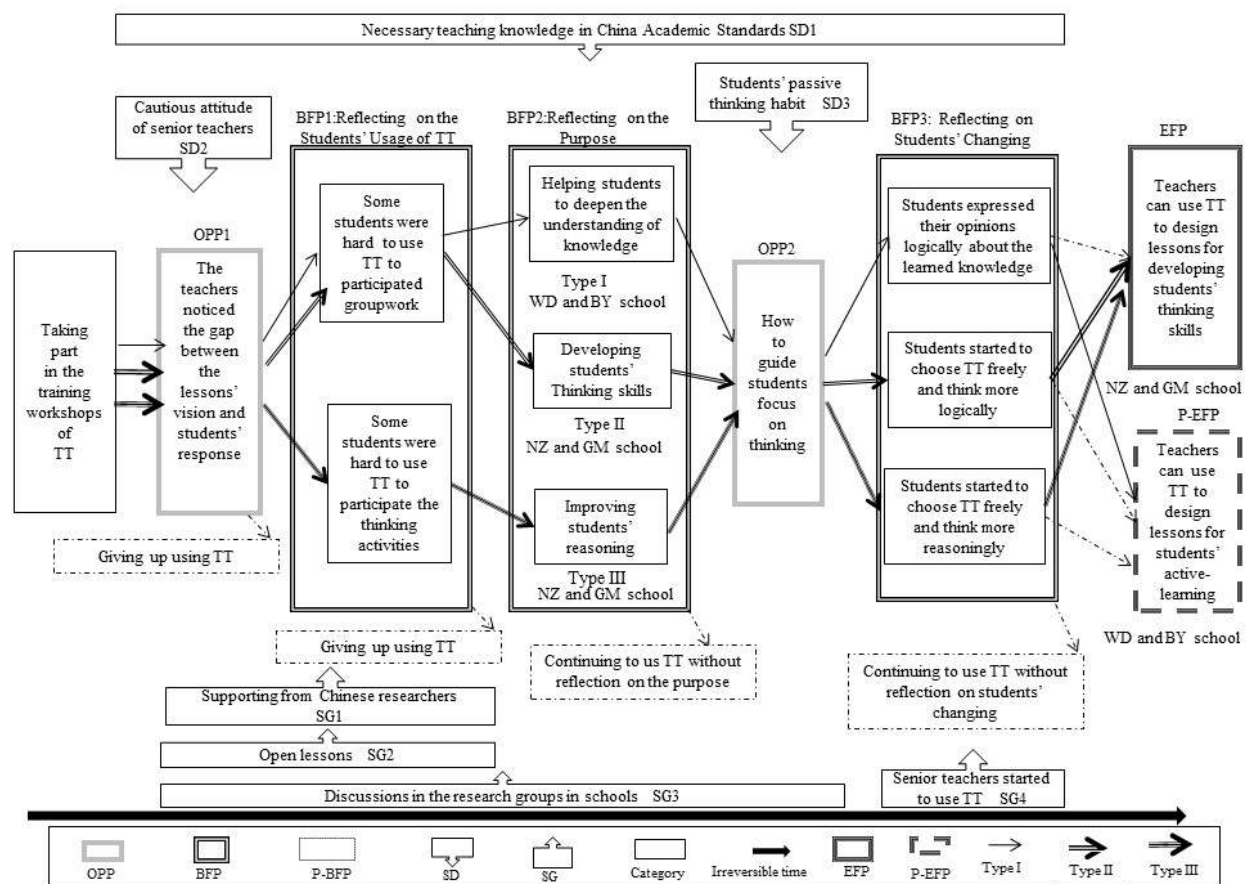


Figure 1. TEM of the Reflections among Chinese Primary Teachers

*DE: If we did not overemphasize the importance of necessary knowledge, we should not reach our teaching goals. Every lesson had its own teaching goal.*

1st Interview data of DE:141-142 lines

opinions logically about the learned knowledge”, before reaching the developmental point that was “teachers used TT to design lessons for students’ active-learning” (P-EFP).

## Type B : Developing Students' Thinking Skills Teachers

Type B is the Type teachers who used thinking tools to develop thinking skills. These teachers were SH (NZ school) and LA (GM school).

After the teachers of Type B participated in the training workshops of using thinking tools, they also experienced “the gap between the lessons’ vision and students’ response” (OPP1).

Next, they experienced the reflection of how to close the gap between excellent students and performed poorly students (BFP1). The teachers provided leadership training to some of the students, and encourage them help the others. The method was influenced by “the role in groupworks” from Chinese researches (SG1), where open lessons triggered them to make lessons better (SG2) and encouraged discussions in the research groups in schools (SD3).

*SH : Some lazy students totally did not think independently even if you allow them to think about something. However, he became interested in groupwork because many students thought with him together when we used TT. This kind of lazy student need the other students to help him, particularly with excellent students.*

*3<sup>rd</sup> interview data of SH:210-213 lines*

After the teachers of Type B went through reflection of how to close the gap between excellent students and students who perform poorly, SH and LA did a deep reflection about the reason for using TT. For example, SH noticed she “went grossly wrong” because she did not explain what TT was and how to use TT. After she realized the purpose was to develop students’ thinking skills, she explained TT to students.

*I noticed students didn't understand the essential of TT....I thought you (students) were able to fill the knowledge on TT if I told them how to fill TT. (I told them) just used the tools. It was **in fact a mistake!** At that time, I went grossly wrong*

*2<sup>nd</sup> interview of SH: 172-174*

In the next, SH and LA tried to “How to guide students focus on thinking”. SH wonder how to trigger students thought positively and derive the questions after asked the senior teachers in the research group in her school. LA also was puzzled about it and paid attention on relating things with their daily lives after discussed with the member of research group. Therefore, they decided to strive to guiding students thinking, by explaining such concepts as to how to use TT.

As a result, teacher SH and LA found “Students became choose TT freely and shaped positive thinking altitude”. For example, SH said: “I was very glad because all of the students became to like thinking”. Teacher SH and LA achieved the point of

“Teacher can use TT to design lesson for nurturing thinking skills” (EFP).

## Type C : Improving reasoning teacher

Type C was the Type of teacher who used thinking tools to improve reasoning. The teachers of this Type were LU (NZ school) and GA (GM school).

The teachers of Type C participated in the training class of thinking tools and soon were concerned about how to develop children’s thinking skills. LU said: “*The starting point was to improve children’s thinking skills.*”

LU and GA also experienced “the gap between the lessons’ vision and students’ response” (OPP1) like Type A and Type B. LU found that students did not understand the relationship in TT in the early stage. GA also stated that her class was not successful.

Next, LU and GA noticed “some students had difficulty using TT to participate the thinking activities” (BFP1). LU mentioned that she often reflect on the lessons through children’s feedback and found that some students did not focused on thinking. To solve this problem, LU and GA provided some special supporting to concentrate on thinking.

*LU: I often observe the situation in the lessons. How students used TT? What did they think about the topic? I can feel them through what children said. After the class, I often reflected on the lessons through children’s feedback.....When they express in a mess, I knew the did not understand truly about TT and did not focus on thinking.*

*1<sup>st</sup> interview data of LU:490-495 lines*

After they solved the problem of the gap between students, LU and GA reflect on how to use TT to achieve the professional goal in science and mathematics classes. They realized that the goal in their subject was to improve children’s reasoning (BFP2). LU pointed out the reasoning was important in science. GA said she wanted to improve students’ reasoning, too. Therefore, LU and GA tried to guide students to focus on thinking the reasoning in Math and Science.

*In our area, there are a few professional science teachers. We researched how to teach in Science. It not only improved our teaching skills, but also we hope students’ thinking skill could be developed.*

*1<sup>st</sup> interview data of LU: 390-395 lines*

The next reflection points of LU and GA was “students’ changing” (BFP3). They compared the class used TT and the class without using TT, and found the class that used TT made great progress in reasoning. For example, a student of GA, used the pyramid chat to reason the unknown number. Furthermore, the students who had longer had usage of the TT experience, could chose TT freely to infer.

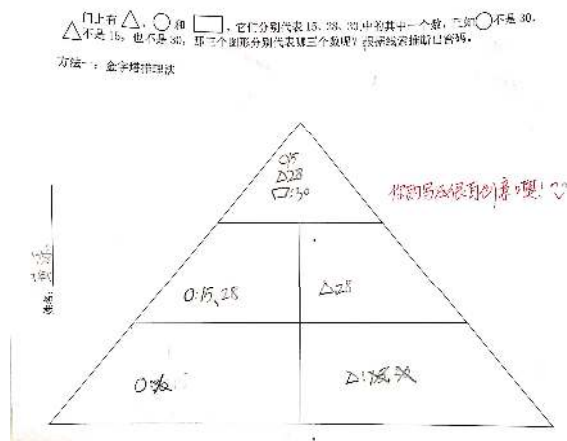


Figure 2. A Case of Using Pyramid Chat for reasoning

Finally, LU and GA reached the point of “Teacher can use TT to design lesson for nurturing thinking skills” (EFP).

Through TEM, the authors found out that (1) there were three Types teachers among Chinese primary teachers when they used TT; (2) Reflecting on the purpose was a major turning point that influenced their changing pattern.

## DISCUSSION

### Tensions Formed from SG and SD

From the TEM, the authors found that all of the reflection points occurred through the interaction of social guidance and social directions.

Table 3 Social directions and Social Guidance in TEM

Converged Point	Social Direction	Social Guidance
OPP1	Necessary teaching knowledge in teaching guiding outline (SD1) Cautious altitude from senior teacher(SD2)	Supporting from Chinese researchers (SD1) Open lessons(SG2) Discussion in research group in schools(SG3)
EFP1	Necessary teaching knowledge in teaching guiding outline (SD1)	Supporting from Chinese researchers (SD1) Open lessons(SG2) Discussion in research group in schools(SG3)
EFP2	Necessary teaching knowledge in teaching guiding outline (SD1)	Discussion in research group in schools(SG3)
OPP2	Students' passive thinking habit(SD3)	Discussion in research group in schools(SG3)
EFP3		Senior teachers start to use TT(SG4)

There were three SDs which were necessary for teaching knowledge in China Academic Standards (SD1), cautious altitude from the senior teacher (SD2) and students' passive thinking habit (SD3). Necessary teaching knowledge in the China Academic Standards was the direction existed in the whole reflection points. On the other hand, some social guidance existed to help teachers progress. They were supported by Chinese researchers (SG1), had open lessons (SG2) and discussions in the research group in schools (SG3) and senior teachers began using TT (SG4). Cautious altitude from the senior teacher (SD1) occurred in the early stage. It exerted extreme

pressure on the teacher who tried to use the new teaching strategy. However, in the latter period, senior teachers start to use thinking tools and became a helpful environmental factor to trigger teachers to reach EFP or P-EFP.

These point to convergence of peoples' multiple paths before they reach the Equifinality Point because of harmful or helpful social factors. Yasuda, Nameda, Sato (2015) indicated that the tension in the point of OPP and BFP constrained the behavior of people.

### Purpose direct teachers' changing

From the perspective of mediated action, the authors found that the reflection points of the eight teachers moved on the triangle of mediated actions of TT in time (Figure 3). It showed that the eight teachers experienced the same contents of reflection in a time sequence.

The biggest turning point was reflection on the purpose. Even if all the teachers reflect on why they used TT, the specific purpose of three Types teachers were different. The purpose of Type A was Helping students to deepen the understanding of knowledge. However, the purpose of Type B and Type C was to develop students' Thinking skills and to improve students' reasoning. Wertsch (1991) identified that people have different purposes even if they do same actions. The Type of purpose people had, was depended on their social context.

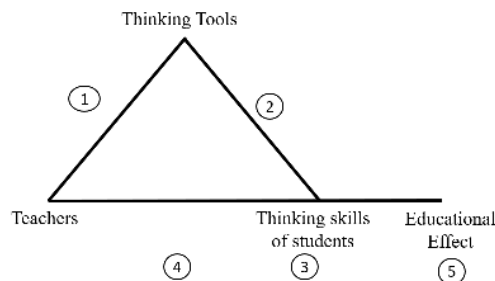


Figure 3. Reflection Points in the Triangle of Mediated action

From the results, the authors found Type A were HE, DE, LO and MO. All of them worked in Guangzhou city. Their social directions in TEM were greater and more stressful than Types B and C. These social directions were the pressure of grade scores from students' parents, and the intense competitions of schools. Guangzhou is the 3<sup>rd</sup> largest city and has long history in China with most elitists living there and expecting their children go to prestigious universities in the future.

However, Foshan is the new and small city, with lower income people than in Guangzhou and more local populace. Furthermore, the competitions of schools were less aggressive than Guangzhou. In conclusion, the environmental factors prevented Type

A to reflect on deeper level of why they used TT. Teachers compromised between the social direction and social guidance.

### Reflection levels between Type B and C

The authors identified why Type A was different with Type B and C. However, it was hard to explain the reasons for the differences between Type B and C.

Type B teachers reflected on the purpose and noticed the purpose was to develop thinking skills but not specified the concrete thinking skill. Type C teachers reflected on what kind of thinking skills they should develop in their subject. Korthagen, F & Vasalos, A (2005) pointed out the professional identity is a higher level of reflection. Professional identity means what kind of teacher want to be, or pursuit to be a professional teacher in their fields.

As a science teacher, LU had a strong awareness to pursuit to be a professional teacher. She “researched how to teach in science” and found out students should learn to reason why science phenomena occurred. As a math teacher, GA put a high value on reasoning. GA was not only used the TT introduced in the training workshops, but also researched how to use the new tools focusing on reasoning by herself.

### CONCLUSION

The authors found that the reflection on the purpose was the big turning point from the perspective of mediated action. The purpose influenced the changing patterns of Chinese primary teachers when they used thinking tools. Based on the purpose of using TT, these teachers were divided into three Types. These Types are using TT to acquire knowledge (Type A), to nurture positive thinking attitudes (Type B), and to improve reasoning (Type C).

The study about how the professional identity influenced the reflection levels among Chinese primary teachers is need to do in the future.

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