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ICT-Assisted Support System for Teacher's Problem Solving

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Disclaimer

I hereby declare that this dissertation is my own original work and has not been submitted before to any institution for assessment purposes. And all the sources used have been cited in the reference section.

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Yang Lei **Date**

Acknowledgement

This report is the result of my five years of study in Palacky University Olomouc, during which I paused my career and left my family thousands of kilometres behind. Just like the participant teachers did in their reports, I was also looking for meaning in the five-year-long odyssey, but now I have realized that the meaning lies not only in the years gone but also in the years to come; it lies not only in the foreign country here but also in the homeland afar; it lies not only in the result of my research but also in the connections between me and my teachers, colleagues, friends, family, and the participant teachers.

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Abstract

Teachers have to confront various problems relating to learners, curriculum, learning environment, parents, public opinions, school management, colleagues, and themselves. Solving these problems is very important because they are related to teacher outcomes and curriculum outcomes, teacher education programs, teacher support and effective teaching, professional development, and teacher well-being. In addition, these problems may provide clues about the weaknesses in the current education system, the gap between the expectation for and the reality of education, and a direction for improvement.

Research on TPS (teacher's problem solving) is under the influence of MPS (mathematical problem solving), CPS (cognitive problem solving) and SPS (social problem solving). Earlier researches have investigated the problems encountered by teachers, ranked them by frequency or teacher's importance ratings, and examined the problems from the perspective of teacher development, cognitive development, or socialization. Questionnaire was frequently used to collect data and the reported problems were found to be similar across countries, over time, between experienced and novice teachers, and by strong or weak research designs. But the definition of teacher's problem was often borrowed from MPS, CPS and SPS without examining the differences between them. The differences between problems were ignored, which led to an inaccurate understanding of teacher's problems. The frequency of report was unable to reveal the importance of problem solving to individual teachers. And it remains unknown how teachers define a situation as a problem, select a problem as their target, and attach meaning to their problem solving.

Earlier researches borrowed the idea that problem solving was a higher order thinking skill and focused on the assessment and training of teacher's problem-solving skills. Teacher's problem-solving skills were often found to be low by the inventories

that were designed to evaluate teacher's perceptions of their own problem-solving beliefs and their general problem-solving skills. Teachers were unable to report the actual skills they used in the process of solving different kinds of problems.

Some researchers believe that as adult learners, teachers are learning by themselves and they are able to create a better system if they have the time, autonomy, and support to do so, and the lack of support for teachers is another reason that makes teacher's problem solving difficult. Different approaches have been developed to support teacher's problem solving. But all of these approaches have limitations and teacher's initiative, needs, and choices in support seeking are often ignored. And it remains unknown how teachers seek support for their problem solving.

In this research, the pragmatic paradigm and mixed research methods were adopted to answer these questions. A descriptive and bottom-up approach was used by taking a teacher perspective and a holistic view and stressing the individual and situational differences between particular problems. Maximum variation samples were selected from three sample schools and one-month-long chat log entries were selected from a teacher's chat group. Data collected by narrative interview, semi-structured interview and chat log analysis were combined and compared for narrative, thematic, text and descriptive analysis. The results revealed that the participants were facing a variety of problems which could be categorized by their primary problem-solving goal. And learning problems were assumed to be most important to them. The participants distinguished problems from quasi problems after a three-step process of problem definition. They used 13 different kinds of strategies separately or combined for problem solving. The five-step process could take place with or without careful planning. Reviewing the success and failure of the participant's problem-solving attempts, 22 implications were found for teacher's problem solving. There were many factors affecting participant's strategy selection and use. The factors could cause difficulties for teacher's problem solving. And the participants had established an ICT-assisted support system to deal with the difficulties. The support system consisted of problems, goals, difficulties, needs, channels and supports. Based on the analysis of

participant's support seeking, five principles were suggested for building such a system. And there were 16 style indicators that could describe the differences between teacher's problem definition, problem solving and support seeking.

Different from MPS, CPS and SPS, it is dissatisfaction rather than unknown or difficulty that makes a situation a problem for a teacher. Though problems may sound familiar, each one of them is unique. Teacher's problem solving is in essence the teacher-student cooperation on improving learning rather than just a teacher's effort to find a solution. A teacher's problem is solved by improving learning, teaching or environment rather than just "knowing" how to do it. It is impossible to identify a solution before implementing it because every problem-solving attempt is unique, and a problem can be solved by adopting different strategies, and strategy use is affected by many less-controllable factors, and the relationship between a problem and a strategy is probable, and a good strategy should be effective for the problem and appropriate for the teachers and students, and the effects of a strategy is unpredictable. With a growing goal for improving learning, teacher's problem solving can have gradual results rather than either-or results. Support seeking is the communication initiated by teachers to acquire resources for dealing with their problem-solving difficulties. Though the participant's problem-solving strategies were identified, it is difficult to learn them. And teacher's problem solving may go beyond a teacher's responsibilities and expertise because of the interconnections between problems. So, it is very important to establish an integrated ICT-assisted support system for teacher's problem solving.

Teachers seldom recognize themselves as problem solvers, but problem solving is an integral part of the teaching profession, and it gives meaning to a teacher's work and life by revealing the dilemmas or difficulties confronting them, offering them learning opportunities, strengthening their beliefs or opinions, triggering self-reflection, turning their attitude around, and enabling them to build a strong emotional bond with students and parents.

Keywords: teacher's problem solving, support system, ELT, ICT

Contents

Part I Introduction

"Teachers must be prepared to handle unanticipated situations, to adapt current knowledge to deal with new problems, to learn radically new things in short, to deal constructively with change." (Silverman & Welty, 1990: 95)

1.1 Research background

In practice, teachers may have to confront various problems relating to learners, curriculum, learning environment, parents, public opinions, school management, colleagues, and themselves. For example, Gandara, Maxwell-Jolly and Driscoll (2005, p. 10) surveyed 5,300 English language teachers and found that teacher-student communication, motivating students, variation in student needs, teacher-parent communication, student's lack of skills to do required class-work, lack of appropriate tools and materials, lack of support from state, federal, district and/or school policy, and student's lack of basic readiness to learn were the top challenges faced by teachers in secondary classrooms of California. In the new millennium, educational change presents new challenges, such as more responsibilities for the teacher outside the school, new possibilities of learning offered by mass media, controversies and contradictions of different educational models, social judgement against the teacher and the general criticism of the educational system, the mismatch between the needs of the schools and available resources, authority and discipline in the classroom and school, the overload of the teacher (Eacute & Esteve, 2000).

Though difficult, teacher's problem solving is very important because the problems are relating to teacher outcomes and curriculum outcomes (Silins, 1994), teacher education programs (Veenman, 1984: 143; Moussaid & Zerhouni, 2017: 136), teacher support and effective teaching (Gandara, Maxwell-Jolly & Driscoll, 2005: 2), and professional development (Noom-ura, 2013: 139). In addition, these problems may also be relating to teacher's effectiveness, self-actualization, well-being and may

provide clues about the weaknesses in the current education system, the gap between the expectation for and the reality of education, and a direction for improvement.

Some researchers have investigated the problems encountered by teachers, ranked them by frequency, and examined the problems from the perspective of teacher development, cognitive development, or socialization (e.g. Veenman, 1984; Gandara, Maxwell-Jolly & Driscoll, 2005; Votava, 2006; Noom-ura, 2013; Moussaid & Zerhouni, 2017). The reported problems were found to be similar across countries, over time, between experienced and novice teachers, and by strong or weak research designs (McDonald & Elias, 1983, p. 4; Veenman, 1984, p. 156; Moussaid & Zerhouni, 2017, p. 150).

However, while focusing on the similarities between the reported problems, existing researches may have ignored the differences between them, which are important for the accurate understanding of the problems and successful problem solving. In fact, the frequency of report is more likely to lead to the problems originating from the nature of the teaching profession, and the demographic, economic or educational (including teacher education) situation of a locality and its schools, but the problems that are important (rather than frequent) to individual teacher's effectiveness, learning and development have not been pinned down. It remains unknown how teachers select problems as their targets; which problems are important to them; and why these problems are important.

Based on the research findings of mathematical, cognitive and social problem solving (MPS, CPS, SPS), many researchers stressed the role of cognition in problem solving. They adopted competence-based approaches, which were often rooted in a deficit model of teacher learning (Korthagen, 2017, p. 396), and focused on the assessment (Heppner & Peterson, 1982; Sahin et al., 1993; D'Zurilla et al., 2002; Eskin & Aycan, 2009; Greiff et al., 2017) and training (Sunal, et al., 1989; Yerushalmi & Elyon, 2013; Pannells, 2010) of teacher's problem-solving skills in order to improve their problem-solving competencies or abilities. Teacher's problem-solving skills were often found to be low, but the inventories used in the researches were designed to

evaluate teacher's perceptions of their own problem-solving beliefs and their general problem-solving skills (Heppner, Witty & Dixon, 2004, as cited in Yavuz, Arslan & Gulten, 2010; Turgut & Ocak, 2017; Heppner & Peterson, 1982) rather than the actual skills they used while solving different kinds of specific problems. Therefore, though teacher's general problem-solving skills were assessed, the domain-specific knowledges, skills and strategies that teachers actually use for the solving of different types of problems remain unknown. But it is these knowledges, skills and strategies that distinguish teacher's problem solving from MPS, CPS and SPS.

Different from those who focused on teacher's problem-solving skills, there are others who believe that as adult learners, teachers are learning by themselves (Bell & Gilbert, 1994) and they are able to create a better system if they have the time, autonomy, and support to do so (Sacks, 2013). They believe that the lack of support for teachers is another reason that makes teacher's problem solving difficult. And the lack of prep time, school equipment, guidance, tools and materials, policy support, etc. was reported by participant teachers in earlier researches (Veenman, 1984; Gandara, Maxwell-Jolly & Driscoll, 2005; Votava, 2006; Noom-ura, 2013; Moussaid & Zerhouni, 2017). In addition, the supports available for teachers at school may not be so effective as teachers expected because they may be out of sync with the realities of teacher's problem solving and cannot address teacher's real needs timely in the problem-solving process.

In addition to the above-mentioned cognitive training for teachers, different approaches have been developed to support teacher's problem solving (Gurra, et al., 2009; Blum & Valli, 1988; Gregory, 2010; Dunaley, 2010; Kocyigit & Zembat, 2013; Kinay & Bacecik, 2016; Heitzmann, 2008; Kale & Whitehouse, 2012; Hsu, 2004; Hou, Sung & Chang, 2008; Hew & Knapczyk, 2007; Girod, 2009; Gu, 2010). However, all of these approaches had limitations (Guerra et al., 2009; Blum & Valli, 1988; Toll, 2017; Hou, Chang & Sung, 2008; Hew & Knapczyk, 2007). And, it remains unknown how teachers seek supports for overcoming the difficulties encountered during the problem-solving process.

To conclude, it seems that existing researches on teacher's problem solving are

still inadequate because these questions remain to be answered.

1.2 Objectives and research questions

Thus, the purpose of this research is to improve the understanding of teacher's problem solving by taking a teacher perspective while stressing the differences between situations, individuals, problem types and particular problems. The two main objectives are:

- to explore teacher's problem solving
- to explore teacher's support-seeking for their problem solving

The research questions are:

- How do teachers define real-life situations as their problems?
- How do teachers solve problems?
- How do teachers seek support when they encounter difficulties in the process of problem-solving?

Hopefully, the attempt to answer these questions will lead to a deeper understanding about the problems defined by teachers, teacher's problem-solving strategies and teacher's support-seeking for their problem-solving difficulties.

1.3 Significance of the research

Theoretically, this research tries to discover the principles that can be specifically applied to provide more accurate explanations to teacher's problem solving, rather than borrowing the framework from mathematical, cognitive or social problem solving, which may not be completely applicable to teacher's problem solving.

Practically, this research tries to provide principles that can be used for the improvement of individual support system for teacher's problem solving and for the establishment of a shared support system for teacher's problem solving that features autonomy, communication and cooperation.

Personally, according to my experience and observation, I think that being a teacher is becoming more and more difficult. The autonomy is limited (Villegas-

Reimers, 2003, p. 34). The workload is heavy. The pressure is high. The salary is low. The public opinion is conflicted. The students seem to be less respectful and less grateful. No wonder that some teachers become cautious, complying, materialistic or sceptical. How can a teacher deal with these difficulties which are partly brought about by the social, economic and technological changes; prevent him/herself from becoming degenerate as some media worries; and grow into a teacher as he/she expected, namely, to experience the development, achievement, confidence, and satisfaction of being a self-actualized teacher? While I am exploring the answer for peer teachers, I am also exploring a path for myself. Successful or not, I want my exploration to become a steppingstone for my daughters (aged 8 and 4 now) when they start their own quest of life.

Socially, I hope this research can benefit peer teachers and their students. Based on the findings of this research and in the next couple of years, I wish to build a platform that can be used by teachers as problem solvers to facilitate individual and collaborative problem solving. By improving teacher's problem solving, I want more teachers to realize how powerful they are, and I want more people to realize how important and rewarding it is to trust, communicate, cooperate with and support teachers.

1.4 Terminology

The working definitions of some important terms in this research are as follows:

Teacher's Problem Solving (TPS) refers to teacher's attempts to improve a situation considered by the teacher as dissatisfied or harmful and as related to his/her teacher identity and needing to be dealt with by him/herself.

Support for Teacher's Problem Solving refers to all the resources that can be used to help teachers overcome their problem-solving difficulties, such as knowledges, information, technologies, policies, regulations, trainings, counselling, tools, materials, facilities, funds, time, space, personnel.

Support System for Teacher's Problem Solving refers to teacher's systematic organization of different kinds of resources to deal with the difficulties they may

encounter during the process of solving different types of problems.

Information and Communication Technologies (ICT) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer, and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning (as cited in Kumar, 2008).

ICT-assisted Support System for Teacher's Problem Solving refers to teacher's systematic organization of resources with ICT as an optional tool to acquire, adapt, produce, store, exchange and organize resources for the purpose of overcoming the difficulties encountered during the process of problem-solving.

English Language Teaching (ELT) refers to teaching English to students whose first language is not English in mainland China where English is not the dominant language and natural English language immersion situations tend to be rare.

English as a Foreign Language (EFL) is the term used to describe the study of English by non-native speakers in countries where English is not the dominant language.

1.5 The structure of the dissertation

This dissertation consists of six parts. The Introduction includes the background of the research, the research objectives and questions, the significance of the research, the terminology, and the structure of the dissertation. It will elaborate the educational phenomenon of interest, the limitation of existing researches, the objectives of this research, the significance of this research, and the working definitions of terminology.

The second part reviews the literature on teacher's problem solving, support for teacher's problem solving and the use of ICT to support teacher's problem solving, explains the rationale of this research, and introduces the socio-cultural background of this research. It will summarize the trends, the findings, and the weaknesses of existing researches. The summary will provide the foundation of this research.

The third part illustrates the methodology of this research. It explains the reasons for adopting the pragmatic paradigm and mixed methods, the process and methods of

data collection and analysis, and the methods of reducing threats to the validity of this research.

The fourth part exhibits the results of this research, namely, the reported problems and a classification based on teacher's goals, the process of teacher's decision making to deal with a problem, the strategies used by teachers to deal with their problems, the difficulties and needs of teacher's problem solving, the supporters for teachers as problem solvers, teacher's evaluation of problem-solving and support-seeking results, the factors that can influence teacher's problem definition, problem solving and support seeking, the indicators of the style of problem definition, problem solving and support seeking, the role of ICT in teacher's problem solving and support seeking.

The fifth part examines the validity of this research, and discusses the generalization of the research results, and ethical considerations.

The last part clarifies the key findings of this research, namely, a framework that illustrates the process, product and style of teacher's problem definition, problem solving and support seeking.

Part II Literature review

This chapter reviewed the literature about the problems perceived by teachers, teacher's problem solving, and support for teacher's problem solving, and introduced the rationale and the social-cultural background of this research.

The major search engines were Web of Science, SCOPUS, Google Scholar, Educational Resources Information Center (ERIC), and China Knowledge Resource Integrated Database (CNKI). The libraries in Uppsala University and Palacky University were also used for the collection of literature. The keywords used include "problem solving", "teacher", "support", "ICT", "upper secondary school", "ELT" and "QQ".

The retrieved literature was arranged by their focus on teacher type (preservice teachers, beginners, or in-service teachers), school level (primary, secondary or tertiary education), topic of problem (e.g. mathematics, science, or classroom discipline), field of study (teacher education or mathematics education) and selected by their pertinence to the research questions. The literature about teacher's solving of mathematical problems and teacher's use of problem solving as a teaching method were excluded because these were not the objectives of this research.

The selected literature is about the problems perceived by teachers, the theoretical frameworks of teacher's problem solving, the factors in teacher's problem solving, teacher's problem-solving strategies, teachers as problem solvers (beliefs, behaviour, collaboration, self-reflection, metacognition, expert-novice differences, problem-solving skills), and the approaches of supporting teacher's problem solving.

2.1 Review of literature

Research on problem solving can be traced back to the experiments in psychology in the first half of the 20th century (e.g. Duncker, 1935; Wertheimer, 1945, as cited in Csapo & Funke, 2017, p. 34). With the cognitive revolution in psychology in the late 20th century (p. 26) and rapid technological, social and economic development at the

beginning of the 21st century (p. 22), the research on problem solving has gained importance and expanded at an accelerating speed (p. 266).

In the field of education, the early and influential trend is the research on mathematical problem solving (MPS). Problem solving is considered to be a large part of or even a synonym of mathematics (Wilson, Fernandez & Hadaway, 1993). Research emphasis about mathematical problem solving has extended from process and strategies of problem solving (Polya, 1945), identification of key determinants of problem difficulty, identification of characteristics of successful problem solvers, comparison of expert and novice problem solvers (strategy training), metacognition in problem solving (metacognition training), problem solving in context (Lester, 1994), the role of affect in problem solving (Carlson & Bloom, 2005), problem solving as an instructional goal, problem solving as an instructional method, the use of technology as a tool for problem solving and instruction, and the evaluation of problem solving (Wilson, Fernandez & Hadaway, 1993), to the structure of a general theory of in-the-moment decision making (Schoenfeld, 2010, 2013).

A corresponding trend sees problem solving as an important skill or one of the key competencies humans need in a fast-changing world with increasing uncertainties (Greiff, S. et al., 2017; Csapo & Funke, 2017) and focuses on the improvement and assessment of problem-solving skills. For convenience of reference, it is referred to as cognitive problem solving (CPS) in this report. In this trend, problem solving was studied from different perspectives such as its complexity (Frensch & Funke, 1995), cross-disciplinarity (OECD, 2004, p. 156), the use of technology for problem solving (OECD, 2013a), collaboration in problem solving (OECD, 2013b, p. 6), the role of creativeness and reflection (OECD, 2013c, p. 122), and the adaptiveness of problem solving (Mayer, 2014). And the educational methods aimed at improving higher-order thinking skills developed from direct teaching of thinking skills, content-based methods that integrate the teaching of disciplinary content and improving reasoning, enhancing instruction to improve problem-solving abilities, to global approaches to improving interest, motivation and the quality of learning, and corresponding large-scale

assessment projects developed from curriculum-based content-focused assessments, assessing the application of knowledge, to assessing general cognitive skills, or the psychological dimensions of knowledge (Csapo & Funke, 2017).

A third trend is the research on social problem solving (SPS), namely, an individual's attempts to find solutions to specific problems encountered in everyday living, including the problems about challenging social interactions (D'Zurrila & Nezu, 2007, as cited in McMurran, Crawford, Reilly, Delport, McCrone, Whitham, et al., 2016). SPS researchers assumed that deficits in SPS skills are antecedents of mental health problems and they mainly focus on the relations between SPS skills and emotional or mental health outcomes such as well-being, decision-making, depression, suicidality, worry, psychological stress, and externalizing behaviours such as aggression, risky driving, delinquency, and substance use (as cited in Jiang, Lyons & Huebner, 2016; Koruklu, 2015). They found that SPS training had significant effects in reducing social adjustment problems and depressive symptoms (as cited in Jiang, et al., 2016; Bell & D'Zurilla, 2009), improving college student's quality of life and mental health (Chinaveh, 2010), and training students with emotional and behavioural disorders (Maag, 2006). In addition, there were studies about the relations between SPS ability and personality traits (D'Zurilla, Maydeu-Olivares, Gallardo-Pujol, 2011), temperament (Walker & Henderson, 2012), and social information processing abilities (Adrian, Lyon, Oti, Tininenko, 2010).

Under the influence of these trends, namely, the interests in problem solving in a discipline such as mathematics, in problem solving as key competencies or higher order thinking skills needed for future challenges, or in everyday problem solving relating to mental health and social interactions, there were research interests in problem solving in the teaching profession.

2.1.1 The problems perceived by teachers

Existing researches have provided the definition of teacher's problems, investigated the problems perceived by teachers, and classified the problems reported

by teachers.

The definition of teacher's problems

According to Frensch and Funke (1995), a problem exists when an animal's goal cannot be achieved by performing a simple available act (Thorndike, 1898), when an organism does not have a ready response to a stimulus situation (Davis, 1973, p. 12; Woods, Crow, Hoffman & Wright, 1985, p. 1), when one doesn't know the answer to a question (Skinner, 1966, p. 225), when one doesn't know how to achieve a particular goal (Duncker, 1945; Newell & Simon, 1972, p. 72; Hayes, 1980, p. i); or, a problem is characterized as a situation where there is a difference between a current state of affairs and a to-be-achieved goal state, whereby no means are readily available to reduce this difference (Greeno, 1978; Bransford & Stein, 1993; Jonassen, 1997).

These definitions were based on either behavioural or cognitive psychology, focusing on the problem solver or the problematic situation, and described the behavioural (the unavailable act), cognitive (the unknown), or situational (the to-be-achieved goal state) feature of a problem solver or a problem.

However, few definitions could be found for the problems encountered by teachers. One example is provided by Veenman (1984, p. 143): "a problem is seen as a difficulty that beginning teachers encounter in the performance of their task, so that intended goals may be hindered". Though the definition is about the problems encountered by beginning teachers, it could also be applied to the problems encountered by experienced teachers.

This definition provids inspirations for the understanding of "teacher's problems". First, a "difficulty" is defined by a teacher. In fact, the prerequisites of the existence of a difficulty are that 1) there must be a situation and 2) a teacher to decide whether the situation is difficult.

It seems that a teacher will face a problem related to the teaching profession when

- There is a situation with a teacher in it.
- The teacher believes the situation to be related to his/her teacher identity.
- The teacher believes the situation to be problematic.

However, a problem will not belong to a teacher until the teacher makes a decision to deal with it, and the decision will be affected by the belief about teacher's responsibilities and competencies:

- The teacher believes that he/she should deal with the problematic situation.
- The teacher believes that he/she can do something to improve the situation.

Thus, the definition of a problem depends on both the objective attributes of a situation and the subjective attributes of a teacher. And, the opinion that a problem is an unknown "entity" (Jonasson, 2000, p.65) sounds doubtful if a teacher perspective is taking into consideration.

Next, the standard of "difficulty" is relative. While discussing the definition of pedagogical problems, Yerushalmi and Eylon (2013) proposed that "unfamiliar situations requiring the teacher to consider alternative solutions would be categorized as pedagogical problems". If the concept of "unfamiliarity" can be applied to define the difficulties confronting teachers, the standard of difficulty will become varied according to the knowledge or experience individual teachers have; and "whether a phenomenon in education can be regarded as problematic or not depends on different reference standards" (Zhou, 2006). Fortunately, the use of relative standards in problem definition may empower individual teachers to grow into autonomous problem solvers by enabling them to target problems of individual concerns or the problems arising from specific learning environments. Thus, it is possible for any event faced by an individual to be perceived as a problem (Turgut & Ocak, 2017) and a teacher needs to decide whether a situation faced by him/her is a problem and whether to engage with it. And, the role of teacher becomes pivotal as a problem definer.

In addition, teacher's definition of a problem may also be affected by affect and contextual factors. On one hand, the word "problem" has a negative connotation suggesting an "unwanted and unresolved tension" (Gardiner, 2008, p. 995), and a teacher may renounce responsibility for a problem to reduce such tensions. On the other hand, Kilpatrick (1985, p. 3) once wrote, "… a problem for you today may not be one for me today or for you tomorrow", implying that besides the differences between belief,

knowledge and affect, the relationship between a teacher and a situation may be affected by the changes in environmental factors and may evolve with time.

Similarly, the meaning of "goal" and "hindrance" in Veenman's definition may vary with teachers and lead to different problem definitions.

To summarize, there are three ways to define a "problem": a lack of ready response, a lack of knowledge because of the presence of cognitive barriers, or the gap between the initial state and goal state of a situation. However, this research stresses teacher's role as a problem definer and considers a problem as the relationship between a teacher and the situation encountered by him/her, namely, a teacher's expectations about the situation. And, the working definition of a teacher's problem is provided as "a situation considered by a teacher as dissatisfied or harmful and as related to his/her teacher identity which needs to be dealt with by him/herself" (c.f. Problem, n. d.).

The problems reported by teachers

Then, what are the problems perceived by teachers? Some studies have been conducted to answer this question. For example, Blum and Valli (1988, p. 184) discovered that beginning teacher problems were isolation, imitation, transfer, and techniques. Hertzog (2000) found that beginning teachers' problems were related to interpersonal relationships, school-related business/routines, classroom management, behaviour management, time management, curriculum planning, and instruction delivery.

Four studies (Veenman, 1984; Gandara, Maxwell-Jolly & Driscoll, 2005; Votava, 2006; Noom-ura, 2013; Moussaid & Zerhouni, 2017) are compared here, but it is only possible to make a broad comparison since these studies are different in many ways (Table 2.1). For example, the participant teachers in these studies were teaching different subjects to primary or secondary school students in different countries.

Table 2.1 Characteristics of the studies on teacher's problems

Author	Year of investigation / publication	Location	School level	Method of investigation	Number of participants	Participants
Veenman	1961-1984	9 countries in North	primary secondary	Review of 83 studies	5-3,588	beginning teachers

		America, Europe and Oceania				
Gandara, Maxwell-Jolly & Driscoll	2005	USA	primary secondary	Questionnaire	5,300	inservice teachers
Noom-ura	2013	Thailand	secondary	Questionnaire	34	inservice teachers
Moussaid & Zerhouni	2017	Morocco	secondary	Teaching journal Teaching reports Mentor feedback	60	preservice trainees

The comparison revealed that more than half of the reported problems were repeatedly reported (Table 2.2) in these studies, suggesting that there may be a group of problems confronting all of those who practice the teaching profession. The existence of such a group of problems is supported by earlier studies: “Whether a study has a careful design or a poor design, whether the sample is small or large, whether the teachers queried are students, beginners, or experienced teachers, the conclusions are remarkably similar” (McDonald & Elias, 1983, p. 4, as cited in Veenman, 1984); “There were no perceptible differences between the studies of the sixties and the seventies or between the studies executed inside and outside the United States.” (Veenman, 1984); “The majority of trainees’ problems … are generally similar to those reported by other researchers in the literature review, …. It can be concluded that … Moroccan EFL beginning teachers’ practicum concerns are comparatively similar to their counterparts elsewhere.” (Moussaid & Zerhouni, 2017).

Though similar problems were reported in earlier studies, it is difficult to decide the extent of similarity in the reported problems since the description of these problems is often brief and important individual and situational information about these problems was not reported, though some studies focused on the relationship between

Table 2.2 Comparison of frequently reported problems in existing studies

	Veenman	**Gandara, Maxwell-Jolly & Driscoll**	**Noom-ura**	**Moussaid & Zerhouni**
Teacher / Teaching	*assessing students' work *organization of class work *planning of lesson and school days *effective use of teaching methods *determining learning level of students *knowledge of subject matter *effective use of textbooks	\	*teaching writing *experiential learning in English classes *minimal use and/or exposure to English *assessment of language skills	*lesson delivery *time management *lesson planning *subject matter knowledge *anxiety and stress *class coverage …
Student / Learning	*classroom discipline *motivating students *individual differences *problems of individual students *slow learners *students of different cultures and backgrounds	*motivating students *variation in student needs *student's lack of skills for required class-work *student's lack of basic readiness to learn	*student's lack of practice on their own *student's lack of English exposure *students' insufficient knowledge and skills of English …	*class control
Curriculum / Teaching materials	*insufficient teaching materials and supplies	*lack of appropriate materials	*impracticality of guidelines *too much coverage *not understood by teachers …	*materials use

Context / Learning spaces, equipment, facilities	*inadequate school equipment	*lack of appropriate tools	*inadequate computers and language labs	*voice projection *classroom mobility
School leaders / Administration	*heavy workload and lack of prep time *burden of clerical work *awareness of school policies and rules *lack of spare time *inadequate guidance and support *large class size	*lack of support from state, federal, district and/or school policy	*lack of native speaking teachers *lack of time for English classes	*practice school *mentor support
Relationship / Understanding, support	*relations with parents *relations with colleagues *relations with administrators	*teacher-student communication *teacher-parent communication	\	\

* 31 (underlined) in 58 problems have been repeatedly reported in the studies

the amount of perceived problems and the variables such as participant teacher's age, experience, gender, personality traits, locality of school, and professional training (as cited in Veenman, 1984). So, it is possible that a problem can have a varying degree of similarities with other problems in a same or different problem category. For example, a real-life problem reported by a teacher as "motivating students" may be approached by other teachers as the problem about "classroom discipline" or "variation in student needs". This implies that a teacher's problem may not be so simple and distinguishable as it seemed in the reports of earlier studies.

In addition, Veenman (1984) proposed that problem was not properly defined in these studies and some of the reported problems were not a true experience but just a teacher's impression or "complaints" and even if the really experienced problems were reported, "one cannot exclude the possibility that the reported problems had only a remote relationship with the real problems of the beginning teachers and might not hamper their functioning at all" (Veenman, 1984).

Thus, the real problems were not pinned down and it is necessary to find them out, but it would be better to focus on the problems that teachers attach importance to because teacher learning should build upon his or her concerns, gestalts, personal strengths and mission (Fullan, 2007). In other words, teachers should be able to choose their priorities when they are confronted by multiple problems so that they can learn by problem solving according to personalized schedules.

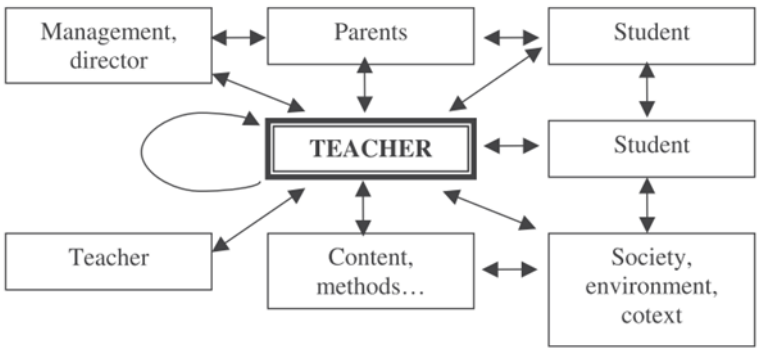
Classification of teachers' problems

The earlier researches about problem solving have provided several typologies of problems and most of these typologies were based on cognitive psychology. For example, there are knowledge-rich and knowledge-lean problems, single-step and multi-step problems, static and dynamic problems, well-defined and ill-defined problems (VanLehn, 1989; Funke, 2010; Greeno, 1978; Jonassen, 1997); there are decision making, system analysis and design, troubleshooting (OECD, 2003); there is a typology of problems on a continuum from well-structured to ill-structured, including story problems, rule using/rule induction problems, decision-making problems,

troubleshooting problems, strategic performance, policy problems, design problems, and dilemmas (Jonassen, 2011); potential problem contexts may comprise personal, work-related/occupational, and civic/social problems (Greiff, et al. 2017). For social problem solving, there are impersonal problems, personal or intrapersonal problems, interpersonal problems, as well as community and societal problems (D'Zurilla, Nezu, & Maydeu-Olivares, 2004).

But interestingly, other typologies were often used for the problems reported by teachers. For example, Veenman (1984) and Gandara, Maxwell-Jolly & Driscoll (2005) ranked the problems by the frequency of report and teacher's ratings of the importance of the problems. Noom-ura (2013) established five problem categories: problems involving teachers, students, curricula and textbooks, assessment, and other factors (such as the lack of computers, native-speaking teachers, and time for English classes) and ranked the problems by teachers' rating scores. Moussaid and Zerhouni (2017) organized problems into seven main themes: teaching methodology, classroom management, getting prepared, reaching out, context of placement, content adequacy, self-concerns and ranked the problems by frequency. Votava (2006) tried to adopt a systematic view and take all important actors and contexts into consideration (Table 2.3). Guerra et al. (2009) identified the personal, academic, financial and professional problems confronting teachers.

Figure 2.1 Classification of problems related to teachers and teachers' practice (Votava, 2006)



These typologies are either based on the frequency of teacher's report, teacher's ratings of problem's importance, the role of all the important actors and context in education, teacher's professional responsibilities, or the aspects of a teacher's life. But these typologies have weaknesses: frequency of report may not lead to the problems that are important to teachers; importance rating may not lead to the problems that a teacher actually deals with; a problem may involve multiple actors and context in education; and it may also involve multiple aspects of a teacher's life. Interestingly, these typologies all centre around the teacher, implying that a typology of teacher's problems can be developed from a teacher perspective because these problems are related to teacher's professional identity. Such a typology should be able to cover various problems defined by teachers, exclude the problems irrelevant to the teaching profession, and be accessible to teachers so that they can use it to facilitate individual and collaborative problem solving.

2.1.2 Teacher's problem solving

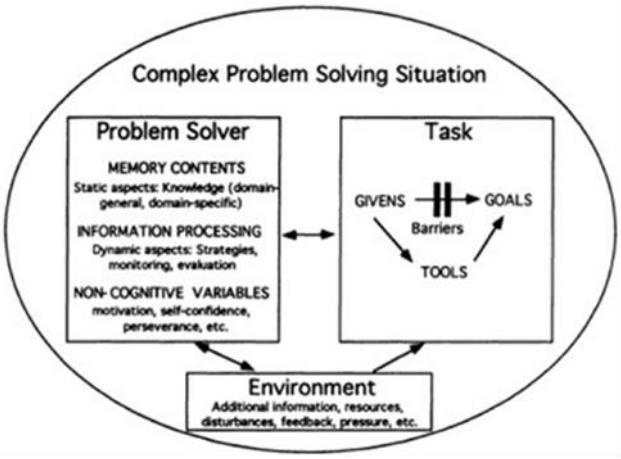
Existing researches have provided the theoretical frameworks for teacher's problem solving; identified teacher's problem-solving strategies and the factors in teacher's problem solving; and investigated teacher's problem-solving skills, beliefs, behaviours, metacognition, self-reflection, collaboration and expert-novice differences.

The theoretical understanding of teacher's problem solving

In 1945, Poyla distinguished four phases for mathematical problem solving: understanding the problem, devising a plan, carrying out the plan and looking back. Since then, a few frameworks have been established to explain the process of problem solving. For example, Frensch and Funke (1995) viewed complex problem solving as a dynamic interaction between a problem solver and a task in the context of an environment. Within the problem solver, there is static memory content, dynamic information processing, and non-cognitive variables such as motivation and personality. The task is depicted by the barriers between a given state and a goal state. The barriers are complex, dynamically changing, and intransparent. Transition from the given state

to the goal state is affected by the problem solver and the tools available to him/her. Environment includes resources available for problem solving, feedback, expectations, cooperation, peer pressure, disturbances, and so on. The environment can affect the problem solver and the task. It can be changed by the problem solver but not the task. (Frensch & Funke, 1995)

Figure 2.2 Theoretical framework for understanding complex problem solving (Frensch & Funke, 1995)

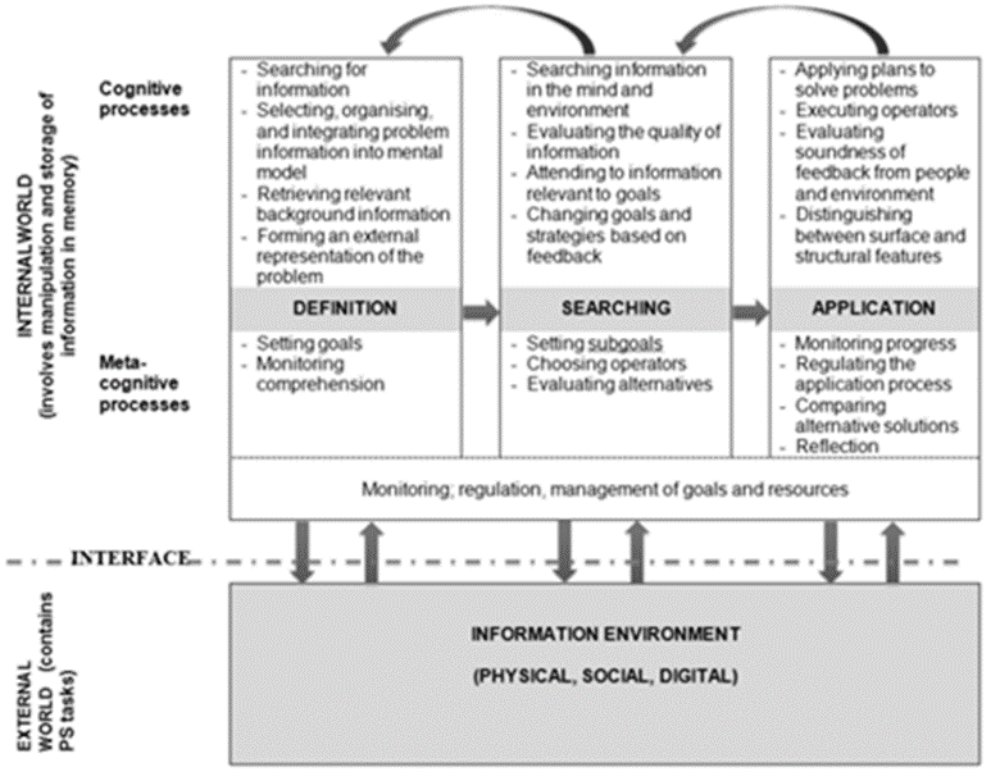


In this framework, the task is separated from the problem solver and the environment. The separation may be applicable to mathematical problem solving but for some problems reported by teachers, such as the problems of “knowledge of subject matter”, “anxiety and stress”, and “the lack of materials”, the task may overlap with the problem solver or the environment and aims to change them.

According to Greiff, S. et al. (2017), there are three major stages for adaptive problem solving: defining a problem, searching for a solution and applying the solution (Gick, 1986; Newell & Simon, 1972; Greiff et al., 2017). In this model, the process of defining the problem requires a person to construct a situation model at the cognitive level. The process requires factual and conceptual knowledge. The model comprises information on the initial state, the goal state to be achieved, the legal operators, and the set of intervening states. These various states make up the problem space. Searching for a solution relies heavily on the knowledge about the problem’s structure, which is

acquired from defining and understanding the problem situation. Finding a solution can involve domain-general and domain-specific problem-solving strategies. In most cases, there will be interplay between searching a solution and representing the problem in a situation model. During the third stage, a problem solver applies plans to solve a problem and executes the specified operators at a cognitive level. The process relies on procedural knowledge. A problem solver needs to monitor the problem-solving progress at a meta-cognitive level. Adaptive problem solving takes place at the interface between a person's cognitive and meta-cognitive processes and the external information environment. This environment consists of the physical, social, and digital world that provides us with resources for problem solving. (Greiff, S. et al., 2017)

Figure 2.3 Conceptual model of adaptive problem solving (Greiff, S. et al., 2017)



This model described the cognitive and meta-cognitive process of problem solving but it did not explain the role of non-cognitive factors (such as a problem solver's belief, motivation, emotion, self-efficacy, personality, perseverance) in the problem-solving process, though non-cognitive factors were believed to be important for problem

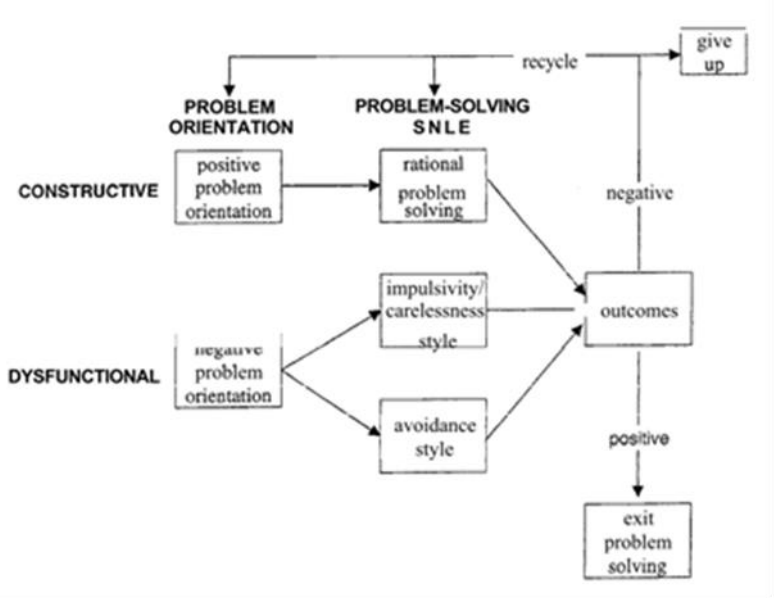
solving (Greiff, et al., 2017, p. 28).

Different from mathematical and cognitive problem solving, social problem solving deals with everyday problems including interpersonal problems and the theoretical framework is different. It was assumed that there are two general, partially independent processes for social problem solving: problem orientation and problem-solving skills (later referred to as "problem-solving proper," D'Zurilla & Nezu, 1999, and then "problem-solving style," D'Zurilla et al., 2002, as cited in D'Zurilla, Nezu & Maydeu-Olivares, 2004). Problem orientation is a metacognitive process involving the operation of a set of relatively stable cognitive-emotional schemas that reflect a person's general beliefs, appraisals, and feelings about problems in living, as well as his or her own problem-solving ability. Problem-solving skills refer to the cognitive and behavioural activities by which a person attempts to understand problems and find effective "solutions" or ways of coping with them. The two problem-orientation dimensions are positive and negative problem orientation, and the three problem-solving styles are rational problem solving, impulsivity-carelessness style, and avoidance style. Problem orientation involves a general disposition to (a) view a problem as opportunity or threat, (b) be optimistic or pessimistic about problem-solving results, (c) demonstrate high or low problem-solving self-efficacy, (d) be willing or unwilling to spend time and effort for problem solving, (e) commit oneself to solving problems or avoid them, and (f) show high or low frustration tolerance. And the four major problem-solving skills are: (a) problem definition and formulation, (b) generation of alternative solutions, (c) decision making, and (d) solution implementation and verification. (Chang, D'zurilla & Sanna, 2004, p. 16)

For Chang, D'zurilla and Sanna (2004), problem solving is different from solution implementation. The former refers to the process of finding solutions to specific problems, while the latter refers to the process of carrying out those solutions in the actual problematic situations. Problem-solving skills are assumed to be general, whereas solution-implementation skills are expected to vary across situations depending on the type of problem and solution. And a person may have good problem-

solving skills but bad solution-implementation skills or vice versa. (Chang, D'zurilla & Sanna, 2004)

Figure 2.4 Schematic representation of the social problem-solving process based on the five-dimensional model (D'zurilla et al., 2002)



Social problem solving expanded the scope of research on problem solving by starting to focus on new problem types such as interpersonal problems. It absorbed the cognitive perspective from earlier models and started to focus on problem orientations and problem-solving styles. However, it sees the impulsivity-carelessness style and the avoidance style as problem solver's dysfunction and ignores their intentions as autonomous problem solvers. In addition, the theory focuses on general problem-solving styles, and it ignores the fact that problem-solving styles may vary with particular problem types and problems.

Like these models, the existing models for teacher's problem solving also stress the cognitive process of problem solving. Votava (2006) borrowed a model from cognitive psychology (Figure 2.4). Toll (2017) proposed a model (problem identification, understanding, deciding and trying) for training after considering the defects of the trial-and-error approach and data-driven approach (Figure 2.5).

Figure 2.5 Problem solving cycle (Sternberg, 2002 as cited in Votava, 2006)

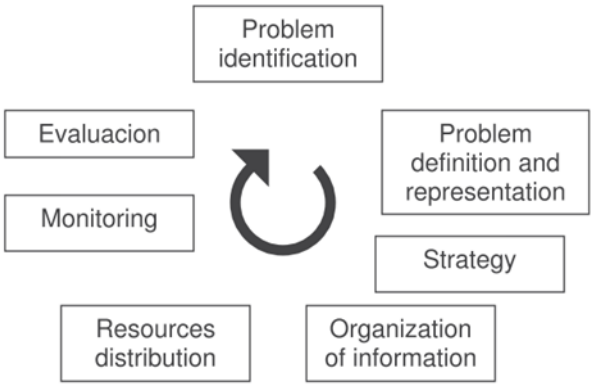
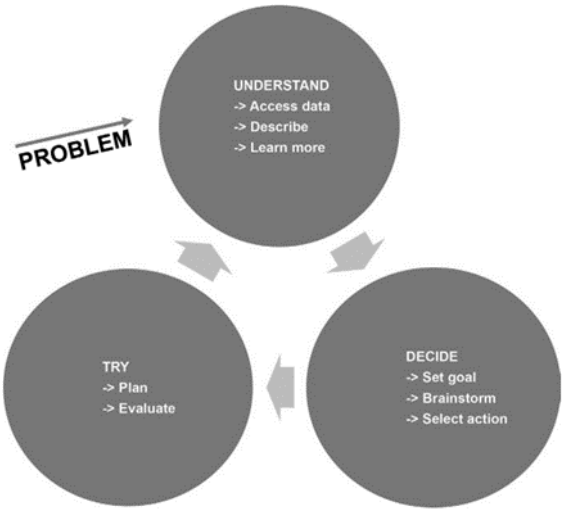


Figure 2.6 The problem-solving model for effective coaching (Toll, 2014; 2017)



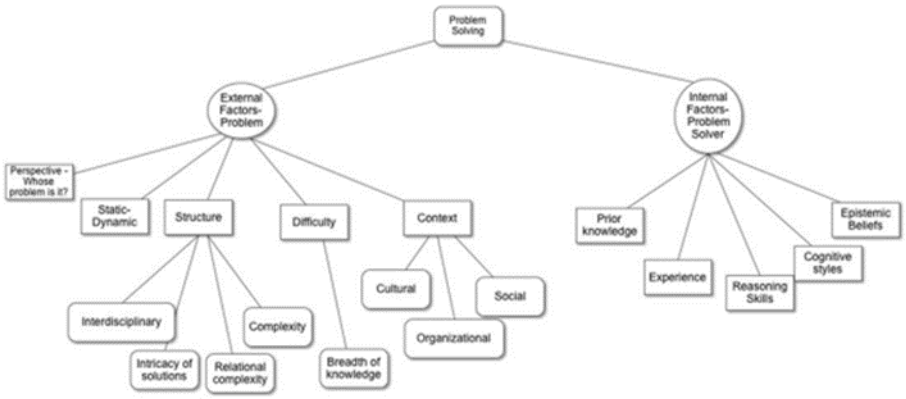
It seems that these models try to explain problem solving in different ways: situational perspective, cognitive process and problem-solving style. The complex problem-solving model stresses the role of the problem solver, the task and the environment in the problem-solving process and the interactions between them. The adaptive problem-solving framework focuses on the cognitive process. But as a mental process, cognition is difficult to be observed and the theoretical models are often based on the hypothetical-deductive approach. The social problem-solving model highlights the problem solver's orientations, styles and problem-solving skills. The positive problem orientation and the rational problem-solving style are assumed to be more

constructive than the other orientation and styles. Interestingly, it seems that the differences between these frameworks are related to the differences between the problems, and these models may not be completely applicable to teacher's problem solving because teachers are facing different types of problems.

The factors in teacher's problem solving

Frensch and Funke (1995) identified internal subject factors including experience, cognitive variables (background knowledge, monitoring and evaluation strategies, cognitive styles, general intelligence), non-cognitive variables (self-confidence, motivation, perseverance, enjoyment; personality and social factors) and external factors including problem structure (semantics, complexity and transparency of the task), problem context and environmental factors (feedback, feedback delay, expectations, cooperation, peer pressure). Jonassen (2011) listed internal factors including learner's levels of prior knowledge, experience, reasoning ability, various cognitive styles, epistemic beliefs, and external factors including perspective (whose problem is it?), dynamicity, structure, difficulty, context of the problem. Greiff, et al. (2017) suggested cognitive precursors (executive control, working memory capacity, monitoring of attention to relevant information, speed and accuracy of perceptual-motor-cognitive operations, activating and using prior knowledge and metacognitive strategy knowledge, and general reasoning skills), noncognitive precursors (achievement motivation, beliefs about content, beliefs about learning, expectancies for success, self-regulation skills, personality attributes, self-concept of problem solving), covariates (literacy and numeracy), problem contexts (that may comprise personal, work-related/occupational, and civic/social problems), and ICT literacy.

Figure 2.7 Factors in problem solving (Jonassen, 2011, p. 97)



Veenman (1984, p. 156) suggested that teacher's problems were related to many personal and situational variables such as gender, age, job satisfaction, attitude, teacher behaviour, experience, concerns, personality traits, student ratings, supervisor ratings, and teacher training. But there may be some other factors (such as student-teacher relationship, parent-teacher relationship, peer relationship, and public ratings of the teaching profession) that can influence teacher's problem solving and it is necessary to find out what are the key factors and how they affect the TPS process.

In addition, researchers have identified five of the most common barriers to problem solving: confirmation bias (Nickerson, 1998), mental set (Luchins, 1942; Wiley, 1998), functional fixedness (Maier, 1931; German & Barrett, 2005), unnecessary constraints (Kellogg, 2003), irrelevant information (Kellogg, 2003).

Greiff, S. et al. (2017, p. 18) explained that bounded rationality is due to the fact that humans' information processing is influenced by a wide range of cognitive and motivational biases (Tversky and Kahneman, 1973) such as availability bias (to accept information more accessible in memory as true), confirmation bias or myside bias (to prefer information that confirms their own views), representativeness bias (to wrongly estimate the frequency of occurrence of features or events), motivational bias (to prefer goals of high personal relevance). But while Tversky and Kahneman (1973) emphasised the errors in humans' information processing that occur due to biases and the use of heuristics, others have emphasised that especially the use of heuristics is what makes humans smart by allowing them to come to fast (albeit possibly biased and sometimes incorrect) decisions in an often complex and uncertain world (Gigerenzer, Todd & the

ABC Research Group, 1999).

Apparently, these barriers are all cognitive, but there are many external challenges confronting teachers (Le Maistre & Paré, 2010; Guerra et al., 2009) and these challenges may bring in external barriers against teacher's problem solving. For example, Hertzog (2000) found that when teachers' lives were dominated by problems with interpersonal relationships, their teaching effectiveness declined. Teachers expressed the need to be considered an accepted member of the school community, describing how membership influenced decisions that affected problems within and outside of the classroom. So, there are some external factors that may influence teacher's problem solving.

Teacher's problem-solving strategies

Many cognitive strategies have been identified for mathematical problem solving. Polya (1945) suggested broad strategies of analogy, auxiliary elements, decomposing and recombining, induction, specialisation, variation, and working backward. Wang and Chiew (2010) made a summary of the approaches (Matlin, 1998; Ormrod, 1999; Rubinstein & Firstenberg, 1995; Wang et al., 2006; Wang & Ruhe, 2007): direct facts, heuristic, analogy, hill climbing, algorithmic deduction, exhaustive search, divide-and-conquer, analysis and synthesis. And there are other cognitive strategies such as: abstraction (Langer, 1953), brainstorming (Osborn, 1953), hypothesis testing (Bellhouse & Stafford, 2001), lateral thinking (De Bono, 1967), means-ends analysis (Simon, 1981), method of focal objects (improved by Whiting in 1958), morphological analysis (Zwicky, 1967; 1969), proof (Carsten, 1989), reduction (Burgisser, 2000), research (OECD, 2015), root cause analysis (Wilson, Dell & Anderson, 1993), trial-and-error (Radnitzky & Bartley, 1987).

For teacher's problem solving, Hew and Knapczyk (2007) assumed that teachers might adopt many solutions such as decision-making, trouble-shooting and instructional design to solve ill-structured problems. Metallidou (2009) found that primary school teachers gave higher ratings for the use of strategies (free production, analogy, step-by-step analysis, visualization, combining) in study problems and lower

ratings in interpersonal problems. Free production was rated as the most useful strategy for interpersonal problems, analogy for practical problems, and step-by-step analysis for study problems. They inferred that the five general strategies might not be representative of the methods people usually employ in order to solve interpersonal problems. Thus, the typical strategies that teachers use to solve different types of problems have not been pinned down, though these strategies are very important because they distinguish TPS from MPS, CPS and SPS.

Teacher's problem-solving skills, beliefs, self-reflection, etc.

There are some researches that focus on teacher's problem-solving belief, behaviour, collaboration, self-reflection, metacognition, expert-novice differences and problem-solving skills.

Hertzog (2000) found that teachers who perceived the fewest problems had the most significant problems in teaching, and vice versa. Stecher and Mitchell (1995) suggested that teachers do not share a common understanding of problem solving and do not agree about which skills are most essential. Differences in their understanding lead to differences in practice.

Jahreie (2010) found that student teachers use conceptual tools, negotiate their meaning, reflect and reconstruct the tools in the process of problem-solving to explain the task. According to Azad, Kim, Marcus, Sheridan and Mandell (2016), teachers displayed more problem-solving behaviours (for children with autism) than parents. Both groups reported engaging in more problem-solving behaviours than they were observed to display during their discussions. They suggested that teacher and parent training programs should include collaborative approaches to problem-solving.

Moss (1997) found that systematic (rather than focused and random) self-reflective elementary school teachers exhibited significantly higher levels of problem-solving model application and a deeper understanding of the problem-solving model and a common language for problem-solving emerged among them. Ng and Tan (2008) found that due to insufficient reflective thinking, the pre-service teachers in an asynchronous online environment are weak in articulating problem space and tend to

go straight to generating solutions without going through the other processes of ill-structured problem solving.

In mathematical problem solving, Becker (1990) found that search for a solution is directed by one main strategy, whereas the partial steps in the framework of the strategy may show great variety. And, situational conditions have unexpectedly high influence on students' selection and assessment of a strategy for mathematical problem solving. Preference given to a strategy arises from familiarity with it by any context of working (recently used strategy), by any "nice" result (even if this may be wrong) or a seemingly smoothly flowing technique. Metallidou (2009) found that in-service teachers seem to have a well-developed conditional metacognitive knowledge as regards the strategy-selection process in interpersonal problems. They seem to have a cumulative experience stored in long-term memory as regards their strategy repertoire and the condition for the appropriate use of these strategies in different kinds of problems and they base their estimations on previously encounters with such problems. Age along with work experience plays an important role in the formation of the beliefs about strategic behaviour. Additionally, culture-depended socialization practices may affect the metacognitive knowledge base about problem-solving strategies. Metallidou and Platsidou (2008) found that there were few and rather small significant correlations between the learning modes (active experimentation, abstract conceptualization, concrete experience, reflective observation) and the metacognitive knowledge about using problem-solving strategies (brainstorming, analogy, step-by-step analysis, visualization, combining) and no significant differences in the learning modes were found between the pre-service and the in-service teachers.

Berliner (2004) found that expert teachers are more sensitive to issues of context, more opportunistic in their pedagogy, and represent problems of practice differently than novice teachers.

By investigating primary school mathematics teachers' self-regulated learning skills, Marchis (2011) found that respondents' problem analyzing and help-seeking skills are low, but their self-monitoring skills are good.

Using the adapted Problem-Solving Inventory (Sahin, Sahin & Heppner, 1993), Yavuz, Arslan and Gulten (2010) found that prospective teachers' problem-solving skill levels are below the average. The skills do not differ according to their departments, but senior prospective teachers' problem-solving skills are higher than the freshman prospective teachers; female prospective teachers have higher problem-solving skills than male prospective teachers; and the ones studying regularly to courses also have higher skills than the ones studying before the exam.

Using the adapted Problem-Solving Inventory (Sahin et al., 1993), Kaya, İzgiol and Kesan (2014) found that teacher candidates' (of elementary mathematics) problem solving skills and approaches (impulsive style, reflective style, avoidant style, problem-solving confidence, monitoring, playfulness) were not affected by gender, family income, settlement (village, town, district, province), leisure activities and region before coming to the university, but the first and third graders used impulsive style more than the second and fourth graders.

Using the adapted Problem-Solving Inventory (Sahin et al., 1993), Temel (2015) found that teachers' (of various subjects) problem solving skills (impetuous approach, considering approach, avoidant approach, evaluator approach, self-assured approach, planned approach) were at medium level (evaluator and planned approach were over high level). The problem-solving skills were related to lesson hours per week, mother's occupation, father's education status, and the sports they do actively, but not related to gender, age, marital status, educational status, professional service year, the place they lived most, secondary education institution they worked, mother's education status, father's occupation, and their active sport type (team sports, individual sports).

Using the adapted Problem-Solving Inventory (Sahin et al., 1993), Bahtiyar and Can (2016) found that sophomore pre-service science teachers' perceptions about their problem-solving skills are lower compared to that of junior and senior pre-service science teachers. Sophomore pre-service science teachers use impulsive approach styles more than junior and senior pre-service science teachers. Freshmen pre-service science teachers present more avoidant approach styles compared to junior and senior

pre-service science teachers.

Using the adapted Problem-Solving Inventory (Savasir & Sahin, 1997), Temel (2016) found that prospective teachers' levels of perceived problem-solving skills (reliance on problem solving skills, approaching-avoidance, personal control) are low in general. They have low levels of efforts and patience and they cannot sustain personal control in solving problems. There is a significant correlation between their levels of perceived problem-solving skills and their traditional scientific epistemological beliefs.

According to the adapted Social Problem-Solving Inventory (Eskin & Aycan, 2009), there are five domains of the social problem-solving process: positive problem orientation (PPO), negative problem orientation (NPO), rational problem-solving style (RPSS), impulsive-careless problem solving style (ICPSS), avoidant problem solving style (APSS). İçen and Öztaskin (2017) investigated preservice social studies teachers' social problem-solving levels and found that year 3 students had higher NPO scores than year 4 students; females had higher NPO scores than males; males had higher APSS scores than females.

Using the adapted Problem-Solving Inventory (Sahin et al., 1993), Turgut and Ocak (2017) found that as teacher candidates' problem-solving appraisal increase, their utilization of motivated strategies for learning decrease in both sexes and in the departments except Elementary Science Education and Early Childhood Education. Problem-solving appraisal predicts utilization of motivated strategies significantly, but problem-solving appraisal and various variables (gender, department, class level) do not have a common effect on utilization of motivated strategies for learning.

Using the adapted Problem-Solving Inventory (Sahin et al., 1993), Mutlu-Göçmen and Güleç (2018) found that primary school teachers' problem-solving skills were at low level. Their problem-solving skills did not differ according to the variables: gender, marital status, age and educational status. Their perceptions of mobbing phenomenon were at "Never" level; and their perceptions were found to be affected by the variable of age. There was a low level of significant relationship between the teachers' perceptions of mobbing phenomenon and their problem-solving skills.

Using the Problem-Solving Inventory (Heppner & Peterson, 1982), place lived, gender, locus of control, and two categories of major are found to be significant predictors of teacher's perceived problem-solving ability. Problem-solving skills develop with age, which may be influenced by such factors as intelligence, creativity, endurance, and the frequency of being confronted with problems (Cakir, 2017).

According to the TALIS and PIAAC survey results of 2012 (by computer-based international assessment), the education sector performs well for information and communication technology (ICT) and problem-solving skills, although it still lags behind the professional, scientific and technical activities sector. Primary and secondary teachers have better ICT and problem-solving skills than the general population, and similar skills to other tertiary-educated adults. In Japan and Korea, however, primary and secondary teachers are over 40 percentage points more likely than other tertiary graduates to have good skills when age is taken into account. (OECD, 2016a)

Tolson (2013) found that culture can influence white female teacher's problem-solving abilities and relationships with black students in mid-western America, and the students' relationship with their education, which will influence agency and self-efficacy.

These researches suggested that though there may be a group of different kinds of problems confronting those who practice the teaching profession, teachers may have different understandings about these problems and may deal with them in different ways. Many researches focused on the assessment of teacher's problem-solving skills, but the findings were different when different assessment methods (i.e. process measures and outcome measures, c.f. Chang, D'Zurilla, & Sanna, 2004) were used. With self-report inventories as process measure, teacher's problem-solving skills were often reported to be low; but their skills were found to be good in online performance tests that highlight the cognitive process (OECD, 2013). Thus, teacher's self-reports of their general problem-solving skills may not correspond with their actual performance in the process of solving particular problems. In other words, a teacher's self-report of general problem-solving skills may not be consistent when different problems or problem types

are taken into consideration.

2.1.3. Support for teacher's problem solving

According to Stansbury and Zimmerman (2000), there are different types of support for teachers such as personal and emotional support, task- or problem-focused support and critical reflection of teaching practice; there are several kinds of specific support strategies including low-intensity strategies (orienting teachers, matching beginning and veteran teachers, adjusting working conditions, and promoting collegial cooperation), high-intensity strategies (selecting and training important support providers, providing release time, mini-courses addressing common challenges, examining the evidence), and additional strategies from abroad (networking new teachers, group observation and advice); the institutional role in teacher support includes early identification of beginning teachers by the personnel office, realistic expectations for beginners, cooperative agreements with unions, coordination of efforts, release time; and the inevitable challenges for support programs include choosing and preparing support providers, providing time for support activities, managing the relationship between beginning teacher support and evaluation, getting resources to struggling teachers.

In fact, many approaches have been developed to provide support for teacher's problem solving, which focus on the training of cognitive and metacognitive skills, mentoring, collaboration, the use of ICT, case method, and authentic tasks.

Cognitive training and mentoring

- teacher education courses and inservice training with experimental intervention instruction focusing at least partially on nine basic encoding processes (Sunal et al., 1989)
- employing reflection and dialogue with colleagues for teaching mathematics as problem solving and professional development (Rickard, 2005)
- the use of satisficing (and with the help of mentors) for beginner teachers to survive the early years of practice (Le Maistre & Paré, 2010)

- the Osborn-Parnes model of creative problem solving taught to preservice teachers as a pro-active measure for enhancing preservice teacher creative problem-solving skills (Pannells, 2010)
- a mentoring approach of cognitive apprenticeship in customization workshop to support teachers perform an expertlike pedagogical problem-solving process (Yerushalmi & Eylon, 2013)
- a holistic problem-solving mentoring approach monitoring teacher self-awareness and self-managed change in the structured mentor-mentee communication; LIBRE (listen and list challenges as experienced, identify a focus, brainstorm options, reality test/developing plausible action responses, encourage the development of a personalized plan to solve the identified concern) model as diagnostic intervention tool for self-exploration, problem solving and decision making (Guerra et al., 2009)

Facilitating parent-teacher and peer collaboration

- the use of peer collaboration to reconceptualize teacher's understanding of classroom problems and generate a variety of successful individual interventions (Pugach & Johnson, 1988)
- task force teams (of education students, cooperating teachers, university supervisors and faculty) using observation/data gathering techniques such as journal keeping and audio and videotaping, worked cooperatively to identify issues which concern neophyte teachers in their initial field experiences (Blum & Valli, 1988)
- problem-solving teams (comprised of teachers, specialists, and administrators) identifying the student problem, developing individualized interventions, and assessing student change (Gregory, 2010)
- RtI (response to intervention) model as a systematic, three-tier, problem-solving approach to school improvement, featuring data-based decision-making (student academics and behaviour performance) and collaborative problem-solving (student success team or student assistance team or teacher

assistance team) (Dulaney, 2010)

- involving parents and teachers together in cooperative problem-solving (Sheridan, 1992)

Using authentic tasks and authentic assessment in teacher education

- the use of authentic tasks in developing preservice teachers' problem-solving perceptions and attitudes towards classes (Kocyigit & Zembat, 2013)
- the use of authentic assessment (self-assessment, group assessment, portfolio assessment, teacher-peer assessment, weekly performance assessment, and student journals) to improve prospective teachers' problem-solving skills (Kinay & Bagçeci, 2016)

Using ICT to facilitate training, mentoring, collaboration and simulation

- applying the online problem-solving knowledge-sharing discussion activity between teachers (Hou, Sung & Chang, 2008)
- (college students') asynchronous online problem-solving discussions without intervention or guidance in a web-based instructional design environment (Hou, Chang & Sung, 2008)
- asynchronous online mentoring and question prompts that can enhance the professional development of both practicum teachers and mentors by helping them learn about and apply intervention strategies in solving real-world teaching problems. (Hew & Knapczyk, 2007)
- a web-based environment (the Cook School District simulation) in which teacher candidates' practice "connecting teaching and learning" using the framework of teacher work sampling. (Girod, 2009)
- "teaching problem archives", an approach of collaborative problem solving in a primary school where a website was established for teachers' problem identification, retrieval and discussion (Gu, 2010)

Case-based training and discussion

- case study instruction as a central component to teacher preparation programs (Heitzmann, 2008)

- supplying field experiences by developing video cases that present a variety of actual teaching situations for developing preservice teachers' higher-order cognitive and metacognitive thinking in pedagogical problem solving (Kale & Whitehouse, 2012)
- the use of a website developed to provide support for student teachers by sharing cases and personal experiences (Hsu, 2004)

These supports can help teachers to become more confident about their problem-solving and decision-making ability, be able to analyse their thinking process, build a genuine collaborative relationship within schools (Blum & Valli, 1988), improve problem identification, promote consistent and systematic behavioural consultation (Sheridan, 1992), increase teachers' understanding of problems, obtain knowledge and skills to solve problems, gain positive attitudes towards teaching as a profession (Hsu, 2004), promote teacher-mentor interaction, improve engagement in task-oriented discussions, maintain greater privacy in an online environment (Ensher et al., 2003; Knouse, 2001; Wade et al., 2001; and Walther, 1992, as cited in Hew & Knapczyk, 2007), assist teacher's knowledge internalization/externalization (Hou, Sung, Chang, 2008), improve teacher's problem-solving perceptions and attitudes towards classes (Kocyigit & Zembat, 2013).

However, there are some limitations to these approaches. For example, beginning teachers must make a number of decisions instantaneously and simultaneously (Le Maistre & Paré, 2010, as cited in Guerra et al., 2009), but often mentoring/induction support lacks clearly defined criteria (Feiman-Nemser, 2001, as cited in Guerra et al., 2009) and does not provide adequate opportunities for novice teachers to develop, dissect, and internalize differing problem-solving and coping skills (Swanson, et al. 1990; Niebrand, Horn & Holmes, 1992, as cited in Guerra et al., 2009). Collaboration becomes difficult because of disengagement, schedule conflicts and changes of personnel (Blum & Valli, 1988). Data-based model may make teacher's decision-making and problem-solving dependent on data collection and analysis tools and procedures; and teachers may become disengaged and unmotivated for problem solving

(Toll, 2017). The problem-based online discussion may be brief or even end without conclusion; learners may experience bottlenecks, such as insufficient information or inadequate deduction (Krajcik et al., 1998, as cited in Hou, Chang & Sung, 2008). School-based preparations for professional practice, such as simulations and case studies, were inadequate replications of workplace complexity (Le Maistre & Paré, 2010, as cited in Guerra et al., 2009). Solving ill-structured problems that pertain to discipline and management of student behaviour can vary widely depending on the circumstance (Hew & Knapczyk, 2007), and skills learned from an authentic task may not be effective while applied to other situations.

This implies that every approach has strengths and weaknesses and the key of providing effective support is to understand the difficulties encountered by teachers during problem-solving process, teacher's needs for overcoming the difficulties, and their choices when supports are available or unavailable.

It is worth noticing that some of these approaches have used the Information and Communication Technologies (ICT) to facilitate teacher's problem solving by establishing an online environment for sharing cases and experiences, building a platform for online communication and collaboration, or providing teacher work sampling, online mentoring and video cases for facilitating online training and teacher education.

ICT is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer, and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning (as cited in Kumar, 2008).

Some researchers believe that ICT can be used to improve education. It helps transform to the learner-centered learning environment by enabling new ways of learning such as active, collaborative, creative, integrative and evaluative learning (Tinio, 2003). It can be used to support knowledge production, collaboration, and knowledge sharing by students and teachers and help them build knowledge

communities, and to support deep understanding of interrelated concepts, address misconceptions, explore systems, solve problems, and connect students and teachers to outside contexts (Kozma, 2005).

ICT has been used to facilitate learning and teaching. For example, Tencent QQ, as one of the most popular instant messaging software in mainland China, has been widely used in resources transmission and sharing, online tutoring, online discussion, building platforms that support distance teaching and learning, improving student's cognitive strategies, promoting teacher reflection, enhancing interaction, class organization, parent-school communication, moral education, interpersonal relationship, psychological healthcare, online interview, online library services, organizing students and teacher's knowledge, teaching assessment, EFL teaching, EFL learning, online communication in English (Huang, 2008; Li, Zhao, Le, Yang & Duan, 2011; Liu, 2013; Lei & Maresova, 2018).

ICT has also been used to improve access to and the quality of teacher training (Tinio, 2003). There are four categories of ICT teacher training forms: ICT use as main content focus of teacher training, ICT use as part of teaching methods, ICT as core technology for delivering teacher training, ICT used to facilitate professional development and networking (Jung, 2005). Teacher educator's innovative use of ICT are influenced by the willingness to keep extensive contacts with colleagues and experts in the area of ICT for professional development, seeing and experiencing the advantages of the innovative use of ICT in his/her education, student-oriented pedagogical approach, ICT competence complied with the pedagogical approach (Drent & Meelissen, 2008). And the new generation of pre-service teachers is increasingly knowledgeable about and skilled in the use of ICT (Martinovic & Zhang, 2012).

But there are some obstacles about integrating ICT and education (Pelgrum, 2001; Tinio, 2003; Kozma, 2005; Lim & Khine, 2006; Livingstone, 2012; Martinovic & Zhang, 2012; Klement, 2017). According to Lim and Khine (2006), teachers may encounter the barriers such as lack of access to ICT (Ertmer, Addison, Lane, Ross, & Woods, 1999), insufficient time to plan instruction and for teachers to familiarize

themselves with ICT (Cuban, Kirkpartrick, & Peck, 2001), inadequate technical and administrative support (Atkins & Vasu, 2000; Sandholtz, 2001), the lack of training provided to teachers in integrating ICT (Rosen & Weil, 1995; Adams, 2005; Cuban et al, 2001; Hunter, 2001), the pressure for students to do well on end-of-course examinations (Lim, 2001), teachers' lack of belief that ICT enhance the learning process (Greenberg, Raphael, Keller, & Tobias, 1998), teachers' belief systems about students in their schools, "good teaching" in their school context and the role of ICT in their student lives (Windschitl & Sahl, 2002; Zhao et al., 2002), teachers' unwillingness to change (Ertmer et al., 1999).

In addition, ICT does not work for everyone, everywhere in the same way (Tinio, 2003). Personal factors (subject matter, teaching experience and gender) are strongly associated with the beliefs and perceptions teachers hold about ICT in education (Jimoyiannis & Komis, 2007).

To conclude, the use of ICT as a tool to provide effective support for teacher's problem solving is possible. ICT can act as an external memory of a teacher (Kouba, 2002, as cited in Klement, 2017) and help teachers to deal with their lack of knowledge very quickly; it can help them to establish various forms of connections with relevant people and facilitate collaborative problem solving; it can be adapted according to problem solvers' and others' schedule and preference; it can act as a powerful and productive tool used directly for the solving of different kinds of problems; it can be used innovatively for sharing in a community to increase the sense of achievement and commitment, and improve problem solvers' efficacy and confidence; it can broaden teachers' horizon and promote teacher learning and development by exhibiting the new trends of education development. Besides, the cost of using popular ICT is low because users already have the necessary equipment, applications, and the knowledges and skills for using them; and services such as maintenance and update will be constantly provided by software companies. However, the use of ICT for supporting teacher's problem solving should not ignore the individual and situational differences between teachers and the contexts of their problem solving, and should focus on the problems

targeted by teachers, the difficulties that arise during the problem-solving process, and the needs of teachers as problem solvers.

2.1.4 Summary

Existing researches on teacher's problem solving focus on the definition, perception, ranking and classification of teacher's problems, the illustration of the cognitive problem-solving process, the investigation of the factors in teacher's problem solving, the assessment of teacher's problem-solving skills, and the development of approaches to supporting teacher's problem solving. These researches have contributed to the current understanding of teacher's problem solving. However, there are some deficiencies.

Problem is often unclearly defined in earlier studies (Veenman, 1984). Most definitions of problem and problem solving start from mathematics (Verderber, Szivak & Vamos, 2016) and are often used in teacher's problem solving without examining the differences between them. In fact, the problems under discussion are different in these problem-solving models (Table 2.3). They arise in different contexts; solving these problems require different knowledges, skills and strategies; the problem-solving process may be influenced by different factors or the factors may affect the process in different ways; and the problem-solving evaluation may be made by different standards. For Example, though both SPS and TPS deal with interpersonal problems, interpersonal problem solving in SPS aims to identify a resolution that is acceptable or satisfactory to all parties involved (Chang, D'zurilla & Sanna, 2004), but the teacher-student relationship is characterized by a subordinate structure that develops towards a way benefiting the teachers who are in a dominant status, although the teacher-student relationship should be equivalent and is not always antagonistic (Shao & Hu, 2018). Thus, interpersonal problems between teacher and student can be based on equivalent, antagonistic, or subordinate teacher-student relationship and a teacher may not aim to discover a solution that is satisfactory to both parties. Anyway, it is believed that the problems encountered by teachers are different from those discussed in earlier models

and that's why a new working definition that stresses the role of teacher as problem definer is provided in this research.

Table 2.3 Examples of problems in different problem-solving models

Types	Example(s)
Mathematical problems	In a room with ten people, everyone shakes hands with everybody else exactly once. How many handshakes are there? (Avcu & Avcu, 2010)
Cognitive problems	choosing a best route for transportation between two bus stops; to find out how the buttons of a MP3 player works (OECD, 2014)
Everyday problems	missing a train to work, an acute illness, repeated unreasonable demands from a boss, repeated violations of curfew by an adolescent, continuous pain, boredom, feelings of loneliness, and interpersonal problems (D'Zurilla, Nezu, & Maydeu-Olivares, 2004)
Teacher's problems	lack of subject matter knowledge, unmotivated students, lack of teaching materials, lack of school equipment, heavy workload, poor relations with parents (Veenman, 1984)

While earlier studies often used questionnaires for investigation and focused on the similarities between teacher's reports, the reported problems were not described in detail and the differences between them were often ignored, which may lead to an inaccurate understanding of teacher's problems and it is possible that teacher's problems are not so definable and distinguishable as earlier studies suggested.

In addition, the frequency of report is more likely to lead to the problems that are regular rather than important to individual teachers. While teacher's importance ratings may be given to the "not-really-experienced" problems, the experienced problems may not hamper a teacher's functioning. Anyway, it is necessary to find out which problems are important to teachers; why are the problems important; and how teachers define situations as their problems.

The existing models of MPS, CPS and SPS may not be completely applicable to TPS, especially in explaining the role of non-cognitive factors and domain-specific strategies. Though the general cognitive process may be similar between them, the actual process of teacher's problem solving was rarely reported in earlier studies, and the complexity, dynamicity and interactivity of teacher's problem solving are hardly

explored.

Many factors in MPS, CPS and SPS were pinned down, but fewer factors in TPS were reported, suggesting that the key factors in TPS have not been identified. In addition, it is important to understand how the factors operate and interact to influence TPS.

Though the general problem-solving skills (i.e. defining a problem, searching for solutions, choosing a solution, implementing the solution, evaluating the results) for MPS, CPS, SPS and TPS may be similar, domain-specific knowledges, skills and strategies are also required for problem solving. These knowledges, skills and strategies constitute the expertise that are critical to the success of TPS, which distinguishes TPS from MPS, CPS and SPS. But earlier studies often used questionnaires or online tests that focused on cognitive (e.g. brainstorming, analogy, step-by-step analysis, combining, visualization) and meta-cognitive skills for the solving of general or simulated authentic tasks, and teachers were unable to report the domain-specific knowledges, skills and strategies they actually used to solve different types of real-life problems.

Many approaches supporting TPS have been developed and tested, but the existing researches often focused on the development of approaches and ignored teacher's initiatives, needs and choices in seeking supports. It is also necessary to focus on the differences of teacher's support-seeking between problems, individuals and contexts. While it is possible to use ICT to provide effective support for TPS, teacher's everyday use of ICT for supporting their problem solving often remains unexplored.

Literature review reveals that existing researches on TPS are greatly influenced by the researches on MPS, CPS and SPS, but the differences between them are often ignored. In earlier studies, problem solving was often understood as a skill that can be learned and improved by the understanding, use and practice of sequenced steps: identifying the problem; brainstorming a variety of solutions; choosing one solution and trying it out; evaluating what has happened (Britz, 1993); the focus is often on the assessment and training of teacher's problem-solving skills; and the lack of problem-

solving skills was often considered to be a deficit or dysfunction. However, teachers may have different understandings about problem solving (Stecher & Mitchell, 1995) and may not understand it as a skill. For instance, they may consider a challenge to be a problem-solving opportunity rather than a problem (Gleockler & Cassell, 2012) or they may not conceive interpersonal problems as "problems" with an initial and a goal state, and a need for certain steps or strategies to be applied to reaching a solution, but as a specific category of ill-defined problems, which are subjected to a decision-making process rather than to the application of specific technical strategies (Guss & Wiley, 2007, as cited in Metallidou, 2009). Problem solving can be learned and improved by the understanding, use and practice of not only the sequenced steps but also the domain-specific knowledges, skills and strategies, and besides general cognitive skills, finding solutions may also require other skills such as social skills and ICT skills. While focusing on the general problem-solving skills, earlier studies often ignored teacher's goals, needs, efforts and choices.

The research on TPS seems to be inadequate. There is not a term referring to the problems encountered by teachers that can be widely accepted. In this research, "teacher's problems" is used to refer to the group of problems encountered by teachers, believed by them to be related to their teacher identity, and chosen by them as their problem-solving targets because other terms seem to be unsuitable for this research. For instance, the term "perceived problems of teachers" cannot distinguish really experienced problems from teacher's complaints; and "teaching problems" or "pedagogical problems" exclude many problems that are not directly related to teaching but are important to teachers and their functioning. Besides, there has been a lack of literature on pedagogical (Verderber, Szivak & Vamos, 2016) and mathematical problem solving (Chapman, 1997; Thompson, 1985; Xenofontos, 2007, as cited in Evans, 2012) from teacher's perspective. There are often just some specific problem-areas (such as problematic students, discipline problems, material or socio-economic difficulties) of educational reality discussed without a systematic view (Votava, 2006). But a systematic view is needed because the problems encountered by teachers may be

interconnected and may interact with each other.

To conclude, some important questions about TPS are unanswered and this research will focus on the following questions:

1). How do teachers define situations as their problems? Presumably, a teacher will face many difficult situations in practice and needs to decide whether a situation is a problem and whether to engage with it. The knowledge about teacher's decision-making can be used to improve the understanding about teacher's problems and to provide the explanation and prediction of teacher's decisions.

2). What strategies are used by teachers to solve the problems encountered by them? Existing researches often use questionnaires or online tests to assess the cognitive skills that are assumed to be important for general problem solving and participant teachers are not able to report the specific strategies needed for the solving of teacher's problems. These are the important strategies that distinguish TPS from MPS, CPS and SPS.

3). How do teachers seek support for overcoming their problem-solving difficulties? When teachers confront difficulties in the problem-solving process, it is assumed that they will try to seek support for overcoming these difficulties. In this research, support-seeking is considered to be an important step in the TPS process. The knowledge about teacher's support-seeking can be used to improve TPS by providing problem-specific, individual-specific, and context-specific support for teachers.

2.2 Rationale of the research

The rationale of this research is based on the following literatures about teacher's problem solving, professional development, and learning:

(Social) challenges can be viewed as problem solving opportunities rather than (toddler) problems (Gleockler & Cassell, 2012) and problem solving provides learning and development opportunities for teachers. Human beings working in the contexts of their schools become the starting point for change processes (Postholm, 2012, as cited in Korthagen, 2017, p. 399). Teachers can provide solutions best suited to a problem because they are in sync with the realities of both teachers and students, but teachers

need to have time, autonomy, support, peer assessment, and leadership support to make greater changes (Sacks, 2013). Regular follow-up support is regarded as an "indispensable catalyst of the change process" (Schifter, Russell, & Bastable, 1999, p. 30). Novice teachers need adequate opportunities to develop, dissect, and internalize differing problem-solving and coping skills (Swanson, et al. 1990; Niebrand, Horn & Holmes, 1992, as cited in Guerra et al., 2009).

Professional development has evolved from the theory-to-practice approach (e.g. by Carlson, 1999) through workplace learning (Avalos, 2011) to the approach that gives the person of the teacher a more central place (Korthagen, 2017, p. 389). The most effective form of professional development is based in schools and is related to the daily activities of teachers and learners (Abdal-Haqq, 1996; Ancess, 2001; Baker and Smith, 1999; Darling-Hammond, 1998; Dudzinski et al., 2000; Ganser, 2000; McLaughlin and Zarrow, 2001, as cited in Kerness, 2014). Professional development is perceived as a long-term process as it acknowledges the fact that teachers learn over time (Villegas-Reimers, 2003, p. 13). The variables that can contribute to the success of teacher development include leadership support (Fullan, 1987), site-based initiatives, respect for teacher learners (Corcoran, 1995), team support (Guskey, 1995), collaborative problem-solving (Hawley & Valli, 1999), sustainable resources (Reid & Kleinhenz, 2015), and integration with school improvement (Ai & Liu, 2018). Teacher development can be viewed as teachers learning, rather than as others getting teachers to change (Bell & Gilbert, 1994).

The process of teacher learning should build upon his or her concerns, gestalts, personal strengths and mission, within the context of their actual work (Fullan, 2007). Teachers learn what they need to know, are autonomous and self-directing learners, draw on their experiences in the process of learning, learn when they are ready, are task- or need-oriented in learning, and respond to external motivators (Konwles et al. 2005).

The competence-based approaches of teacher learning, often rooted in a deficit model, are sometimes ineffective (e.g. Clarke & Hollingsworth, 2002; Guskey, 1986 as cited in Korthagen, 2017), and the core reflection approach based on positive

psychology is proposed for productive teacher learning and the development of competencies (Korthagen et al., 2013). Teacher's learning from everyday experience is described as a process of identifying problems that classrooms present and solving these problems through deliberate reflection, in action and on action (as cited in Yerushalmi & Eylon, 2013).

Based on a socio-cultural perspective, the central components of learning are teacher knowledge, teacher knowing, teaching practices and teacher identity, and reflective writing and online problem-based learning communities can play a key role in affecting teacher identity (Kelly, 2006). Teacher learning is often unconscious, multi-dimensional, and multi-level, and the building of communities of practice and the organising of individual or group coaching, including peer coaching, seem pivotal to success (Darling-Hammond and Richardson, 2009, as cited in Korthagen, 2017, p. 400).

ICT does not work for everyone, everywhere in the same way (Tinio, 2003). Personal factors (subject matter, teaching experience and gender) are strongly associated with the beliefs and perceptions teachers hold about ICT in education (Jimoyiannis & Komis, 2007). There are user, social and technological perspectives on the use of ICT tools in education (Klement, 2017). The user perspective may overestimate the strength and self-reliance of the participants (Kanuka, 2012, as cited in Klement, 2017).

From these literatures and the literatures listed in earlier sections, the rationale of this research is established as:

- **Teacher-centeredness**: this research will focus on teachers because they take the central role of problem definer, problem solver and support seeker in the process of problem solving;
- **Problem-orientation**: this research will focus on specific problems because the problems can reveal the real relationship between individual teachers and the specific situations encountered by them;
- **Strategy-implementation**: this research will focus on the real strategies used by teachers for problem solving because these strategies distinguish TPS from MPS,

CPS and SPS;

- **Support-seeking**: this research will focus on teacher's support seeking because it is assumed that they will actively deal with the difficulties encountered in the process of problem solving rather than just wait for help;
- **ICT-assistance**: this research will focus on teacher's use of ICT as an optional tool to facilitate problem solving because ICT can be used to provide problem-specific, individual-specific, and context-specific support for teacher's problem solving.

In addition, this research will adopt a holistic view because it is assumed that there are interconnections and interactions between teacher's problems that may affect the problem-solving process. This research will also focus on the differences between problems, problem types, individuals and contexts.

This research tries to advocate a shift of focus from the frequency of reported problems (quantitative research perspective) to the personal meaning of problems (qualitative research perspective), from general problem-solving skills (rational perspective) to domain-specific knowledges, skills and strategies (pragmatic perspective), from the development of support approaches (instrumental perspective) to the understanding of teacher's problem-solving goals, difficulties, needs, and choices (humanistic perspective).

2.3 Education, teachers and ELT in China

This research will focus on the problem solving of ELT teachers from the upper secondary schools in China. What follows is an introduction of the education system in China, the general situation of education, teachers and ELT, and some issues related to teachers' problem solving and the support for it.

The education system and the general situation of education

The school system in China consists of preschool (age 3-5), primary school (6-11), lower secondary (12-14) and upper secondary school (15-17), university and vocational college (18-21), Master's (22-24) and PhD programs (25-27) (OECD, 2016b).

Completion of lower secondary education marks the end of a 9-year (6+3)

compulsory education program. To obtain a certificate of graduation from lower secondary schools, students are required to pass graduation examinations and meet minimum physical education standards, commonly known as Zhongkao (中考) in China. (Education system in China, n.d.)

After Zhongkao, students can choose to enter either general (academic) upper secondary school or vocational upper secondary school. Graduates of upper secondary schools seeking admission to tertiary education are required to take the National Higher Education Entrance Examination, also called National College Entrance Examination (NCEE), commonly known as Gaokao (高考) in China. (Education system in China, n.d.)

In 2018, according to the Ministry of Education (MoE), there are 13,700 general upper secondary schools with 23,753,700 students and 1,812,600 teachers in China. 98.78% of these schools have access to the Internet. 88.13% of the schools have equipped psychological counselling room. 92.1% of the teachers have a bachelor's degree or above. The gross enrolment ratio (GER) of lower secondary education is 100.9%; GER of upper secondary education is 88.8%; and GER of tertiary education is 48.1%. (Chen, 2019)

Education reforms have been adopted to narrow the rural-urban gap and regional differences in education, reform curriculum at all levels and focus on creativity, reduce the role of standardised testing and Gaokao, and strengthen educational inspection. (OECD, 2016b)

Education in rural areas

Traditionally, China's urban and rural areas were equal and united, with the former as political centre and the latter as production centre. In rural areas, education was completed by many small private schools funded by local squires. The graduates went to cities to serve as officials and returned to home villages upon retirement. In modern times, with the collapse of the Qing dynasty and the invasion of western countries, rural areas were plundered and suppressed by capitalists and bourgeois in cities. Modern education system was introduced into rural areas. However, the graduates did not inherit

the traditional philosophy valued in rural areas and could not serve as the countryside needed. Education in urban and rural areas were separated and rural education lagged behind. Compared to traditional private schools (e.g. funded by village or clan), modern schools required tuition fees. The poor dropped out of school and the illiterate rate rose in rural areas. As a result, traditional social structure collapsed and an era without scholar-officials began in rural areas. From 1949 to 1978, a lot of primary and lower secondary schools were established in rural areas to achieve the goal of "school in every hamlet, school near home, primary school within hamlet, and secondary school within village". From 1978 to 2000, limited education funds were largely invested in higher education, key schools, and obligatory education in cities. In rural areas, obligatory education was supported by multi-channel fundraising. As a result, every hamlet had primary schools and every village had secondary schools, but schools were small, teachers were inadequate, and the quality of education was low. From 2000 to 2015, in order to improve the situation, there was a redistribution of schools in rural areas: "no primary schools within hamlet, and no secondary schools within village", and a lot of government funds were invested into rural areas for tuition fee exemption, living subsidies, establishment of boarding schools, renovation of dilapidated school buildings, extension of obligatory education, eradication of illiteracy and distance education. As a result, there were less and less schools in rural areas. Many students went to towns and county level cities for education. The idea that "schooling is useless" became popular in rural areas and many students dropped out of school and wanted to leave the rural areas and agriculture. (Rao, Ye, & Guo, 2015)

The well-being of primary and secondary school teachers

A study of over 2,000 teachers showed that primary and secondary school teachers averagely work 52.54 hours per week, including 44.11 hours in workdays, 4.84 hours on the nights of workdays, and 3.59 hours at the weekends. In average, they teach more than one subjects (often including those they are not trained to teach) to 96 students in 2 classes and undertake non-teaching tasks with strong aversion (such as conferences, paperwork and study notes for superior inspections, which have nothing to do with

classroom teaching and learning). They don't have time for reflection and reading. 80% of the teachers think their workload is heavy; 44% think they can only manage to finish part of their job; 59% think that the burden of non-teaching tasks is heavy; 86% think that heavy workload influenced their health on an intermediate level and above; only 28% are satisfied about the current workload. (Li, 2016)

Based on a survey of over 7,000 teachers across 12 provinces in 2015, Yang and Zhao (2017) found that there are great differences in teacher income in primary and lower secondary schools. Teachers in the east (73% of teachers' income is above 4,000 CNY per month) have higher income than those in the west (15%) and central China (6%). Teachers in the urban areas have higher income than those in the rural areas, for example, in a city in east China, the rate can be 8:1; in a province in west China, the rate can be 3.8:1. Few teachers rate teacher's social status above average: the east (7%), the west (7%), central China (3%), and most teachers rate it below average: the west (64%) and central China (64%). Many teachers expressed a strong willingness to leave the teaching profession: the east (26%), the west (41%), central China (41%). (Yang & Zhao, 2017)

The transformation of teacher-student relationship

In ancient China, the teacher-student relationship was influenced by some Confucian ideas (such as "worship for heaven, earth, monarch, ancestor and teacher", and "respect teacher and value his teaching"), limited source of acquiring knowledge (such as teachers and classical books), and imperial civil service examination system that strengthened the authority of teachers. As a result, the dignity of teachers and the absolute obedience of students were advocated. In modern times, the teacher-student relationship is influenced by the reform of employment from "national job assignment" to "two-way selection" (between job applicants and employers), the reform of education payment from government-paid to student-paid, multiple ways of acquiring knowledge in the information era, one-child policy and the law of minor protection. As a result, students have gradually established the sense of having dialogues on an equal footing with teachers. And, the conflicts between teachers and students occur. (Wu, 2013)

While Wu (2013) suggested teachers to change their mind and improve teacher-student relationship by learning and research, Li (2012) believed that in the context of modern mechanism, teacher-student relationship is contract-orientated and means alienation and suggested to learn from ancient times, when, in the context of classical teleology, the relationship (intimacy, kindness, equality, mutual respects and reverence for teachers) is partner-oriented and means fraternity. Inspired by Habermas' communicative action theory, Du (2018) suggested that it is possible to establish a communicative relationship between teachers and students through the dialogue interactive relationship mode and interactive cooperative teacher-student relationship mode.

Shao and Hu (2018) argued that the interaction between teachers and students should be equivalent, but in practice it is characterized by a subordinate structure. Under such a structure, the teacher-student relationship always develops towards a way that benefit the teachers who are in a dominant status. However, there is not always an antagonistic relationship between teachers and students. Ai (2017) explained that the relationship between teachers and students is not a simple parallel relationship of the master and the subordinate, the center and the periphery, but a symbiotic relationship of collaborative dependence, interactive feedback, and joint promotion.

Public opinion about teacher's corporal punishment behaviors

In china, corporal punishment is prohibited by *Compulsory Education Law* (2006), *Teachers Law* (1993) and *The Law of Minor Protection* (1991). However, corporal punishment has a long history in China's education and many people are committed to the doctrine that teachers should inflict proper punishment on disobedient students. And, the laws didn't distinguish corporal punishment from discipline or proper disciplinary behaviors from improper ones. As a result, the public opinion is divided. For example, about an incident in 2015, 33% of the netizens' comments supported the teacher's corporal punishment behavior, 29% rejected it, and 38% remained neutral. (Wu, Zhang, Xu, Liu & Long, 2016)

From 2011 to 2015, 119 incidents about teacher's corporal punishment in primary

and lower secondary schools were exposed by influential Internet media, became a hot issue that attracted public attention and was followed by the enforcement of *Treatment Measures against Teachers' Violation of Professional Ethics in Primary and Secondary Education* (2014). While the exposure helped to enhance the legislation on punishment in education and the supervision of school education by the public, punishment (and sometimes even discipline) in education was condemned and disapproved by angry parents and cautious school leaders. Some teachers became afraid to discipline students and the justified right to discipline was lost. (Zhou, Yuan, Yang, Peng & Jiang, 2017)

A study of 903 teachers illustrated this negative influence on teachers:

Table 2.4 Teachers' right to discipline students in primary and secondary schools (Liu, 2016)

Statements	Agreed	Unsure	Disagreed
Teachers have the right to discipline students.	56%	15%	29%
Teachers should discipline students who violated school rules.	69%	7%	23%
I will discipline students when they violated school rules.	21%	60%	18%
I think that "I do not dare to discipline students; I'm afraid to get in trouble".	68%	8%	24%
I can clearly distinguish between "discipline", "corporal punishment" and "disguised corporal punishment".	40%	28%	33%

In addition, when discipline students in a strict manner, teachers' greatest concerns include students' overreactions (41%) and parents' overreactions (38%). About whether teachers can find corresponding measures in school rules against students' misbehaviors, the answer is no on most occasions: completely yes (2%), mostly no (55%), completely no (24%). (Liu, 2016)

According to *Regulations of Class Teacher in Primary and Secondary Education* (2009), teachers have the right to criticize students. According to *Nine Departments' Guidance on Preventing and Dealing with Bullying and Violence in Primary and Secondary Education* (2016), teachers have the right to discipline bullying and violent behaviors. *Qingdao Primary and Secondary School Management Measures* (2017) is

the first regulation that designated teacher's right to appropriate disciplinary behaviors. Teachers have different beliefs about education. On the premise that they abide by the laws and code of ethics, teachers are justified to hold different ideas and adopt different forms of and contents for student management. (Huang, 2018)

The blurring of teacher's moral boundaries

There is a blurring of teachers' moral boundaries (the boundary between teachers' personal, professional and public morals, as well as the uncertain state of ideal morals and the boundaries of moral baseline) influenced by moral tradition (the use of personal morals as the basis of professional and public morals), the professional characteristics of teachers (the history of requiring high moral standards for the profession) and the particularity of teachers' practice (the extension of teaching practice into personal and public life). For example, *Primary and Secondary School Teachers' Professional Ethics* (2008) specifies not only teacher's professional ethics but also family virtues and public morals; the article about "teacher's reception of gifts from student" in *Treatment Measures against Teachers' Violation of Professional Ethics in Primary and Secondary Education* (2014) overlaps with *Criminal Law* (2011); the baseline moral standards such as "patriotism and observance of law" is described as an ideal moral in *Primary and Secondary School Teachers' Professional Ethics* (2008). This blurring of teachers' moral boundaries induced problems such as the confused principle of teachers' moral evaluation, the void of responsibility, and the excessive high standard of teachers' morals. (Deng & Wu, 2018)

Liu (2017) distinguished two types of morality: introverted (marked by self-discipline and self-sacrifice as the common standard for the whole society) and extroverted (marked by social justice for respect and protection of individuals).

Traditional teacher's morality is introverted. According to it, teachers are above the "normal" standard. They embrace self-discipline, learning and reflection for the sacred mission of education, which features creation, bestowment and sharing. The purpose of teacher's morality is to reveal personality and diversity.

Modern teacher's morality of "normal people" is extroverted: teaching is just a

profession for making a living, a service that can be bought at a fair price (though it is difficult to decide what price is fair); teachers are “normal people” and should have “normal” moral standards; sacrifice in education is unnecessary, abnormal, dubious and despicable. Teacher’s “normal people” morality is enhanced by reliance on education techniques and contractual interpersonal relationship.

Education techniques are tested by scientific methods and their effectiveness is guaranteed, meaning that effects of education are irrelevant to teacher’s attitude, particular teacher-student relationships, and individual differences between students. So, education techniques replaced teacher’s purposes and became the principal reason for the effects of education. Meanwhile, teachers and students use techniques as intermedium to interact with each other. As a result, they are both confined by techniques.

Contractual interaction is preferred by modern people because of the need for self-protection and assured results. Students became customers who purchase knowledge from teachers. The seller-buyer relationship is fair and free. Teachers don’t need to be noble. They are more concerned about the specification of responsibilities and rewards, rather than what kind of person students and themselves will be.

In fact, uncertainty is an important feature of education. The value of education cannot be calculated. No method, model, rule or technique can tell us when is “the right moment to educate”, but the moment will reveal itself in a practical situation in a natural way. Specification of how to teach may eliminate the possibility of growth. The effects of education cannot be controlled by scientific methods. Statistics can be used to define students, but teachers can choose whether to accept the results. Only based on the close connection with students, techniques of education can be used properly and flexibly, and education can be effective. The modern requirement of “contract” and “promise”, which is based on distrust between people, is a doubt about and insult to traditional teacher’s morality. Education means intimate connections between teachers and students. They are a symbiotic community of growth. The relationship between them is not technical and contractual employment, but communication in life. Communication

with individual students requires courage.

Every teacher is unique. Teachers should not be contended with being “normal”. They should be brave to challenge the “normality”, make sacrifices and extra efforts, even if they are scorned and suppressed for not being “normal”. Teacher need to deal with harm to the students, injustice, conflict of values and deviated education, not by scientific methods or techniques, but by teacher’s devotion, courage, empathy, loyalty, righteousness, generosity and sacrifice for education and students. (Liu, 2017)

Liu’s observation is very insightful, but the historical background of teacher’s morality was ignored. With the need for more and more people to join the teaching profession in modern China, traditional teacher’s morality is facing the challenges brought about by profound social, economic and technological transformations.

The observation about “normal people” morality revealed that there may be a trend unfavorable for strengthening teacher’s morality and social status, but the “normal people” morality may not necessarily indicate the degeneration of teacher’s morality. A teacher may need to adopt “normal people” morality for self-protection when he/she believes that there is the lack of necessary support, inequality, or injustice. In such a case, the need for the explanation that teacher is “normal people” just reveals that the teacher does not completely give up high moral standards. Or else, the explanation is not needed at all. So, the teacher may adopt higher moral standards as long as he/she is protected, trusted and supported to be a better teacher.

The relationship between the “normal people” morality and the traditional teacher’s morality may not always be antagonistic. It is reasonable for teachers to establish personalized moral standards that conform to the national and professional ones and the different stages of professional development since teacher’s morality aims to reveal personality and diversity (Liu, 2017). Anyway, the growing need for a large number of teachers presents a great challenge to the current teacher education system.

General situation of English Language Teaching

From 1949 to 2009, the curriculum of ELT for primary and secondary schools has changed from learning English as a tool to the learning of English culture and cross-

cultural communication, from grammar translation method to audio lingual method and communicative language teaching, from the learning of oral speaking to reading skills, from teacher-centered classroom to student-centered and ICT-assisted classroom, from only one self-compiled textbook to multiple choices including imported textbooks. (Zhang, 2009)

According to Lv's (1999) comparison of ELT curriculums in primary, secondary and tertiary education, there were conflicted objectives in these curriculums, the role of language use in teaching was ignored, class hour arrangement was not proportional to curriculum objectives, vocabulary was repeated in the curriculums from primary to tertiary education (41-55%), grammar was also repeated in secondary and tertiary education.

Before 2001, there was no national ELT curriculum for primary schools, and they could offer ELT courses according to their conditions and plans. After the publication of *Experimental Version of English Curriculum for Chinese Primary and Secondary Schools* (2001), many primary schools started to teach English since the third grade, but there were still schools that could not offer ELT; the objective of ELT was unclear in some primary schools; and some schools valued the development of pupils' interests and emotions over their language abilities. As a result, pupil's English was usually poor and varied when they entered lower secondary schools, where textbooks were more difficult, emphasis was laid on reading and writing skills, and teaching methods changed accordingly. (Li, 2004; Liu, 2012)

A study (Du, 2013) investigated the anxiety of 68 non-English major students from 15 ethnic minorities and found that they experienced greater anxiety than students from the Han ethnicity when learning English, and they experienced high level of anxiety over test (46%), listening comprehension (43%) and communication (22%). The reason is that education and economy in ethnic minority areas lagged behind: students often started to learn English since lower secondary schools; listening was not included in NCEE for them; they could have 30-50 bonus points in NCEE; there were many important English exams related to graduation and employment, which added to their

stress and anxiety.

Since 2010, MoE invested in national training programs which provided short-term, long-term and distance training for ELT teachers in primary and secondary schools in rural areas. (Wang, 2013)

According to Cheng and Sun (2010), the problems of pre-service training of ELT teachers include: less education courses (15%) than language courses (37%), (which was caused by the bias that ELT was not a major, teacher education colleges' need to survive, and the opinion that the key of ELT teacher training was language and academic skills), low quality of training (which was caused by separation and opposition between learning English and learning how to teach English, uncertainty about the objectives of training teaching skills, lack of education courses, applied linguistic courses, practicum opportunities, etc., and trainers' lack of teaching skills), separation from the reality of ELT in primary and secondary schools (which was caused by the emphasis on abstract pedagogical knowledge, limited time and opportunity for practicum, and separation between teacher education colleges and primary and secondary schools), a number of non-teacher graduates as novice ELT teachers.

The problems of in-service teacher's professional development include: lack of an integrated support system for teacher's professional development (such as lack of in-service training, lack of research on in-service teacher training, lack of cooperation between teacher education colleges and primary and secondary schools), teacher's lack of awareness for professional development, disadvantages for teacher's professional development (such as lack of time, heavy workload, lack of training, high pressure in school, lack of opportunities for studying abroad, limitation on pursuing in-service degree programs and off-the-job training, teacher's doubt about research's influence on teaching), and lack of support for teacher's professional development (such as lack of expert trainers, training courses and materials). (Cheng & Sun, 2010)

Gao's (2016) investigation of 28 secondary school ELT teachers enrolled in the part-time degree program of Master of Education revealed that their research abilities were still weak because of heavy workload, lack of research atmosphere and platform,

and lack of training for research. They did not enroll in the program for the development of research abilities, but for promotion along the professional ranks. They believed that the best way to improve professional skills were not degree programs but learning from experienced elite teachers, reading professional books, and communicating timely with peers. The results revealed that there was still a lot that needs to be done to integrate degree program, professional development and teaching practice.

In summary, the current situation of education in China is based on her unique history, culture and tradition; geographical, economic and ethnic diversity; impact of social, economic and technological transformations; and conflicts in the philosophies, theories and perspectives on education. The complexity presents difficult cultural, regional, legal, economical, curricular, interpersonal and moral challenges to Chinese teachers. Meanwhile, it provides an overall context for teacher's problem solving and a background for us to understand it.

However, while MoE, schools, researchers, teacher education colleges, private education institutions or companies, and the public, etc. are making efforts to improve the situation, how do teachers deal with the challenges is a very important but often ignored question.

Part III Research methodology

Earlier researches often consider teacher's problem solving as a skill, competence, or ability, focus on the assessment and training of general cognitive and meta-cognitive problem-solving skills, and adopt prescriptive method for research. The disadvantage of the method is that the complexity of problem solving and the role of non-cognitive factors may be ignored. Therefore, this research adopts descriptive method and teacher perspective for research and focuses on how teachers define challenging situations as their problems, what kind of domain-specific strategies they use, and how they seek supports for overcoming the problem-solving difficulties.

3.1 Research design

Based on the objectives of research and the result of literature review, pragmatism, mixed methods approach and corresponding data collection and analysis methods were considered to be effective for answering the research questions.

Research paradigm

The choice of paradigm sets down the intent, motivation and expectations for a research, and without nominating a paradigm as the first step, there is no basis for subsequent choices regarding methodology, methods, literature or research design. (Mackenzie & Knipe, 2006)

Research paradigm may be defined as "a loose collection of logically related assumptions, concepts, or propositions that orient thinking and research" (Bogdan & Biklen, 1998, p.22) or the philosophical intent or motivation for undertaking a study (Cohen & Manion 1994, p.38). There are different paradigms discussed in the literature: positivist (and postpositivist), constructivist, interpretivist, transformative, emancipatory, critical, pragmatism and deconstructivist (as cited in Mackenzie & Knipe, 2006).

Among these paradigms, pragmatism is not committed to any one system of

Table 3.1 Comparison of research paradigms (as cited in Patel, 2015) (c.f. Lincoln & Guba, 2000)

Paradigm	Positivism	Constructivist / Interpretive	Pragmatism	Subjectivism	Critical
Ontology	There is a single reality of truth.	There is no single reality or truth. Reality is created by individuals in groups.	Reality is constantly renegotiated, debated, interpreted in light of its usefulness in new unpredictable situations.	Reality is what we perceive to be real.	Realities are socially constructed entities that are under constant internal influence.
Epistemology	Reality can be measured, and the focus is on reliable and valid tools to obtain it.	Reality needs to be interpreted, to discover the underlying meanings of activities and events.	The best method is one that solves problems. Finding out is the means. Change is the underlying aim.	All knowledge is purely a matter of perspective.	Reality and knowledge are both socially constructed and influenced by power relations within society.
Theoretical perspective	Positivism Post-positivism	Interpretivism: Phenomenology, Symbolic interactionism, Hermeneutics, Critical inquiry, Feminism	Deweyan pragmatism Research through design	Post-modernism Structuralism Post-structuralism	Marxism Queer theory Feminism
Methodology	Experimental research Survey research	Ethnography, Grounded theory, Phenomenological research, Heuristic inquiry, Action research, Discourse analysis, Feminist standpoint research, etc.	Mixed methods Design-based research Action research	Discourse theory Archeology Genealogy Deconstruction, etc.	Critical discourse analysis Critical ethnography Action research Ideology critique
Method	Usually quantitative, could include: Sampling, Measurement and scaling, Statistical analysis, Questionnaire, Focus group, Interview	Usually qualitative, could include: Qualitative interview, Observation, Case study, Life history, Narrative, Theme identification, etc.	Combination of the any above and all, such as data mining, expert review, usability testing, physical prototype	Autoethnography Semiotics Literary analysis Pastiche Intertextuality, etc.	Ideological review, Civil actions, Open-ended interviews, Focus groups, Open-ended questionnaires, Open-ended observations, Journals

philosophy or reality (Mackenzie & Knipe, 2006). For pragmatists, truth is what works at the time and research always occurs in social, historical, political, and other contexts. (Creswell, 2014). Reality cannot be accessed solely by virtue of one single scientific method (Mertens, 2005, p.26). All methods that are most likely to provide insights into the question will be used because the pragmatic paradigm places "the research problem" as central (Creswell, 2003, p.11, as cited in Mackenzie & Knipe, 2006). So, pragmatism opens the door to multiple methods, different worldviews, different assumptions, as well as different forms of data collection and analysis, and individual researchers have a freedom of choosing the methods, techniques, and procedures of research that best meet their needs and purposes (as cited in Creswell, 2014).

This research adopted pragmatism for several reasons. First, it is believed that there can be different views about the reality of teacher's problem solving. Secondly, this research aims to seek the knowledge of teacher's problem solving according to the contexts in which problem solving occurs. Thirdly, it is believed that mixed research methods can be used to provide multiple perspectives for understanding teacher's problem solving.

Research approaches

According to Creswell (2014), research approaches are plans and the procedures for research that span the steps from broad assumptions to detailed methods of data collection, analysis, and interpretation. A research approach involves three components: research paradigms, research designs and research methods, and the following paragraphs will discuss the research designs.

The three research approaches are qualitative, quantitative, and mixed methods. The selection of a research approach is based on the paradigm of the research, the research design related to the paradigm, the specific research methods, the nature of the research problem or issue being addressed, the researchers' personal experiences, and the audiences for the study (Creswell, 2014).

Table 3.2 A summary of quantitative, qualitative and mixed methods research approaches

(Creswell, 2003; Bird, 2009; Creswell, 2014)

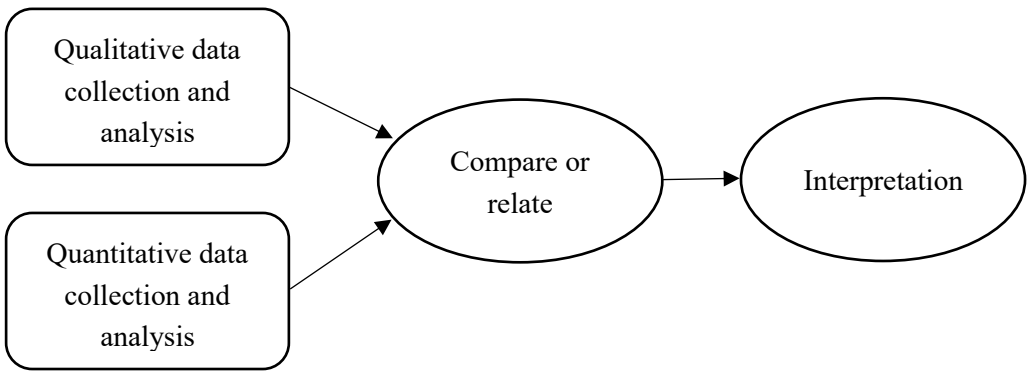
	Quantitative	Qualitative	Mixed methods
Philosophical assumptions	● Postpositive knowledge claims	● Constructivist, transformative knowledge claims	● Pragmatic knowledge claims
Strategies of inquiry	● Experimental designs ● Non-experimental designs, such as surveys	● Narratives ● Phenomenology ● Ethnographies ● Grounded theory ● Case studies	● Sequential ● Concurrent ● Transformative
Specific research methods	● Predetermined ● Close-ended, instrument based questions ● Performance, attitude, observational, and census data ● Statistical analysis ● Statistical interpretation	● Emerging methods ● Open-ended questions ● Interview, observation, document, audiovisual data ● Text and image analysis ● Themes, patterns interpretation	● Both determined and emerging methods ● Both open- and close-ended questions ● Multiple forms of data drawing on all possibilities ● Statistical and text analysis ● Across database interpretation
Motivations for selection	● Test a theory of explanation ● Identify factors that influence an outcome ● Understand the best predictors of an outcome	● Understand a concept or phenomenon due to insufficient or new research ● Identify unknown variables	● Generalize findings to a population whilst developing a detailed explanation of the concept or phenomenon

Mixed methods research is an approach to inquiry involving collecting and integrating both quantitative and qualitative data, and "the core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone" (Creswell, 2014). In this research, mixed methods was adopted because 1) pragmatism is seen as the paradigm that provides the underlying philosophical framework for mixed methods research (Tashakkori & Teddlie, 2003; Somekh & Lewin, 2005, as cited in

Mackenzie & Knipe, 2006); 2) the answer to the research questions should be based on the combination of qualitative and quantitative data, i.e. an integrated explanation of teacher's attitudes, opinions and performances in problem solving.

Research designs are types of inquiry within qualitative, quantitative, and mixed methods approaches that provide specific direction for procedures in a research (Creswell, 2014). There are many mixed methods designs such as convergent parallel, explanatory sequential, exploratory sequential, transformative, embedded, and multi-phase mixed methods (Creswell, 2014). In this research, convergent parallel mixed methods was adopted so that qualitative and quantitative data can be analyzed separately, and the results can be compared to see if the findings confirm or disconfirm each other (Creswell, 2014). The key assumption of this strategy is that both qualitative and quantitative data provide different types of information - often detailed views of participants qualitatively and scores on instruments quantitatively - and together they yield results that should be the same (Creswell, 2014), but this research highlights the assumption that teachers can have multiple understandings about problem solving, which may vary with many factors such as problem types, and individual and contextual differences, and qualitative and quantitative approach can be combined to present a more complete picture of TPS from teacher's perspective.

Figure 3.1 Convergent parallel mixed methods (Creswell, 2014)



While combining qualitative and quantitative approaches, narrative research was adopted as the qualitative strategy and survey research as the quantitative strategy.

Narrative research is a design of inquiry in which the researcher studies the lives of individuals and asks one or more individuals to provide stories about their lives, and the information is often retold or restoried by the researcher into a narrative chronology (Creswell, 2014). This strategy was used so that teachers can give a detailed report of their problem-solving process, which contains the information for answering the research questions. Survey research is a design of inquiry that provides a quantitative or numeric description of trends, attitudes, or opinions of a population by studying a sample of that population (Creswell, 2014). This strategy was used to investigate teacher's general attitudes and opinions about problem solving and their support-seeking in a chat group. Then, the results of narrative and survey research were compared and combined with each other and related to participant teachers' background information such as their education and work experiences.

Research methods

Research methods involve the forms of data collection, analysis, and interpretation that researchers propose for their studies (Creswell, 2014).

Table 3.3 Research methods used in this research

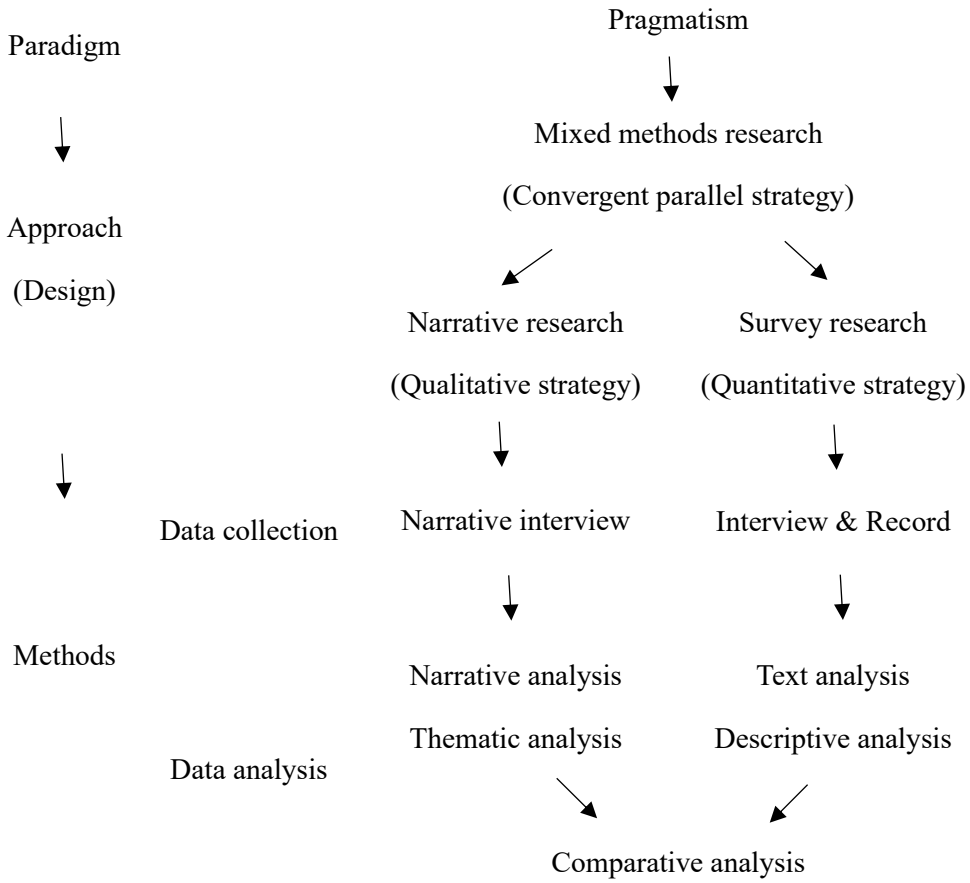
Research questions	Research design	Data collection methods	Data analysis methods	Merging data
Q1 Q2 Q3	● Qualitative research (Narrative research)	● Narrative interview	● Narrative analysis ● Thematic analysis	● Side-by-side comparison ● Data transformation ● Joint display of data
	● Quantitative research (Survey research)	● Semi-structured interview ● Record of chat log	● Descriptive analysis ● Text analysis	

In this research, qualitative data was collected by narrative interview, and data analysis methods included narrative analysis and thematic analysis, each corresponding to the contextualization and categorization process (Bickman & Rog, 2009; Chen, 2000). Quantitative data collection methods included face-to-face, single-person, semi-

structured interview and record of chat log in a teacher's online community. Data analysis methods included descriptive analysis and text analysis. Then, side-by-side comparison, data transformation and joint display of data were used to merge qualitative and quantitative data.

To summarize, the research design can be illustrated as follows:

Figure 3.2 The framework of research design



3.2 Research process

The research process (c.f. Mackenzie & Knipe, 2006; Chen, 2012; Creswell, 2014) is as follows:

- determine the area of investigation and the phenomenon of interest
- conduct literature review

- raise research questions
- identify research paradigm and research approach
- determine the scope of investigation
- prepare instruments and tools for data collection and analysis
- identify when, where, who data will come from
- enter the field for ethics approval
- collect qualitative and quantitative data
- process and analyze qualitative and quantitative data
- merge qualitative and quantitative data
- write up findings, discussions and conclusions

Participants

By qualitative research, I investigated ELT teacher's problem solving in the upper secondary schools of Sichuan, China because it would be easier to conduct this research since I have been an ELT teacher working in the province, and the results can be used to help local teachers. I adopted purposeful sampling to focus on the research questions and particular characteristics of participants (Chen, 2000), and selected maximum variation samples to acquire different views on TPS and to compare TPS in different schools.

I selected sample schools by school rankings and local social and economic situations. There are four school ranks for upper secondary schools in Sichuan: first-rank provincial model school, second-rank provincial model school, municipal model school and regular school. By 2018, there were 97 first-rank provincial model schools and 125 second-rank provincial model schools in 768 public schools of the province. These schools were ranked by a committee of 139 education experts according to 53 indicators in the four categories of teaching staff, school-running conditions, school management and educational achievements (First-rank schools, 2018). In this research, the three sample schools belonged to the first, third and fourth rank.

The sample schools faced different social and economic situations. The first two sample schools located in county town A and town B, which lay within 30km between

each other and Chengdu, the capital city of the province and a metropolis with over 16.3 million population (Chengdu's resident population, 2019). The Engel's coefficient was 33.0% in urban areas and 36.6% in rural areas (Statistical Communique of Chengdu, 2018), and the terrain was plain and over 99% of the population belonged to the Han ethnicity (A district, n. d.). The third school located in county town C, which lay about 300km away from Chengdu. The Engel's coefficient was 39.9% in urban areas and 83.7% in rural areas (Statistical Communique of County C, 2018), and the terrain was mountain, with an altitude ranging from about 1,700 to 5,200 meters and 94% of the population belonged to the Tibetan ethnicity (C county, n. d.).

In 2018, the highest admission score of the upper secondary schools in Chengdu was 630 and the minimum admission score was 506 (Admission score in Chengdu, 2018); Sample school 1 and 2 each had one qualified foreign teacher from native speaking countries; among the five ELT teachers in School 3, one came on secondment and another came as a volunteer teacher for one year.

Table 3.4 Background of sample schools

No.	Rank	Number of students	Number of teachers	Number of ELT teachers	Admission Score in 2018
1	First-rank provincial model	3,810	400	50	563
2	Municipal model	2,414	196	24	518
3	Regular	438	59	5	200

I selected participants by gender and experience. And four participants were selected from each sample school, including two males and two females, and two veterans and two novice teachers (Table 3.4).

Table 3.5 Background of participant teachers

No	Name	Gender	Age	Years of teaching	Education	Major	Professional titles	Duties

S11	Frank	M	30	5	bachelor	ELT	Second Rank	1) EFL teacher
S12	Hebe	F	29	5	master	ELT	Second Rank	1) EFL teacher
S13	Gavin	M	56	34	bachelor	ELT	Advanced	1) EFL teacher 2) Class teacher 3) EFL lesson leader 4) Member of municipal ELT team
S14	Sarah	F	46	24	bachelor	ELT	Advanced	1) EFL teacher 2) Excellent class teacher of the city
S21	Donald	M	31	6	master	Linguistics	First Rank	1) EFL teacher 2) Class teacher
S22	Sonia	F	25	1	master	Translation	/	1) EFL teacher 2) Staff of international office
S23	Sean	M	46	22	post-graduate	ELT	Advanced	1) EFL teacher 2) Class teacher
S24	Zandra	F	50	33	bachelor	ELT	Advanced	1) EFL teacher 2) Class teacher 3) Vice dean of students
S31	Simon	M	41	18	bachelor	ELT	First Rank	1) EFL teacher
S32	Zoey	F	27	5	junior college	ELT	/	1) EFL teacher
S33	John	M	54	32	bachelor	ELT	Advanced	1) EFL teacher 2) Head of EFL teaching research group
S34	Yvette	F	36	14	bachelor	ELT	First Rank	1) EFL teacher 2) Class teacher 3) School accountant

*All the names are pseudonyms.

Sean enrolled in a post-graduate program for in-service teachers, got the certificate of completion without a diploma. Donald's master's degree was academic, but Hebe and Sonia's were professional. Simon was a volunteer teacher from another city and

planned to stay for one year. Zoey was the only Tibetan teacher in this research, and she was working in her hometown. The professional ranking system set five ranks for teachers in primary and secondary schools: Third Rank, Second Rank, First Rank, Advanced and Senior. Most participants have taken on multiple duties and half of them work as class teacher, which is a central role for monitoring and supporting student learning, coordinating teaching in collaboration with other teachers of the class and facilitating school-home cooperation.

In quantitative research, the same participants of narrative interview took part in the semi-structured interview so that the results of the two approaches can be compared. And I selected QQ Chat Group to investigate teacher's use of ICT for supporting problem solving because Tencent QQ is one of the most popular instant messaging software in China, which had 0.807 billion monthly active users by the end of 2018 (Tencent latest financial report, 2019), and it has been widely used by teachers to facilitate ELT (Lei & Maresova, 2018). I selected a very popular QQ chat group for EFL teachers because it was one of the largest of its kind and has been actively used by about 1,200 teachers at the time of data collection from upper secondary schools all over China. Though established for commercial purposes including sales promotion, teachers used it frequently to support their problem solving. The chat group was established in March 22, 2017 by a company in Guangdong province that sold supplementary teaching materials. The company has provided free and sustained organization and management service for the chat group users. ELT teachers can join the chat group and use it for free. The Chat Group continues to grow and has more than 2,000 members now, which makes it a typical and successful example of teacher's autonomous use of ICT to support their problem solving. I selected the chat log between August 9th and September 9th, 2017 (20 days in the summer holidays and 9 days in the new term) for analysis and comparison to reveal the differences between teacher's use of ICT for support seeking in holidays and workdays.

Instruments

In qualitative research, researcher is the main research instrument, who uses

interview to collect data, observes the teachers, takes journal notes, does data analysis, ensures the validity of the research, protects participant teachers' privacy, etc. According to Helfferich (2009), a good interviewer needs technical competence and interactive competence (attention and steering, competencies in communication theory and knowing how to deal with previous knowledge and personal bias). I did four things to prepare myself:

- learning by reading methodology books and online resources such as Chen, 2000; Anderson, & Arsenault, 2005; Cohen, Manion, & Morrison, 2007; Zhang & Xu, 2015; Creswell & Poth, 2017; Mackenzie, & Knipe, 2006, Creswell, 2014; Mackenzie & Knipe, 2006
- gaining field experience by practice, keeping journal notes and reflective thinking, for example, I interviewed five teachers from two schools and collected three clips of video recordings of teaching in Sichuan in February 2016; I observed teaching in TEFL classrooms nine times and conducted eight informal interviews and discussions with teachers and teacher educators in Uppsala in April 2018; I had trial interviews with two teachers from two different schools in Sichuan in September, 2018
- learning from doing pilot researches, attending conferences and publishing articles, to be specific, I participated in five conferences, one research project and published four articles related to this research
- learning by consulting and discussing with experts and colleagues

In addition, I have work experience in ELT, teaching management, student management, educational research, and teacher education, which gave me a multi-perspective understanding of education that could facilitate data collection and analysis.

In the process of research, I maintained a dual identity in the field, i.e. the fellow member of ELT profession (insider) and a stranger to participant teachers' life and work (outsider) so that the participants could trust me and tell me what I didn't know. I considered myself to be one of their kind (i.e. an EFL teacher facing problems and trying to solve them) and a friend who wanted to help them deal with the problems and

I tried to listen and understand without judging because this was the best way to acquire "real" stories, "justified" reasons, and "true" feelings of teachers as problem solvers.

The second instrument was a self-made outline of interview questions, which combines questions about teacher's specific problem-solving stories and their general attitudes, opinions and performances in problem solving. The outline consists of five parts and fourteen questions: introduction, questions about background information, questions about problem-solving narrative, questions about teacher as problem solver, and questions about support for problem solving. After the interview, participant teachers were asked to make a brief introduction about their education and work experience to enrich the background information for a better understanding of their problem-solving decisions. I designed the outline on the basis of existing problem-solving theories (D'Zurilla et al., 2002; Frensch & Funke, 1995; Greiff, 2017) and the result of literature review, and modified the outline after two trial interviews, reflective thinking and expert validation by two colleagues from Palacky University.

The tools used for data processing and analysis included YuJi, QQ Chat Log Analyzer 2.0, and Excel. YuJi is a speech-to-text converter software developed by iFlyTech, one of China's leading companies in speech technology. I used YuJi to transcribe interview recordings. And after the conversion, I made corrections to avoid voice recognition errors caused by participant's use of Sichuan dialect.

QQ Chat Log Analyzer 2.0 was a free tool developed by Ph.D. Wang Can from Tongji University and MIT. This tool allowed users to analyze group chat or private chat history, including time of log entries, member activities (number of messages sent, time period of active chatting, number of starting/ending a topic, time intervals between a message and response for it, etc.), text analysis (word cloud, abstract), association analysis ("my" relationship with others, social network analysis), etc. (Introduction to QQ chat log analyzer 2.0, n.d.). I used Analyzer 1.0 for data processing, got a problem and wrote to Ph.D. Wang, who offered help by upgrading the Analyzer into Version 2.0.

In addition, I used Microsoft Excel to sort, filter, compare, and visualize data with charts and tables, and conduct descriptive analysis.

Data collection

For qualitative data collection, I found goal keepers through colleagues, friends and acquaintances before entering into the field. The goal keepers helped me to select participants according to the research requirements, get participant's consent and permission, and arrange the time and place for interview. I have selected six sample schools but had to give up two of them because of goal keeper's "warnings" that the results might be "undesirable". In the end, I have been to four schools and interviewed 17 teachers. However, I had to give up the data collected from one remote school in south Sichuan because the participants were all females and they were scheduled for a focus group interview when I came to the field. Though I tried to interview more participants the next day, I was only able to find and interview one male participant and had to leave because of the lack of time.

Finally, there were 14-hour-long audio recordings and 137 pages of transcription (Table 3.5).

Table 3.6 The amount of data collected by interview

Participants	Audio recording	Transcription (Chinese)
S11	56m	8p
S12	28m	5p
S13	1h41m	17p
S14	1h3m	11p
S21	57m	12p
S22	1h34m	15p
S23	1h13m	11p
S24	1h59m	24p
S31	37m	5p
S32	55m	9p
S33	51m	6p
S34	1h50m	14p
Total	**14h4m**	**137p**

For quantitative data collection, I acquired membership of the chat group from one of the administrators, who knew about my identity, but the information was not made public. At the beginning, I participated in the group chat by greeting others and

answering questions in order to be “accepted” by other members (Lei, Tang, & Maresova, 2018). Then, the chat log was selected and downloaded, which consisted of 2,059 entries. There were 1,252 entries (61%) in 183 Q&A (Question and Answer) cycles. The Q&A cycles started with a question and ended when no more answers or discussions followed.

Data analysis

After transcribing the audio recordings and correcting the transcription, I used thematic and narrative analysis methods for qualitative data analysis. Thematic analysis is a method for identifying, analyzing, and reporting patterns (themes) within data. Based on Braun and Clarke (2006), the process of thematic analysis in this research is:

- familiarizing with the data
- generating initial codes
- searching for themes (related to the research questions)
- reviewing themes
- defining and naming themes

And there are different approaches of narrative analysis such as thematic organization (Labov & Waletzky, 1997), functional approach (Bruner, 1991) and narrative ethnography (Gubrium & Holstein, 2009). They stressed the referential and evaluative function of narrative and the structural order of narrative, individual’s making sense of reality by narrative, and the contexts of narrative production. In this research, the process of narrative analysis is:

- restructuring the narrative in chronological order
- focusing on the themes (research questions)
- making extension by connecting the themes with other information (such as background information of the sample schools and participants or information in another narrative)
- highlighting the dilemma or conflicts related to the themes

On the other hand, I put the log entries into 17 data sets such as time of speaking, speaker, identifier, comment, and time intervals between two entries, and then used text

analysis and descriptive analysis methods for quantitative data analysis. Text analysis methods include word frequency, collocation, concordance, N-grams, entity recognition, dictionary tagging, document categorization, corpora comparison, language use over time, detecting clusters of document features, visualization (Introduction to text analysis, n.d.; Underwood, 2012). In this research, I used the methods such as word frequency, entity recognition, and association to investigate:

- the number, rate, frequency and duration of Q&A cycles
- the topic, time and rate of response, satisfaction with response, efficiency of response to the questions in Q&A cycles
- the relationship between group members, administrator activities, background information of the chat group, the frequency of logging in, teacher's purpose of using the chat group, etc.

Then I conducted descriptive analysis to measure the frequency of different types of questions more accurately.

And after qualitative and quantitative data analysis, I compared and combined the results to develop an integrative understanding of TPS and support for it.

Ethical considerations

Researchers need to protect the participants; develop a trust with them; promote the integrity of research; guard against misconduct and impropriety that might reflect on their organizations or institutions; and cope with new, challenging problems (Israel & Hay, 2006, as cited in Creswell, 2014). I have done the following to address the anticipated ethical issues (cf. Creswell, 2014):

- gain school and participant permission though goalkeepers
- assure that the research will benefit participants by discussion with teachers
- inform the participants of the general purpose of the research
- respect the participant's requirements and opinions
- use pseudo names to protect the privacy of participants and their schools
- bring a gift as reward for participating
- report honestly

- report in a different language
- report multiple perspectives
- store data and materials for 5 years
- give credit for ownership to researcher, participants, and advisors

There were two teachers who kept me waiting for several months and one of them finally refused to participate. I understood that they were busy and showed patience and respect for them. And I reflected and learnt how to invite participants in local culture. In addition, their reluctance may be a clue to their attitude towards research on teachers, and a possible estrangement between teachers and researchers.

There were two participants who showed worries that the interview might harm them or their school. I promised that they would be protected by anonymity and I believe that proper use of these data can help to improve the understanding of TPS and enhance the trust, respect and support for teachers.

One participant asked for an assessment on herself as a teacher and I explained that the purpose of research was not to judge them but to understand them.

3.3 Research validity

Qualitative researchers routinely employ member checking, triangulation, thick description, peer reviews, and external audits to demonstrate the credibility of their researches (Creswell & Miller, 2000). In this research, validity strategies include (cf. Johnson & Christensen, 2004; Kinnunen, 2017):

- descriptive validity: examining the accuracy of descriptive information
- interpretive validity: respondent validation
- theoretical validity: pattern matching and peer review
- researcher bias: continuous reflection and actively seeking negative cases
- internal validity: data and method triangulation
- external validity: reader's recognition of results or building a theory (Chen, 2000)

According to Cohen, Manion and Morrison (2007), to minimize the amount of

bias is a practical way of achieving validity in interview, and I adopted the following to reduce bias:

- formulate questions carefully so that the meaning is crystal clear
- get familiar with the procedures and get ready for possible problems
- combine probability sampling with non-probability sampling
- include participants of various characteristics

Silverman (1993, as cited in Cohen, Manion, & Morrison, 2007) suggested several ways to enhance the reliability of interview, and the following was adopted in this research:

- careful piloting of interview schedules
- learning about how to conduct interview
- use of closed questions

In addition, semi-structured interview was adopted to control validity by making participants feel at ease and to control reliability by having semi-structured interview questions.

Part IV Research results

The results consist of four parts: the problems reported by teachers, the problem-solving strategies used by teachers, support seeking reported by teachers, and understanding and supporting TPS.

4.1 The problems reported by teachers

The participants reported many problems. And detailed description of the problem-solving process in the next section offered a dynamic perspective to understand the nature of a teacher's problem. Data analysis suggested a typology for these problems, the process of teacher's problem definition, the process of teacher's decision-making to handle or ignore a problem, and the indicators of the style of teacher's problem definition.

Table 4.1-3 illustrated the problems reported by teachers. To make the report trustworthy and informative, I tried to use teacher's original description as much as possible.

Table 4.1 Problems reported in narrative interview

Participant	Description of the problem or situation
Frank	PN1. A student from a rural middle school with poor English asked me how to learn English. PN2. A very mischievous student from an experimental school didn't hand in homework and slept in the classroom.
Hebe	PN3. I didn't know how to find out whether students had learned new words. PN4. I don't know how to discipline or criticize students. I'm not strict enough. I don't know the correct way. When I am very strict with them, it is not good. When I am tolerative, it ends even worse. I don't know how to adjust the degree of strictness and tolerance. As a result, I am always close to the students, but they are not afraid of me. I don't have a teacher's prestige. My mentor told me that I must build my prestige when I first met the students. It was very important to be strict at the beginning. If I fail to build my prestige at first, it will be difficult to do it later on (not a story).
Gavin	PN5. Unhappy about my comment in a class meeting that a student should not let his grandpa carry school bag for him, the student wrote me a letter with very fierce

	words. PN6. There were many conflicts between (my) students and the living-care teacher, and between this teacher and me.
Sarah	PN7. With parents divorced, there was a student who learned English very poorly. PN8. There was a second-to-last student, expelled by five schools before, a) who swore at the election campaign for student cadres, b) whose mobile phone was forfeited, and his parents were invited to school, c) who wanted to restudy for one more year upon graduation. PN9. I was too tired and restricted by some formalism and could not spend more time to communicate with students after teaching, whose learning might improve greatly if I did (not a story).
Donald	PN10. I taught a science class and an experimental class with the lowest scores. PN11. There was a student with poor English, usually got 50-60 points in exams. PN12. I taught my first class very quickly, but they did poorly in exams.
Sonia	PN13. There was a PE student who was good at Math and Science but bad at English. PN14. There were several students who a) always failed to pass the word dictation, b) refused to do words writing as punishment after failing again, and c) contradicted me when I criticized them in front of the whole class.
Sean	PN15. There was a very smart transfer student good at Science, but bad at English. PN16. There was a student in the remedial class, who was from backward mountainous areas, good at Science, bad at English and addicted to cell phone games.
Zandra	PN17. My first class was in middle school and they were a blank sheet for learning English. PN18. There was a student who was very proud, ignoring teachers and was late for classes. PN19. There were a pair of twin sisters a) who were naïve, didn't know the ways of the world and didn't like speaking b) and I worried that they might be isolated by others. PN20. Many years ago, I was teaching 9th graders in a rural lower secondary school. The students were bad at English. PN21. A student in the class recited an article fluently with terrible pronunciation and I couldn't understand a word. PN22. During discussion in the English class, a student talked about the divorce of his/her parents with tears in the eyes. After hesitating for a while, I thought of this as a good chance to combine English teaching with emotional education. PN23. There was a student objecting my comment in class about not buying Japanese products. PN24. The whole class was depressed about the result of an exam. PN25. I wanted to teach gratitude to the students. PN26. I was close to the students, but I indulged them. PN27. There was a girl student who developed bad habits and requested to transfer to the Literature class.

Simon	PN28. My course representative did badly in an exam. PN29. Students in Art and PE class feel frustrated while learning English, become uninterested and give up at last (not a story).
Zoey	PN30. In Ganzi (a Tibetan autonomous prefecture), there was a student who seemed to be obedient and good at study but ganged up with his brothers and got into a fight with others. PN31. I was transferred to my hometown and a family member passed away. I felt guilty and regretful that I didn't say goodbye formally to my last class of students before the transfer.
John	PN32. There was a student a) who came from a poor family, lived far away from school, and studied very hard (but needed tutorials), and b) he later caught pneumonia but had no money for treatment. PN33. There was a student transferred to our school because his father needed to work around here. He studied very hard (but needed tutorials). He went to a high school in big cities and came back for vacations (and tutorials).
Yvette	PN34. Our student's English is very poor, but I'm proud that my students in the 11th grade made progress. They learn to use phonics and can have group discussion and finish the tasks by themselves. They are developing the self-learning ability. PN35. There are many regrets in teaching. The most typical one is that it is hard to find a student who can get 90 in NCEE (not a story).

These are 35 "really experienced" problems, the most satisfied or regrettable experiences that the participants could recall during the interview. These problems are about a teacher's goal to improve student's language skills, learning strategies, interest, attitude, discipline, manners, socialization, gratitude, patriotism, teacher-student relationship, or reduce student's depression and frustration; to improve a teacher's method of learning assessment, classroom discipline skills, collaboration between colleagues, or overcome fatigue, guilt, and indulgence to students. And, some of these problems are related to a student's divorced parents, poverty-stricken family, or the formalism in school administration.

By semi-structured interview, the participants reported the problems they encountered this year, a few of which were told as stories. And they reported more problems (some of them happened many years ago) while answering other interview questions, both of which were illustrated in Table 4.2.

Table 4.2 Problems reported in semi-structured interview

Participant	Description of the problem or situation
Frank	PI1. There is a kind of student who does not respect their teacher at all. They don't have a moral baseline. Usually, you cannot change such a student no matter how much time you spend on him. I don't have any idea about this. They are impatient when a teacher talks with them. They are not willing to listen or will make excuses to shirk (responsibility). They are hostile to teachers and school. They don't want to come to school but are forced by their parents. There may be a parent-child conflict. There was a student who strongly disapproved his parents. This is beyond a teacher's control. PI2. The class teacher can help me with particular problems but cannot change the student's motivation for learning or improve his learning habits. If they don't want to learn, they won't. So, this is a temporary solution rather than a permanent cure. PI3. I felt more and more restrictions on teachers. And I don't know how to deal with this because this is a problem about the large environment. PI4. When you are not a class teacher but an EFL teacher, you can make trouble for yourself if you meddle with too many things. For example, a student didn't turn in homework on time but made it up later, but you still wanted to deal with this. What would you do if the student contradicted you? If you settled with him, you could make trouble for yourself; if you didn't, you made a bad example for other students. PI5. Most people have misconceptions about education. One is that there are no weak students but only unqualified teachers. But even Confucius had only 72 sages out of 3,000 disciples. We must admit individual differences. It is wrong to attribute every problem to teachers because the education system does not only depend on teachers. Teachers are only executors, who cannot change the education system or the society. Another is that education means to inspire students with love. But I think this is far from enough. We should love students, but they are youngsters. With so much temptation and negative energy in the society, they will surely be misguided and confused. Under such a circumstance, to influence students with love is far from enough. With much better education, Singapore has caning. And I think that without damaging student's physical and mental health, appropriate punishment is necessary. But none of the Education Department, the public or the parents can accept this. So, when I teach, I feel one hand tied behind my back. PI6. We need to publish research papers and conduct research projects if we want to achieve professional titles, but I think teachers in primary and secondary schools should concentrate on teaching rather than research. Teachers can do research, but this should not be a mandatory requirement. You cannot ask someone to be a teacher and a scholar at the same time. PI7. I think training programs for teacher's professional development is a severe waste of national resources and teacher's energy. The expert's lectures are macroscopic and impractical. It is based on the assumption that everything is ideal. The students are obedient and there are no social problems. But in practice, it's completely different. And a practical way is to go to other schools for public lessons and teaching and research.

Hebe	PI8. I feel that my teaching has reached a bottleneck. It becomes boring. I don't know how to improve myself (but she added some preparations and plans later). PI9. Moralizing students does not work. More delicate ways are needed to handle the relationship with students. Getting along with students is my biggest trouble. I feel that it is so difficult to be a teacher. PI10. I don't sleep enough. PI11. The pressure is high. PI12. I don't have time for my family. PI13. The salary is low. PI14. The working hours are long.
Gavin	PI15. (Students' use of) cell phone is a difficult problem. It's addiction. It cannot be stopped by me, the school or the parents. The students are facing great learning pressure. Things like cell phone are actually an escape. I don't play games, but I can imagine that and understand their needs. They know right and wrong, but they are emotional. They will choose cell phone over learning. It's their philosophy of life. They don't think so much (like adults). If they do, they are not a youth. PI16. Many years ago, I was the class teacher of a class referred by some as the worst class in the history of the school. It was common to see romantic relationship among students. Once a boy tried to commit suicide for a girl. The parents approved their relationship and told me not to intervene. There was a student who wanted to talk about her homosexual relationship. Fights were common. In today's words, they were not weak learners but wicked youths. They even made knife attacks. PI17. As the (school's) leader of lesson preparation, I need to swap lessons with other teachers so that I can attend teaching and research activities. This becomes troublesome when there are many such activities.
Sarah	PI18. Several high achievers in my class did badly in a recent exam. PI19. Last month, I was very unwell. My white blood cell count was only a little more than 2.0. Knowing that it was an extravagant hope, I didn't ask for a sick leave. I asked to resign from the class teacher post. They refused and it was over (she added later that the school provided help). And sometimes I suffered from anxiety about my health. I didn't know what to do. I thought about myself. Did I think too highly of other's comment on me? If someone says that I leave my students behind (c.f. her resignation from the class teacher post), I cannot get over it. And I think a teacher must keep the dignity of the teaching profession. In addition, the headteacher treated me very kindly. The emotions between people are most valuable. I can only balance my mind in such a way. PI20. Many young teachers come to me to ask for help. I like to help others, but this is no good. Sometimes I cannot help telling others my ideas of teaching planning, but I am subjective, thinking that my ideas are better. Though they agree that in the end, I think I'm too conceited, not modest or cautious. I'm too straightforward. PI21. The salary is unfair, not proportional to the efforts I made. PI22. The better you are, the more for you to do, the poorer your health. My students love me very much. When I'm unwell, I am willing but unable to make

	contributions. I really hate this. PI23. The classroom surveillance system is the shackles on teachers…. There is a conflict between this belief and my belief in education. Sometimes I have a sense of guilt while teaching students. I can only try my best to make sure that my lessons are useful for improving their learning ability, interest in language and the ability to think in English. Intense teaching and school management cannot give students freedom, self-discipline and self-learning ability but ruins their and our physical and mental health. True freedom is based on self-discipline. They need trust and respect. But I cannot change this. PI24. There is a problem about teamwork. The teachers for my class are aged. Similarly, they are not in good health and they complain sometimes. But as class teacher, there is nothing that I can do. I know they are working half-heartedly, but how can I persuade them? Class teachers have no authority and they are my seniors. This is a difficult problem. Your partners may not be so dedicated and conscientious as you.
Donald	PI25. A student was punished by school for smoking, and I didn't know whether I should invite the parents to school and whether this would end after talking to the parents. PI26. I'm also concerned about student's learning problems such as forming good learning habits, using good learning methods, choosing to enter science or literature classes, allocating time wisely for learning different subjects. PI27. Recently, I became a class teacher. The biggest problem is about student management. I deal with problems such as indiscipline, misbehaviour, and penalty decisions from school. There are less problems about learning EFL because the students' attitude becomes much better after I became class teacher. PI28. There are classroom management problems such as arrangement of classroom setting, setting class rules, election of class committee, and moral education. PI29. Several years earlier I travelled between home and school every day. I ran home immediately after class. It was a shame that I didn't spend personal time with the students. Just graduated, I was not enthusiastic about my job. I would get married soon. I was afraid that my girlfriend would leave me, so I went back to stay with her. I was immature then. PI30. I'm young and there is a lot of expenses. Salary is my No. 1 problem. For me, the problems about social recognition and salary goes before those about teaching and student management. PI31. When I need suggestions for a problem, those offered by school leaders or other class teachers are often not specific. Unspecific questions get unspecific answers. For example, when I asked how to deal with schoolwork plagiarizing, they gave me general principles rather than specific measures that I could adopt in my class. It's impossible for them to teach you the real secrets of dealing with student problems. Even if they do, the results (of using these strategies) may be different because different teachers have different temperaments. PI32. When I search resources on the Internet for solving a problem (such as setting class rules or electing class committee), there will be available resources, but the

	quality is uneven. Many are theoretical and abstract. There are not many cases or examples. Highly typical examples are meaningless. Few examples about teaching and student management are written in articles. The published ones are not the best examples or those that need some courage to publish. There are few such stories because teachers don't know how to write them or don't want to write them.
Sonia	PI33. I think a lot about how to improve my professional qualities (about teaching). I must learn about how to teach well. There is not an upper limit to this. I need to learn to teach better. PI34. I also think about how to deal with teacher-student relationship. I think that I'm not good at dealing with others. I think directly and am straightforward. I tend to avoid interpersonal problems, but I like to study the problems about language points and cultural background. PI35. And I think about my career planning. I worry that my English will stay in the high school level after many years of teaching. When I first arrived, I was considering whether I should work in a big city like Chengdu, whether I was suitable to the teaching profession and whether I should find another job.
Sean	PI36. The most difficult problem is to improve science students' learning of English. I'm teaching remedial class these years. English is their weakest subject. They can only get 50 to 60 or even 30 points when the full mark is 150. They have bad attitude, bad learning habits and many problems with the basics. If they follow teacher's instructions, work hard, and spend a lot of time on learning, they can get 80 or 90 points in NCEE. Without a basic vocabulary, they cannot read or write. These are difficult problems. PI37. Another problem is that as a class teacher, I need to control students' use of cell phones. I'm not against this. But they are youngsters and they cannot control themselves, nor can adults. It's easy to spend hours or days on it. But as a student in the remedial class, they don't have time and energy for it. They are doing the right thing at a wrong time. This is a difficult problem. They will secretively bring cell phones to school. They don't hand it over but use it under the quilt even at two or three o'clock in the morning. The living-care teacher and me cannot go and search their beds. Some parents will not cooperate. They say their children have to use cell phones. They cannot restrain them. If they don't comply, their children will make a scene. So, they tell teachers there is nothing they can do, and they ask teachers to do it. They are shuffling the responsibility (of parenting or home education) to teachers. I think the parents are responsible for this. But they don't think so. They think the school should make things right since they paid. They don't realize that many problems in their children are caused by themselves. The parents of our students are at the bottom of society. They are not well-educated. There was a student who played games at two o'clock in the morning. He did this for months. We could not discover that. Later, his father wanted to take away his cell phone, but he would not hand it over to him. Their relationship became very difficult for a long time. And he wanted to run away from home. Then, he stopped to come to school and did not come back. He once wanted to prove to me that cell

	phone could be used to improve learning rather than impair it. When his exam results proved him wrong, he insisted on his argument and refused to change his mind. This problem was related to the student's family. Even the parents could not get control and had to make a compromise. It was a responsibility too heavy for a teacher to shoulder. And as a teacher, I could not take a hard line on the student. First of all, a school must guarantee students' safety. If an extreme behaviour occurred, no one could bear the consequence. And the parents would not believe the teacher to be innocent but would hold him/her responsible. Generally, the school would not take the responsibility in the first place but wanted to find the teacher who should be blamed. So, a teacher should protect him/herself at least in some risky situations. The students may know that teachers are powerless on this, and there is nothing you can do if they insist. If the parents can support me and the school can take responsibility by taking tough measures such as a strict ban of cell phone in school, casual inspection in dorms, and disciplinary punishment of sequestering the cell phone to the end of a term, the students can be deterred and I can go ahead and do my job. Without strong support from school and a right attitude of the parents, I become slack. Why do I have to risk myself to solve this problem? This is not just about me. If they can live with it, I can. I lost the inner drive for solving the problem. I wanted to solve it, but I could not continue forever. Everyone can become inactive. PI38. My health is poor (He had Hepatitis B) and I don't want to tire myself out. As a class teacher, I don't earn much, but I can spend less and make ends meet. I really hate to work and live under pressure. After working for a long time, I become irritated and uncomfortable. I will try to balance myself. I always believe that everyone has an affection for nature and nature is the best cure. PI39. I went to Shanghai for a training program. It was helpful by keeping me learning, but it was a waste when I could not use what I learnt in my school, where the environment was different. We don't have enough funds or the system of collaborative teaching and research here, but our school leaders are concerned about other things.
Zandra	PI40. A student became irritable in the 12th grade. PI41. Many of our students came from rural areas, and I will try everything to make them speak in English. PI42. Today's students are often the only child in a family, indulged by parents and grandparents and living a rich material life. They do not cherish teacher's kindness as those before them and it is more difficult to educate them. PI43. Today's students know computer and so many things in the world, but in fact they are innocent and naïve. They don't know what they should know (e.g. gratitude, social responsibility, family love). We need to educate them, but moralizing can only cause antipathy. PI44. The thought of students born in the new millennium is beyond our imagination, and we need to learn to keep abreast with the times. PI45. I like to work in a very relaxed environment and have a high degree of

	autonomy, but the current professional ranking system cannot motivate teachers. PI46. Textbooks for lower secondary schools are too difficult for students because vocabulary is expanding, which overlaps with the vocabulary of upper secondary textbooks. Some students do not have enough time to memorize them. I guess half of them even don't know how to use phonics and have to depend on rote learning to memorize words in upper secondary schools. And there are a variety of learning materials in our school, that's why students feel difficult to catch up after coming to upper secondary school. This makes my teaching really difficult. PI47. The quality of newly recruited students in our school is declining. The high achievers go to better upper secondary schools. Our students are often good at science but bad at Chinese literature and English. These are most difficult for them because rural lower secondary schools are generally weak in these subjects. The students still don't know the basics. While I teach them, they are like amnesiacs. PI48. Concerned about student's safety and parent's attitude (to the teacher if an accident happens), I dare not to organize student activities or join in their social practice. PI49. Many novice teachers are not majoring in ELT. A TEM 8 (the highest level for the English major) certificate doesn't ensure good teaching results. PI50. Exam in China is too …. Even the Canadian teachers in our school did not know how to solve some grammatical blank filling exercises.
Simon	PI51. I think about why my lessons attract only part of my students, not all of them. I think it would be better to adjust my teaching methods and attract all students. PI52. They don't like taking notes. While they do, the students tend to write down everything rather than only the important parts. This is a small but important problem. It means that the students haven't get used to the demonstrative teaching method. They should have done this in lower secondary school. Maybe there are some deep-seated reasons for this. PI53. There are individual differences. They came from different backgrounds and had different goals in the 12th grade. Some students are not willing to participate (in learning). They may think that it is okay to enter a junior college upon graduation. The admission policy for college is different here (There is preferential policy that awards bonus points to these students in NCEE). So, they are not motivated to enter top universities like their peers in my school. PI54. The teaching research group in the school prepared teaching materials together to save time, but the materials are too difficult for some students and it is difficult to adapt the materials for them because there are many students (about 40 students per class). PI55. It is more and more difficult to get professional titles because there are more and more teachers. I'm still in the First Rank after 20 years of teaching. I hope this problem can be solved when I return after my volunteer service ends here (In some schools, working as a volunteer teacher for one year is a mandatory requirement for achieving a higher professional rank).
Zoey	PI56. Now I came back (to her hometown) to teach in upper secondary school. I felt incompetent and under great pressure. I have my own way to get along with

	students, but as for teaching, there is a lot for me to learn. PI57. And, another big problem is student's ability to absorb the knowledge that I teach. You cannot teach them like common high school students but need to help them pass through the transition from lower to upper secondary school. PI58. In recent years, there are bias against and negative comments on teachers. They think it is not decent for a teacher to go to KTV or a night club, but I want to live my life and don't want to be bounded by the conventional and stereotyped impression on teachers. And when something goes wrong with a student, the parents will blame the class teacher immediately. But we start in upper secondary school. It's a long-term process to overcome the shortcomings they had in primary and lower secondary schools. We can only try our best, but it's difficult to predict the result. PI59. I live far from school. Getting up early every morning is a challenge to me. The class begins at 8:10. It makes me unhappy for a whole day. PI60. Some students may be good at other subjects, but their English is incredibly poor, but I still need to finish teaching tasks. This is a gigantic problem to me. Only one local primary school teaches English here. Most of our students start to learn English from lower secondary schools. At lower secondary school, 2/5 of the students had problems with Mandarin (According to John and Yevette, they use a dozen Tibetan dialects as mother tongue and different tribes in the area cannot understand each other). They had poor family conditions. Their parents did not value their learning or could not afford to send them to better schools away from here. They didn't learn English well at the beginning and finally lost interest with the increase of learning difficulties. As a result, almost all the students are low achievers. They want to learn, but I don't have enough time to help everyone. When we need to turn back to what they should learn in lower secondary schools, they become impatient. And they have problems with other subjects as well. When there are too many problems, they want to give up. PI61. Our school lies in an obscure street. Sometimes, there were robbers and idlers when teaching ended at night. Fortunately, I never ran into one, but I am concerned about my safety.
John	PI62. After teaching and learning for two years, we enter a stage of review in the 12th grade, but it seems that some students have forgotten what they've learnt before. This means that our students do not have good learning methods or learning habits. PI63. Restricted by the mountains, it is difficult for the students here to understand the textbooks because there is something in the textbooks that they haven't seen in their life before. PI64. There is a serious lack of ELT teachers in our school. Though volunteer teachers and volunteers come, some volunteers are not majoring in EFL and they can only stay for a short time (John still asked them to teach English because of the serious lack of teachers). When the students get used to their teaching after some time, they have to leave.

	PI65. Our school does not allow cell phones in classroom. But some students will play cell phone if they are not interested in a subject. This is a very difficult problem. PI66. Our school does not allow corporal punishment for students, what can I do if a student is unreasonable, will not listen to me and the parents refuse to cooperate? It seems that public opinion is unfair. This is also a problem. PI67. My efforts are not paid proportionally.
Yvette	PI68. In our school, teachers are far from enough, not only for English but for other subjects as well. There is only one EFL teacher for each grade, and we do not have colleagues for collaboration in lesson preparation. PI69. Attending public lessons is really necessary, but in our school, it is merely a form. After the lesson, the comments are almost always positive. There are not much people that are willing to help you by pointing out the deficiencies. The atmosphere prevails that everyone minds his own business and when the class is over, it's over. PI70. Now we are told to downplay the role of grammar (training) and focus on improving reading skills when teaching EFL, but I think that there is a contradiction between these goals because grammar and vocabulary are both important for reading. And I want to find the balance between these goals. PI71. Our students are very poor in English. They can't remember words, keep forgetting them, and don't know how to use them. I think they didn't learn with heart. They have no idea about what sentence structures are. They don't know what transitive verb or auxiliary verb is. Though I told them many times, they will never try to distinguish finite and non-finite verbs. When they practice writing and listening, they say that they can't do it and they will finish the task perfunctorily. In the classroom, they answer questions actively in Mandarin, but they are shy to speak English. I think their reading comprehension is limited because they don't see a lot and their scope of knowledge is narrow. For example, they could not name a picture of a computer monitor I showed them or the word for "upload" in Mandarin. They can recognize all the words in a sentence but cannot translate it correctly. Besides their limited scope of knowledge, I think maybe this is related to the difference between the Tibetan and Chinese language. Unlike me, my students often put predicate in front of subject. They showed great interest in English in the 10th grade, but their interest wanes when there are a lot that they need to remember. They didn't learn English well in lower secondary school, so we (the teachers) decided to make some time for filling their knowledge gap rather than finish the task of teaching two books in the 10th grade as required, but we don't have a lot of time for that. PI72. One English class per day is not enough. PI73. The students here have the ingrained thought that learning EFL is useless. Indeed, our students hardly have a chance to communicate with foreigners. I often told them that tourism increased, and foreign tourists might come and need a guide. It becomes a little better, but for most students, they will never travel abroad. They don't understand that language is a media and tool. They cannot imagine that. PI74. The students don't want to learn because their parents do not value learning

	and think that they will go to work upon graduation from high school all the same; their English is poor, they cannot catch up and give up in the end; or as I said earlier, they cannot see the usefulness of learning. Different from their peers in the cities, they don't feel shame if they are the bottom of the class and think of this as normal. PI75. In the end, the students can memorize words but don't know how to use them and cannot do well in exams. This is not a new problem, but I don't have a good solution. I needed to learn and went to a better school to learn in the classroom, but it was too different, and I could not use that method in my school. Then, I found that attending public lessons was very useful. PI76. With heavy workload and lack of teachers, I have no time for further training and learning programs. PI77. Very few students have a computer at home. About the teaching materials, such as their exercise books, I used the Internet to search or buy books, typed them in the computer and printed them with a machine since there was no copycat or scanner then. Now, it's much easier to find teaching materials on the Internet, including audio and video materials. But the students are easily distracted by the video and find it difficult to understand the audio recording of the textbook content and then become disinterested. PI78. Now there are a lot of teaching resources online, but they may not be correct and few of them are useful and good to use. PI79. We have to buy reference books from Xinhua Bookstore, but there is not much books to choose. There is solid basic knowledge in these books that are suitable for our students, but it's difficult to find extracurricular knowledge and exercises for NCEE in these books. PI80. I think that the teaching materials jointly purchased by school are not good because they only focus on the first phase of review. It has been so for more than a decade since I came. PI81. Distance learning is provided by a partner school, one of the best schools in the province. But to be honest, our students cannot catch up on live lectures delivered by those teachers. The online teaching materials provided by them are really good, but they may not be suitable for our students and I really don't have the time and energy to adapt them. I have study halls (as class teacher, she attends study halls every morning and uses the time for homework comment or dictation) and two or three lessons in the morning; lesson preparation, exercise and homework correction in the afternoon; two-hour-long study hall in the evening (once a week); and other tasks (such as class teacher and school accountant). We also need to record and upload lectures for the distance learning project, but this adds to my workload. There is a teacher who should provide technical help when I need to record a lecture, but he is also teaching mathematics and physics. PI82. And the schedules are quite different between our school and the partner school. Our students have one-day weekends and monthly holidays rather than two-day weekends because they live far from the school and there are many traditional festivals they need to celebrate. Our school lies in the county town. Only two or three of my students' families are in the town. The others live in the countryside, on

	a mountain, or by a river. In the holidays, it will take them several days to go home and come back. So, the monthly holidays can last for 7, 10 or 11 days. After they come back, I need to get them ready to learn in the first week. But in the third week, they become excited about the next monthly holidays and cannot concentrate on learning. This happens almost every month.

In the interview, the participants reported new problems about improving student's performance in exams, reducing their anxiety before exams, and dealing with their addiction to cell phones; handling the problems about teacher's health, welfare, safety, professional development, teacher burnout, and improving skills for teacher-student communication or fulfilling the duty of a class teacher; and coping with restrictions from school administration, parents and public opinion such as lack of EFL class hours, lack of colleagues and collaboration, lack of learning opportunities, rigid professional ranking system, inappropriate textbooks and teaching materials, declining student quality, unreasonable downplay of grammar in teaching, unfocused online teaching, long holidays, disproportionate salary, exam-orientated education, excessive concerns about student safety, misconceptions about schools and teachers.

Some of these problems are real experiences, while others are closely related to participant's opinions or beliefs on students, parents, the education system, the school administration, public opinions, etc. (e.g. PI43). These opinions and beliefs are subjective and may be true or false, and the interview did not find out whether they were based on participant's real experiences, but the reports suggest that these opinions and beliefs may affect participant's functioning as a teacher and problem solver (c.f. PI5, PI23, PI48).

Another source of data is teacher's online chat log. In the chat log, there are 183 Q&A cycles (1,252 entries, 61%). In these cycles, 248 teachers asked questions and discussed answers. These questions are related to either problems confronting teachers or their problem-solving needs. In the coding process, I created four juxtaposed categories (Table 4.3) for the Q&A cycles.

Table 4.3 Questions asked by teachers in the chat log

Category	Code	Number of Q&A cycles
Teacher's needs	Resources	119, 65%
	Content knowledge	44, 24%
	Pedagogical knowledge	9, 5%
	Technological knowledge	2, 1%
	other	9, 5%
Teaching objectives	Language skills	45, 25%
	Grammar	32, 17%
	Vocabulary	23, 13%
	Integrated goals	43, 23%
	other	40, 22%
Media type of resources	Text	62, 34%
	PPT	36, 20%
	Audio	13, 7%
	Video	6, 3%
	App	5, 3%
	other	61, 33%
Practical use	Exercise	95, 52%
	Courseware	37, 20%
	References for teaching	19, 10%
	Test paper	8, 4%
	Lesson plan	7, 4%
	Textbook	4, 2%
	other	13, 7%

Below are some example questions:

- Resources: "Hello, who has the text of the English poem Y*ou are always in my dreams*? Please share it." (E233)
- Content knowledge: "Why it should be 'would have started' here?" (E81)
- Pedagogical knowledge: "What problems will I face when teaching students in the transition from the lower to upper secondary school?" (E389)
- Technological knowledge: "How to download the audio clips from the CD of FLTRP textbooks? It's completely different from PEP textbooks." (E955)
- Other: "Hello, everyone. How is *BLD Listening* (about using the app to facilitate teaching and learning)?" (E1319)

These data suggest that teachers are confronting problems about the lack of knowledge or resources for teaching, and they need help from more colleagues on the

Internet.

Now we have a list of problems encountered by teachers. These problems often involve multiple actors in education, and it is difficult to categorize them. For example, a problem about a student's vocabulary learning can be considered by different teachers as a problem about learning difficulties caused by language diversity in a locality, a problem about the design of vocabulary in textbooks, or a problem about the teacher's vocabulary teaching. But by taking a teacher's perspective, it is possible to categorize these problems by using teacher's primary goal or objective of problem solving as the standard of classification.

Table 4.4 The classification of reported problems

General goal	Specific goal	Problem type
Improving learning	■ Improving student's vocabulary, grammatical knowledge, language skills, knowledge of English culture, performance in exams ■ Improving student's learning habits, learning methods, learning strategies ■ Improving student's interest, motivation, attitude for learning, attitude towards teacher and school ■ Improving student's discipline, manners, family love, gratitude, socialization, patriotism, ambition ■ Reducing student's depression, frustration, anxiety, addiction to cell phones	Learning problems
Improving teaching	■ Improving knowledges about the English language and culture ■ Improving methods and skills of teaching, learning assessment, classroom discipline, communication with students, colleagues and parents, student management as class teacher ■ Finding better teaching materials ■ Dealing with teacher's own attitude, emotional and health problems such as irresponsibility, indulgence to students, guilt, stress, doubt about the profession, lack of plan for professional development, teacher burnout	Teaching problems
Improving environment for	■ Dealing with restrictions from school administration such as lack of EFL class hours,	Environment problems

teaching and learning	lack of colleagues and collaboration, declining quality of student candidate, inappropriate textbooks and teaching materials, exam-oriented education, excessive concern about student safety, unreasonable reform programs including the downplay of grammar in teaching, unfocused online teaching, long holidays, classroom surveillance system; and heavy workload, low salary, disproportionate salary, rigid professional ranking system, lack of teacher housing, lack of opportunities for learning and professional development ■ Dealing with restrictions from parents and public opinion such as misconceptions about schools and teachers, lack of support for teacher's right to discipline students, lack of social recognition for the profession, criticism against teacher's personal life and image ■ Improving teacher safety	

This is the typology for the situations that teachers report as problems and the questions that are related to the problems facing them. But before we draw the conclusion that these are the problems encountered by teachers, it is necessary to examine their understanding of the term "problems encountered by teachers" when they attend the interview. In fact, the participants defined this term in different ways.

Table 4.5 Teacher's definition of the term "problems encountered by teachers"

Definition	Participant	Example	Meaning
Provide denotation to the term	Frank Hebe Sarah Sonia Sean Zandra Zoey John Yevette	Hebe thinks that she is facing teaching problems. She is not a class teacher, and teacher-student relationship is not her problem. Sean thinks that there are teaching problems and student management problems.	Task or goal
Add emotional colouring to	Gavin	Gavin thinks that problem is a very hateful word. He is contented and happy with everything. He thinks that there is no problem confronting him. He	Discomfort

the term		considers the conflict between his students, a colleague and himself to be a lubricant of interpersonal relationship.	
Explain the meaning of the term	Donald	Donald thinks a problem is a situation that makes him feel perplexed or difficult, or when others (such as colleagues, parents, students) take an unfavourable attitude towards him. Sean thinks there is a problem when something is not within his grasp and his effort fails to yield desired results.	Unknown
Explain a belief about the term	Simon	Simon thinks that teacher has dedication. From this perspective, all problems can be solved and there will be no problem confronting teachers.	Complaint

The difference between teacher's definition of the term is also apparent in their differentiation between the terms "problem", "difficulty" and "challenge".

Table 4.6 Teacher's differentiation between "problem", "difficulty" and "challenge"

Difference	**Participant**	**Example**
Degree of difficulty	Hebe Sonia Sean Zandra Zoey	For Hebe, challenge is harder than difficulty, and difficulty is harder than problem.
Minor or no difference	Frank Gavin John Simon	For Frank, problem, difficulty and challenge have the same essence. They are different stages of a situation or a same situation viewed from different angels.
Emotional colouring	Donald Sarah	For Donald, difficulty lies in everything that a person does, challenge is positive, and problem is the most negative term. For Sarah, problem is a neutral word, challenge is positive, and difficulty makes her feel hopeless.
Meaning	Yevette	For Yevette, problem is the question in the process of learning, difficulty is the gap between the objective and result of teaching, NCEE is the greatest challenge.

This means that teachers have their own diversified, multiple and possibly changeable definition of the term in a personal vocabulary, which may be related to the various problems they encountered in practice. Moreover, their definition of the term is

not completely consistent with the problems they reported earlier. For example, Gavin reported two problems about teacher-student conflict, but he preferred to consider these incidents as normality rather than a “problem”.

However, the participants chose to report those situations as problems. One explanation for this is that besides the personal definitions of the term, there is a common meaning of it shared among the participants and me, and they have recognized the common characteristic in those situations that makes them a problem. So, it would be better to identify teacher’s definition of a problem or the common meaning of the term from the specific situations they reported rather than from their changeable understanding of the terms.

In fact, when the participants report a particular problem, they are either retelling their earlier definitions of the situation or redefining it. By examining their reports, it can be found that in the process, they 1) describe a situation, 2) explain the reasons for their dissatisfaction, 3) make a causal analysis, 4) attribute responsibility, 5) predict the result of their problem-solving attempt, 6) make a decision to engage with or ignore it, and 7) form personal opinions on it. These actions imply a three-stage process of teacher’s problem definition.

Table 4.7 The process of teacher’s problem definition

Stage	**Action**
Representing situation	describe a situation
Gaining understanding	explain reasons for dissatisfaction make causal analysis attribute responsibility predict the result of problem solving form personal opinions
Making decision	make a decision to handle or ignore it

In the process, the participants displayed differences in their actions. And the differences indicated the various styles of teacher’s problem definition.

Table 4.8 Indicators of the style of teacher’s problem definition

Style of problem definition	Personal interpretation	Differing Conforming
	Attribution of responsibility	Internal External
	Attitude towards PS	Positive Neutral Negative
	Activeness	Active Reactive Proactive
	Self-confidence	Confident Uncertain Unconfident
	Availability of resources	Available Unavailable
	Estimation of results	Optimistic Pessimistic
	Estimation of costs and risks	High Low
	State of mind	Emotional Reasonable

The indicators point to nine aspects of the style of teacher's problem definition, (Table 4.1). They are about the tendencies to understand a problem conforming to or differing from authoritative opinions, to attribute the responsibility of problem solving to oneself or others, to consider problem solving positively or negatively, to identify problems actively or inactively, to be confident or unconfident about oneself when facing a problem, to believe that the resources are available or unavailable, to have optimistic or pessimistic estimation of results, to believe that there are high or low costs and risks, to understand a problem emotionally or reasonably.

Below are some examples for these tendencies:

- Differing: "The classroom surveillance system is the shackles on teachers…. There is a conflict between this belief and my belief in education…. Intense teaching and school management cannot give students freedom and self-discipline but ruins their and our physical and mental health." (Sarah)
- Conforming: "I definitely want to improve students' scores in English exams."

(Zoey)

- Internal: “I don’t know how to criticize students. I’m close to them, but they are not afraid of me. I don’t have teacher’s prestige with them.” (Hebe)
- External: “A very mischievous student from an experimental school didn’t hand in homework and slept in class.” (Frank)
- Positive: “I enjoy successful problem solving. No matter what you teach, you cannot become a good teacher without problems.” (Donald)
- Neutral: “I do not dislike problem solving. I must solve those problems that have to be solved. And it is not necessary to deal with those that I don’t have to.” (Sean)
- Negative: “I don’t like finding problems and solving them.” (Gavin)
- Active: “I identify and overcome problems every day. I identify problems when I talk to students and I think about the problem when there is something wrong with my students.” (Sarah)
- Reactive: “Usually, I don’t raise problems.… and when a problem occurs, I just face it and try to solve it.” (Sonia)
- Proactive: “I worried that they (the twin sisters in her class) might be isolated by others.” (Zandra)
- Confident: “It needs time and accumulation to be good at problem solving. I should say that I am good at it now.” (John)
- Uncertain: “I’m not good at problem solving, but I’m not a clumsy problem solver. I can solve most problems, and I give up on the extreme cases.” (Sean)
- Unconfident: “I’m very bad at problem solving. I think I tend to avoid them. When a problem occurs, I’m unprepared and often at a loss. I’m not good at dealing with others, but comparatively, I’m better at research or lesson preparation.” (Sonia)
- Available: “John has such a solid foundation of the knowledge. Whenever there is something that we don’t know, we usually ask him.” (Yevette)
- Unavailable: “If an extreme behaviour occurred… the parents would not

believe the teacher to be innocent but would hold him/her responsible. Generally, the school would not take the responsibility in the first place but wanted to find the teacher who should be blamed…. Without strong support from school and a right attitude of the parents, I become slack." (Sean)

- Optimistic: "There are always more solutions than problems." (Gavin)
- Pessimistic: "Since then I changed my mind. I cannot change this kind of student." (Sean)
- High: "In the end, I didn't join my students (in their social practice). The school leader advised me not to because if there was an accident I would be accused. I feel regrettable about this." (Zandra)

  "I don't have enough time and energy to digest the recorded lectures online and adapt them to my students. These lectures are good, but we cannot use them directly." (Yevette)
- Low: "If you are willing to communicate with and understand your students and explain clearly what mistakes they make and what punishments they receive, most students know that what you do is for their best interests, and they will accept the punishments willingly." (Frank)

  "For the 12th grade, I will skip through the exercises to find out their difficulty. I can do this quickly. It costs some time, but it's worth it." (Donald)
- Emotional: "I felt guilty and regretful that I didn't say goodbye formally to the students." (Zoey)
- Reasonable: "Without damaging student's physical and mental health, appropriate punishment is necessary. We should love students, but they are youngsters. With so much temptation and negative energy in the society, they will surely be misguided and confused. Under such a circumstance, to influence students with love is far from enough." (Frank)

Decision-making is very important in teacher's problem definition, and based on the analysis of the indicators, it is assumed to consist of two opposing processes.

Table 4.9 The process of decision-making

Willingness to deal with a problem		**Estimation of problem-solving results**
Attitude towards problem solving		Self-confidence
Activeness	**Vs.**	Estimation of results
Personal interpretation		Estimation of the availability of resources
Attribution of responsibility		Estimation of costs and risks

There can be three different results of the decision-making process.

Table 4.10 The results of decision-making

	Optimistic estimation	**Pessimistic estimation**
Willingness to solve a problem	Decided to try	Undecided
Reluctance to solve a problem	Decided not to try	Decided not to try

After this process of problem definition, the participants will have a defined problem. By re-examining the problems and questions reported earlier, it can be found that all of these situations were unwanted by the participants as teachers; the participants understood them in different ways; and they have identified targeted problems that they were about to deal with and quasi problems that they chose to ignore for the time being.

4.2 The reported problem-solving strategies

This section focuses on the strategies used by teachers to solve particular problems, the process of strategy use, the factors affecting strategy use, and the indicators of the style of strategy use.

The reported problem-solving stories

Frank: "Under such a circumstance, to influence students with love is far from enough."

Frank told me two problem-solving stories. He said, "I always teach the slow learners. Five years ago, there was a student who enrolled in our school. Upon arrival, he came to me and told me that he was bad at English. He could only get about 70 scores in exams. And he asked me how to learn English. So, I made study plans for him

every day, and he often came to me for questions. He was from a rural middle school. No wonder he had many problems. The biggest problem was that he kept forgetting words. So, I started with vocabulary, by teaching him how to write words by their syllables and how to read phrases, etc. In the 11th grade, he made some progress. I began to teach him basics such as sentence elements, clauses, and the structure analysis of complex and simple sentences. In the 12th grade, I mostly gave him special exercise assignments. He would buy exercise books and do them as I said. He was very cooperative, but sometimes he got lazy. Then I would give him a little punishment, such as making him stand during class or doubling the exercises. Since he was willing to study, and you made him understand his mistakes, he would willingly accept the punishment. I think the most important thing is his drive for study. He knew exactly the goals of the three years' study and worked for them. I spent a lot time and energy on him. As a novice teacher, I had no wife or girlfriend then. I lived in the dormitory at school and had a lot of time to urge him and communicate with him. In the current education system, this is almost the only way to help this kind of students, to focus on the basics and spend a lot of time. In the end, he got over 120 scores in NCEE and entered a good university." (PN1)

"Also, five years ago, there was a very mischievous student who came from a good experimental school. At the beginning he didn't hand in exercises and slept during class. Though not a class teacher, I worked with vigour and temper then. I used to call him to my office, made clear his faults and beat his palm. He changed, started to hand in exercises and make progress in English. In the 11th grade, he was suddenly expelled from school for too many disruptive behaviours (such as playing cell phone in the dormitory). He was transferred to another school and finally ended up in a junior college. He was a smart but mischievous student with a bad habit. With such students, it is important to communicate with and understand them, and make clear the punishments for misbehaviours in advance. They will understand that you're helping them and accept the punishments. But the process may be long and through ups and downs." (PN2)

These problems are about improving student's EFL learning and changing their behaviours. One student is from rural areas, motivated for learning but with a weak foundation in English; another is with good lower secondary education, knows the importance of study, but prefers playing to learning. In the problem-solving process, Frank designed customized study plans, delivered tutorials, encouraged questions, gave special exercise assignments, paid attention to the student's study, urged him to learn, communicated with the student and inflicted punishment if the student became lazy.

Frank's strategy features **tutorial**, **communication** and **punishment**. He explained the reason for inflicting punishment on students (PI5). Meanwhile, he felt restricted by the cost and risk of using the strategy (PI4) and mentioned a kind of student for whom this strategy was ineffective (PI1). And Frank said he did not insist on this strategy, "First, with my own family and children, I don't have enough time and energy now. Second, if the students will not accept the punishment, it could make big trouble for myself. So, I will not make physical contact with the students. For example, now there are two students who often sleep during class. I will ask their desk mates to poke them and wake them up, tell them to stand at the back of the classroom with their books, and talk to the class teacher about this, who will communicate with the parents. However, there are no apparent effects."

According to the report, Frank used this strategy to achieve his goal, even if he realized that it was disapproved by public opinion and there were risks of using it. Frank preferred this strategy because he knew it could be "effective with most students except two or three 'mischievous' ones". Though this strategy can be effective in correcting bad learning habits, punishment may harm students physically and mentally, and it is difficult to predict, measure and control the harm.

I realized that Frank was facing a dilemma when he reported that he had a wish "to help the underachievers" and a tendency to step out and avoid troubles (PI4) or "to put the 'unsolvable' problems aside" at the same time. On the one hand, Frank believed that "this is almost the only effective way to help the underachievers". This belief is not new. It originated from the education reality relating to China's large population and

rural-urban disparities. It was based on the opinions that 1) everyone has equal opportunities to receive tertiary education; 2) the equality is insured by fair competition in NCEE; 3) teaching and learning in secondary schools aim to win the competition; 4) hard-working is indispensable for achieving this goal, especially for those from rural areas; 5) every student naturally prefers playing to learning; 6) appropriate punishment helps to keep students working hard.

On the other hand, this belief was challenged by new beliefs in education (pp. 61). Frank found that punishment was neither accepted by some of his students (PI1) nor supported by "the Education Department, the public or the parents" (PI5). So, he felt restricted as a teacher, complained about this and came to believe that "teachers are only executors and cannot change the education system or society" (PI3, PI5) and the key to solving learning problems is "student's own drive for study".

The dilemma can affect the development of teacher identity and is a real problem for Frank. He is an insightful observer of education reality, but there is a lack of self-reflection and self-criticism in his report. It seems that this was the only strategy that Frank approved and used. In other words, educators in teacher's college, school leaders, mentors and teacher trainers failed to provide opportunities for Frank to learn what he needed when he needed them (i.e. other strategies that can help more underachievers). And Frank started to doubt the effectiveness of in-service training (PI7).

It is a pity to hear him say that "there is nothing I can do", "teachers cannot change the education system and society" or that he tends to step out of a problem to avoid troubles. If Frank has heard his colleague's problem-solving stories, he may realize that this strategy is not the only option he has and there are always other choices. And, it is important to find a way to help teachers like Frank when they are facing such difficult problems.

Sean is another teacher who adopted a similar strategy. He also communicated with a transfer student who was good at science but bad at English, analysed his weaknesses in learning, gave him tutorials, encouraged him to learn and ask questions. This strategy was successful, and Sean also thought that the success lay in the student's

need to learn EFL (PN15).

But this strategy failed with another student. Sean said, “Last year there was a student who came from a remote mountainous area for remedial courses. His parents were migrant workers in Xi’an (a city about 800 km away). He lived in school on weekdays and lodged at his aunt’s at the weekends. He was good at science but bad at English. He could only get 50 scores in exams. I have talked with him so many times. He listened but was bad at executing (what I told him). He spent little time in memorizing (vocabulary) and said that he could not write the exercises. I despaired of him.”

“His addiction to cell phone was my worst headache. It was a class rule to hand in cell phone upon arrival at school, but he would rather die than do it. His cell phone was confiscated by the Dean of Students twice. He asked me to take his cell phone back, then I knew he was so addicted that he needed it every minute. He even played it in the classroom. I stopped his living subsidies, but still he would not hand it in. One afternoon I talked with him and tried to confiscate his cell phone. I pushed him so hard that we both became emotional, and I scolded him. He was still determined. Then he became excited and started to twitch like he had an epileptic seizure. I was so frightened, and I changed my mind at the moment. I could never change such a student, and I gave up. There would be more problems if something went wrong with him. I felt hopeless. You could do nothing when he played it in the dormitory at two or three o’clock in the morning. Taking his cell phone away was like killing him. I told the school leaders about this. They could not help me, and they said they would not take responsibility if something went wrong with the student. I called the parents, but they would not come. His uncle came once and said that he could not discipline him because he was not his own son, and he regretted to accommodate him because his son was affected by him. I really wanted to change him. He was a left-behind child and he came from a backward mountainous area. I told him everything that I could nicely, such as ‘If you don’t learn, you won’t have a bright future’. I cannot change him. He doesn’t have the persistence and determination to change himself.” (PN16)

Sean didn't refer him to psychological consultation, though the service was provided in the school. He said, "As a teacher, I cannot label a student. It is wrong and I don't have the right (and qualification) to say that he has a (mental health) problem."

With this student, Sean tried to communicate with him and punish him by stopping his living subsidies, confiscating his cell phone and scolding him, but none of these were effective. Sean also tried to find help, but neither school leaders nor parents offered him what he needed. And, Sean became slack (PI37).

Like Frank, John also thought punishment is necessary. He said, "The school and education system forbid us to punish students. But there are some students who won't listen when we try to talk sense to them. They disobey us. Some parents would not cooperate with us. What can we do? We don't have an effective measure against this, and we are helpless with such extreme cases. Moreover, public opinion is not so fair. As a result, every teacher becomes alarmed and dare not to intervene in what they should." For John, punishment should not affect student's mental health but should be conducive to their health and learning. He listed examples such as appropriate amount of physical exercise, running, reading an article, copying words.

It is worth noticing that the concern about the risks of using the strategy affects the participants' functioning as teachers and problem solvers. This concern originates from the conflicting ideas about punishment in education (pp 55) and it is related to the change of teacher-student relationship (pp 54). While students are disobedient and defiant, the strategy featuring tutorial, communication and punishment may become unreliable, and teachers need other strategies to reach their goal of helping more underachievers and to become more effective in teaching and problem solving.

Gavin: "I think that a teacher should communicate with students equally."

Gavin's problem-solving strategy is different from Frank's. "A year ago, there was a new student who came with his grandpa for registration. His grandpa was about 70 or 80 years old, carrying the school bag for his grandson. As his class teacher, I was relaxed, patted on his shoulder, and said jokingly, 'Still need grandpa for the schoolbag?'. I just wanted my students to be independent. Later, at the Entrance Education for new

students, I talked about my principles of class management. I wanted my students to have strong body and good habits such as respecting the old. I used the schoolbag incident as an example, but I didn't remember his name then and I didn't aim at anyone. Half a month later, I mentioned this incident as an example again at a parents' meeting to explain my class management principles. After that, the student wrote me a letter with words too fierce for me to accept. My colleagues and my wife, who was also a teacher, suggested to return the student to the school for replacement. I reflected and realized that I had responsibilities too. I called the student and his parents to my office. They were nervous, worrying that I would have a bias against him. I told them that I abided by teacher's professional ethics and I was also a parent. Then I examined myself and apologized for my mistakes. I didn't know that he was busy with registration and became tired. It was unfair for me to judge him without this knowledge. But I explained that though I criticized him, my heart was in the right place. He couldn't accept this completely. His parents asked him to apologize and they apologized to me. I said I didn't need apologies. I thought parents surely loved their children more and they apologized with purposes. From then on, there was a gulf between the student and me. Later, the students needed to choose to go to science or literature classes. Perhaps he didn't want to stay in my class, which was a good science class, he applied for a literature class, passed the exam and was transferred with a dozen others. After some time, all of these students but one wanted to come back, including him. He and his parents requested the retransfer many times. But this was his own decision, after one week's consideration, agreed by parents, and negotiated at meetings. And the school did not consent. He wrote to me again, saying that 'a teacher for a day is a teacher for a life', and I was touched. So, I talked to the school and got him back. A year passed, we became familiar and got along very well with each other. After the parents and I became familiar, they told me that the student had polio and his feet ached sometimes. He was crippled, though inapparent. As the only child and with this disease, he was indulged by the whole family. That was why he had a temperament." (PN5)

Gavin's story actually includes three consecutive incidents (i.e. the schoolbag, the

offensive letter, the retransfer). The problem is about the misunderstanding and conflict between Gavin and the student. His strategy features **communication** and **support**. He reminded the student kindly, made an example of him to explain his principles, consulted colleagues and family, self-reflected, tolerated the offense, communicated with the student, explained himself, apologized to the student, and provided help with forgiveness.

Gavin's use of the strategy is related to his beliefs. About teacher-student relationship, he said, "In China, teachers are dignified and high above, but I think the students may be afraid of you rather than respect you, especially in this era. I hope our students can respect us and like us. This is a reward for our work. My idea is that teachers and students are equals. I used to doubt about this idea. The students are teenagers. This generation were born in the new millennium. Many of them are the only child and are spoiled and indulged in a family. My interaction with them is often dissatisfying. But this incident (PN5) convinced me that we are equals. I don't ask my students to be completely obedient. As a class teacher, I often consult with them. When they deal with something (such as class management), I tell them that it is their business. They've grown up now. They have responsibilities. I cannot make decisions for them. I hope they can see things, think about them and do them by themselves."

Gavin is tolerant of student's mistakes. "I was angry, but I believed that I was a man with magnanimity. He was a student, much younger than my daughter. If he was my son, I would not drive him off to another class just because he made a mistake."

Gavin believes that education is about love and communication. "If you want to teach them, you need to love them from the depth of your heart, like they are your own children. I think that you can teach well with an emotional connection (between you and your students) because this profession is about dealing with people."

Gavin believes that a teacher must be cautious about imposing punishment. "I would not punish students carelessly. This is related to my parents. They are open-minded and democratic. They didn't indulge me but reasoned with me. As a teacher, if I abuse my authority and stay high above, the students will agree in words but not in

mind."

Apparently, Gavin believes that "teachers and students are equals" and "we should communicate with each other frequently and on an equal footing". But it may not be enough to resolve conflicts only by communication. In Gavin's report, the conflict between him and his student was resolved after he offered help for him rather than after he talked with him and his parents. This is related to the fact that Gavin took a long time to win their trust and respect before they told him about the polio. It seems that Gavin has realized the limitation of teacher-student communication. "Some problems are unsolvable.… For example, my students idolize television celebrities. They won't change their mind even if we reason with them. They have different needs at different ages (PI15). All that I can do is to reduce the negative influence on the students." Therefore, Gavin uses other means to deal with 'unsolvable' problems such as student's addiction to cell phone. He shows understanding to their needs and addiction (PI15), provides a 'class phone' for them to make phone calls, and allows them to use cell phones in a social practice activity. "Some students are becoming better now, but we cannot cure their addiction. As far as I know, some are still playing games secretly, though I didn't catch them on the spot." And he added later, "Sometimes my role is less graceful. They are at such an age. I need to use 'despicable' means. I adopt a carrot and stick approach to the students, beguiling and coaxing them. The students may not realize that I am coaxing them. When they do, the problem is solved. With a knowing smile, they will understand that I do it for their own good."

In addition, it is worth noticing that Gavin is different from young teachers like Frank in many ways. He was teaching the class of excellent students, who might have a bigger drive for learning; he was influential in the school and could help with the retransfer; he was good at self-reflection and perspective-taking; though dislike the word 'problem' (pp 97), he did not think that a problem is all bad and believed that "the friction between people can become lubricant of interpersonal communication"; he was an experienced class teacher who wanted to and did build a teacher-student relationship inspiring mutual respect and love; he was optimistic about problem solving and

believed that there were more solutions than problems (pp 101); he was confident and believed that "there is no trouble that I cannot solve by myself or with the help of my colleagues". Thus, if Frank used Gavin's strategy with his students, it might not be as effective as it was used by Gavin.

Sonia is another teacher who tried to communicate with her student (PN13). "There is a student in the sports class. As a typical example of his classmates, this student is good at math but hasn't learnt English before. He came from Chengdu and he ranked in the top three of the class in several exams, but he finished English exams all by guessing and scored 30 to 50 when the full mark was 150."

"So, I thought a lot about how to talk with him. I wanted to have a relaxed talk and walked with him on the playground. I started with his life and hobbies, moved on to his advantages and goals, and then came to his weakness, saying that he was good at math and high jump, having a good chance to go to top-ranked universities, but English was his weakness, why it was important, how to (improve it), and what he thought of it. He was very resistant and would not listen no matter what I said. He said that his teacher in lower secondary school told him the same thing. But he gave up, and the teacher had to give him up in the end. He told me to give him up too, saying that he was not interested in English, he didn't care about the exams or scores at all, he would never ever learn English, and I should not waste my time on him. Wondering whether he really didn't care about the exams, I talked with him many times, telling him that he might lag far behind others without learning English. But he still would not listen."

"Once he flubbed in monthly exams and ranked 13th in the class. I thought he was upset about this and wanted to take this opportunity to turn his frustration into a drive for learning, but I didn't talk with him alone because it was ineffective before. In an evening study hall, I analysed the students' exam papers including his. I used the economic terms 'bucket effect' and 'opportunity cost' to explain why he should spend some time on learning English. I told the whole class that spending no time on learning English was not smart for him, and I hoped they could 'work smart' rather than 'work hard'. I said that he was smart, and he should think about what he needed to do next.

Then I made no more comment on him. The next day I found that he used logic in reading exercises. Recently he started to learn English. His attitude changed. I didn't praise or criticize him and pretended that I didn't notice him, but I did pay attention to him. I was happy to see his change. I was not sure that I could change him but tried different methods. It was a surprise that he was affected this time."

It seems that the student was reluctant to build a private and intimate relationship with the teacher, and Sonia had to communicate with him in a public and reasonable way. In the process, she learnt how to communicate with such kind of students.

Simon also reported the use of communication. "There were students who would not take notes. All that we could do was to talk with them. There were some effects, but we needed to talk twice a month. I usually talked with them in evening study hall. I didn't talk about study but try to receive updates on their situation, such as their hobbies. They were excited in the talk, but only they could tell whether they understood my intentions. They behaved themselves after the talk. At least, the teacher-student relationship was improved, and this would help in some degree."

It is common for a teacher to deal with student's learning or behaviour problems by communication. Communication can be applied to various problems and can promote mutual understanding between teachers and students. One limitation is that sometimes it is futile to reason with a student. Students can have a negative attitude towards learning, teacher and school, and sometimes it is difficult to change their attitude only by talking. So, when communication is not as effective as expected, teachers need to wait for an opportunity for affecting students or use other strategies such as punishment or support. In addition, in order to communicate with different kind of students effectively, teachers are learning different ways of communicating, such as privately or publicly, explicitly or implicitly, honestly or deceitfully.

Sarah: "I was emotional, and I made the decision."

Sarah's strategy is different from the above-mentioned participants. "There was a student who paid extra money to come to our school. Upon arrival, he ranked the second to last in my class. He had been expelled by five lower secondary schools before. He

was a troublemaker. When he came to my class, his hair went up high, looking like a layabout to me. At the campaign for class committee and at the moment of electing the commissioner of sports, he walked defiantly on the stage, pounded the table, and swore, 'Damn it! With 40 males in our class, we cannot win the fight with the literature class. They only have 11 males! I can't get over it! I want to be the commissioner of sports!' On that day, every candidate needed to make a work report, give a speech and get votes. But I decided to appoint him directly. I explained (to the students) that he noticed our problem and he refused to accept defeat. That was the first time that he ever became a member of class committee."

"Not long from this, I confiscated his cell phone. At that time, cell phone was not allowed in school, but not banned like today. I forbad my students to bring cell phones, but some parents bought cell phones for their children, saying that it would be more convenient for communication, and they always thought that their children would not play cell phones in class, but they did. So, I announced that once the cell phone was confiscated, the parents should come to school, take the cell phone back, and keep it away from the students because it proved that they were not able to control themselves. Upon arrival, the father, an honest businessman, started to tell me his son's 'dark histories' as a precaution. I was really irritated and stopped him, 'Since you arrived, you spent 27 minutes complaining about how bad he was, don't you see anything good in your son? Let me tell you, when cell phone was confiscated, all the other students would tell me they were just checking the time, but only your son said he was playing games. At least, he was honest, and he was brave to take responsibilities. I don't want to talk anymore, and I have lessons to teach. You can go home now.' He took the cell phone and went back home, and he told the mother, 'I think our son can be saved now'."

"While chatting with his father, he once said, 'My greatest wish is that my son will not be sent to prison.' I replied, 'How can you have such a wish! You should never say such things in front of him. You can tell him that you dream about the day to attend his graduation ceremony.'"

"In the 12th grade, the student's best rank was the 18th in my class (with around 70

students). After NCEE, he was the only student who didn't fill in university applications because he wanted to go to the first-tier universities, but his scores were not enough. So, he refused to apply for the second-tier universities and planned to study for one more year. At that night past 11 o'clock, his father called me in a desperate hurry, saying that he had invited all the relatives and friends and had everything ready for an eight-day-long celebration of his son's entrance to a university. Many relatives thought it was incredible that his son could go to university, but his son actually wanted to give up. He had negotiated with him and they agreed to consult me and do as I suggest, so he called me in advance, and asked me to persuade his son to apply for a university. When they arrived, I asked the student what he was thinking. He said that he wanted to challenge himself and study one more year for the first-tier universities. I immediately turned to his father and said, 'Let's support him'. His father looked at me unbelievably, meaning that we had talked about this. I explained to him, 'The next year would be very hard for him. If he wanted to try, we must support him. You are able to support him. You don't need him to work so soon. To challenge himself and to face hardships are valuable qualities for his whole life. Even if he fails next year, he will not bear the hardships in vain.' As it turned out next year, he still missed the first-tier universities by two points, but he entered the best major of a second-tier university. Now he works as a general project manager, only eight years from graduation, and he bought a Volvo by himself."

"He had many setbacks during the process of learning. He said, 'You told me many things. I think I should start to learn now, but I'm like a zero, I don't even know the things in lower secondary schools.' I replied, 'You are like a zero, but your mind and your intelligence is not (a zero). You should try to read the lower secondary textbooks by yourself and see how much you can get. As for what is taught in upper secondary schools, it's impossible to learn it by yourself. Let me tell you a secret: 'put your face in your pocket, and go to your teachers to ask questions, no matter how stupid you may sound.' So, he started from this and got the 18th rank in my class. I think he is really a very good (learner). And I feel fortunate that I didn't follow the regular way of thinking with him and these problems." (PN8)

Sarah's report includes several incidents about a student. The problems are about the student's abrasive manners, breach of discipline, learning difficulties, the parent-child conflict about college entrance, and the father's lack of parenting skills. Sarah adopted a strategy featuring **emotion**, **support** and **communication**. She noticed and appreciated the student's merits, broke the rules to provide opportunities for him to prove himself when he needed it, disciplined him when he violated the rules, defended and protected him against his father, encouraged the student to learn, provided advice on learning methods, and talked with the father and other students for understanding and cooperation. Apparently, Sarah's problem solving is different from Gavin, who cooled himself down when he was angry about the offensive letter and tried to resolve the conflict by having a dialogue featuring sense and equality. In other words, emotion played an important role in Sarah's problem solving.

I thought this strategy originated from Sarah's educational beliefs and teaching experience, but she said: "In fact, it comes more from my character. It's not my character to follow the rules. I'm very emotional and liberal. When the student pounded the table, I appreciated the vigour of his speech. I was emotional, and I made the decision." This tendency to make emotional decisions was displayed again when she was irritated by the father's continuous complaint about his son and when Sarah gave an apple to another student whose parents got divorced as a prepaid reward for her progress (PN7), and she concluded, "If it is futile to focus entirely on (their) knowledge, sometimes we (should) arouse their passion for learning by emotion." However, this tendency may also be related to her belief that education is generative, which happens in the moment and cannot be prepared in advance. "The essence (of classroom teaching) is generated during the interactions between a teacher and her students. You can never prepare it before class."

Emotion is also important in one of Donald's problem-solving stories. While spending a lot of time to tutor a low-proficient learner, who said he would work hard but did not, instead of punishing him, Donald told him a true story about a former student of his, and said, "I don't want you to become my second regret." After that, the

student changed, and his English exam scores improved from about 50 to over 110. Donald said, “When I was teaching my first class, I didn’t have such a true example. I was not convincing, and there was a student whose attitude I failed to change (i.e. the one that he regretted about).” (PN11)

This strategy is effective. It provided another way to deal with the “unsolvable problems” or “extreme cases” encountered by Frank and Sean, and it proved that it was possible for a teacher to affect even the most mischievous students and their parents. She said, “Now the parents and I are friends for life. This is really good.” However, the strategy is difficult to learn and use. It requires tolerance to forgive a student’s abrasive manner, insight to discover his merits, courage to break the rules for him, determination to defend him, strictness to discipline him, and knowledge to support his learning. More importantly, emotion is spontaneous. It cannot be planned, and it is hard to control. For example, while Sarah made the emotional decision, she didn’t consider whether there was a better way that could support the student and had a fair election at the same time. Perhaps a reasonable decision could be more effective than the emotional one, but it was difficult to find it at the moment, and it is hard to say that it could affect the student as much as the emotional one. But it is worth noticing that the relationship between emotion and cognition is obscure (Pessoa, 2009). By making the emotional decision, Sarah was conveying a message to her students: everyone has shining points that should be recognized and appreciated, including those who are destined to lose the competition. The ability to appreciate others is important for students facing strong competition in and out of today’s school.

Anyway, the strategy can be very effective when punishment or communication is not, but its effectiveness depends on individual characters and spontaneous emotions, and it may not be a suitable problem-solving strategy for every teacher, student, and problem.

Hebe: “I thought about this and an idea suddenly came into my mind.”

Hehe confronted a different kind of problem. “I asked the students to extend their vocabulary by reading extracurricular books, but I didn’t know how to examine them

because they learnt different words. I used to collect their notebooks to see what words they collected and compiled quizzes with these words. Then I found that this took a lot of my time, and they could not finish the quizzes because they didn't know the words collected by others. One night, I thought about this and an idea suddenly came into my mind. I asked every two students to exchange their notebooks and devise questions for each other. In this way, they could devise questions for their classmates and learn new words from others' notebooks by writing them down in their own. As a result, the questions were focused, and the students were enthusiastic. Later on, I applied this method to other exercises such as sentence correction and blank filling. I asked them to read each other's mistakes in test papers, or those questions they thought they could make a mistake and use these to design a test paper (with the full mark of 100) with vocabulary, sentence correction and blank-filling questions for their classmates. I think I can use this method with other question types. With this method, the students were really learning and thinking autonomously. This is better than giving them more lectures. Autonomous learning is more focused, and the students are more enthusiastic." (PN3)

This problem is about a teacher's lack of assessment method for student's vocabulary learning. Hebe's strategy features **brainstorm**. She thought of a method, tried it out, reflected on it, thought about a new method, and conducted trial and reflection again.

Hebe's preference for the strategy is related to her understanding of an EFL teacher's duty. "All the problems that I face and think about are about student's learning. I don't think much about my relationship with them because I'm not a class teacher." As a result, though she didn't know how to discipline or criticize students (PN4) and felt that getting along with them was "the biggest trouble" (PI9), she focused on didactics. Later, she encountered a bottleneck in teaching (PI8). "Now it is different from when I just graduated. I had many ideas that I wanted to practice then. It became boring gradually. I don't know how to improve myself (now)." But she asked her students to dub English movies with an app. She attended an ELT forum about cross-cultural communication and a workshop about using mind map in teaching, and she

was preparing a literary seminar for her students. She wanted to go abroad for personal experiences and go back to university to learn latest educational theories. All of these were consistent with her wish to "focus on innovations in teaching so that I can be inspired to solve (didactic) problems" and she wanted to learn "how to apply new teaching philosophies to her teaching practice" so that it can be "efficient and popular with the students." Apparently, brainstorm is a strategy appropriate for Hebe's goal of becoming an innovative teacher.

Hebe's preference for the strategy is also related to her tendency to solve problems by herself first. "When I don't have a clue, I will usually try to solve it by myself. If I'm still clueless after that, I will then ask for help."

The strategy gives Hebe autonomy for learning. She learnt by solving real problems encountered in practice and wanted to learn more theories after several years of problem solving. With this strategy, Hebe can learn a lot from every problem confronting her and may gradually become an innovative teacher and develop her own way of teaching. And, it is easy to adopt the strategy. It enables the problem solver to discover strategies that no one knows before or to understand existing strategies differently from others, and to form unique strategies for particular problems. But the risk of adopting the strategy is that Hebe's attempts may fail, which can result in more learning difficulties. And it may take a long time to find an effective solution.

Donald: "I'm extroverted. I can ask anybody a question."

Donald's strategy seems to be quite the opposite of Hebe's. "For example, I need to arrange seating for new students, but I've never done this before. I searched the Internet and found a lot of information. I spent days to read them, taking down a dozen pages of notes on what I thought to be very important. And my seating arrangement was successful. No one complained. The discipline was good. And no one has come to ask for a change of seating." (PI28)

Donald also asked his mentor for help. "There was a student who was caught smoking and disciplined by school. I didn't know what I should do. Should I ask the parents to come? What should I do after talking with them? Then I asked my mentor,

who said that I must ask the parents to come. If the student made a bigger mistake and was disciplined again, the parents would blame me for not informing them at the first time. Then I asked whether I should let them take the student back home. He said I should let him go home for introspection and let other students have respect and fear (for the school rules). So, I sent him back for two days. Everyone was well disciplined and behaved in those days. They didn't know where he went and whether he would come back. I didn't say it. When he came back, the students were relieved that I let him back." (PI25)

The problems are about Donald's lack of knowledge and experience about class management, and Donald's strategy features **exploration**. He searched the Internet or asked his mentor for information, made a plan adapted to his students, and implemented the plan.

Donald's use of the strategy is related to his belief that learning form experienced teachers is more effective than working by himself. "I will look for information or ask the school leaders for help directly if I cannot solve a problem. This is better than working quietly and alone. I can try my best, but it may still be no match for class teachers with a lot of experience."

Donald's use of the strategy is also related to his personality. "I'm extroverted. I can ask anybody a question, my mentor or other class teachers. Usually I will ask them as long as they are here, for my convenience…. I have a thick skin. If I cannot get an answer, I'll ask somebody else. I won't hold grudges against someone if they don't give me an answer."

But the strategy is sometimes ineffective. "As a new class teacher, I have no experience. When I talk with students, I'm not so expressive and persuasive as experienced teachers. I went to my mentor for help. He simply told me that I needed to talk more frequently with them. This is not helpful. I don't know what he will say to the students."

"When I need suggestions for a problem, those offered by school leaders or other class teachers are often not specific. Unspecific questions get unspecific answers. For

example, when I asked how to deal with schoolwork plagiarizing, they gave me general principles rather than specific measures that I could adopt in my class. It's impossible for them to teach you the real secrets of dealing with student problems. Even if they do, the results (of using these strategies) may be different because different teachers have different temperaments." (PI31)

"You'll find them as long as you search the Internet. But (the quality of) the information you found is uneven. And they are not vivid. Many of them are theoretical, and you cannot find videos, cases or advices to a particular problem. Few examples about teaching and student management are written in articles. The published ones are not the best examples or those that need some courage to publish. There are few such stories because teachers don't know how to write them or don't want to write them." (PI32)

But Donald still favoured the strategy. "After searching for information, you'll know that many people are facing the same problem. One man or another's strategy may not work. But it may work if they are combined. Or, their strategies don't work now, but they will work on another day."

"None of them directly helped with my problems. The students were different. I didn't count on others for solving my problems, but I needed different perspectives and opinions that I could adapt for my problems."

"Indeed, there are some problems that no one can handle very well, such as homework plagiarism and cell phone addiction. But after discussing, we can usually find a coping strategy at least, though we cannot eradicate the problem."

"Their suggestions are not specific but general guidelines that can keep me from making big mistakes. Those are necessary for young teachers like me. So, I must ask them. They can help with my problem solving."

The strategy is effective. It can help young teachers like Donald to find the knowledge they need very quickly and it allows them to get a big picture of the concerned problem by integrating different perspectives and opinions, but as Donald said the strategy is not without problems because the knowledge that an explorer needs

may be unavailable, impractical, unadaptable or even “incorrect” sometimes.

Exploration is important because it may offset the disadvantages of brainstorm, and vice versa. One difference between them is that Donald preferred to search the Internet or consult experienced teachers first, but Hebe preferred to think up and try out answers by herself. This raises an interesting question: should teachers be encouraged to solve a problem by brainstorm or exploration first? On the one hand, it is unfair to include students into teacher’s “experiments” involuntarily and it is a good start to learn from experienced teachers; but on the other hand, even the experienced teachers can make “mistakes” such as punishing students, and sometimes a teacher has to depend on him/herself when it is urgent or when help is unavailable, impractical or unadaptable. Considering the broad individual and situational differences between particular problems, there may not be one “correct” answer but many different answers to this question. In fact, exploration and brainstorm represent two different ways of teacher learning: from experience to practice and from practice to experience.

With another problem, Donald adopted a strategy that features **self-reflection** and **customized teaching**. “It was my first class. After getting the master’s degree, I was proud. I forgot that high school students’ English was not good. The textbooks were very easy. I taught very fast and without pertinence, much faster than other teachers. The exam results were lamentable. But I didn’t think much about it. The students were stupid. Learn it or not. I blamed them. Later, I felt very regrettable. Why didn’t I spend more time and energy with them? They couldn’t go to college after all. If they could learn English well, their life might be better, even if just a little bit. They knew I abandoned them. They must have felt it. This is my greatest regret. In private, I was very close to the students. This is comforting. In those years, I travelled between home and school, left immediately after class, it was a shame that I didn’t spend personal time with the students. I was not enthusiastic about work then. I was not married yet. I went home to stay with my girlfriend, worrying that she might leave me.” (PN12)

“Then, I become mature. I’m an educator. It’s impossible for me to teach only excellent students. It’s my mission to help them to be better, high or low achievers. At

that time, I was teaching the worst science class and experimental class. I chose teaching materials according to their aptitude, especially in the 12th grade, the year of exercises and review before NCEE. There was a marked improvement. I am most satisfied about this." (PN10)

Reflection is an indispensable element in professional learning, and it is important in promoting meaningful learning in teachers (Korthagen, 2017). Reflection is also important for teacher's problem solving. Donald's reflection was triggered by the failure of his first years of teaching and his regret about its influence on the students. Reflection was so effective here that Donald made a complete change of attitude and teaching method. Now it is promising for him to become a very good teacher that can help many students in the future. But the price that his students were unable to go to college was so high that it became a burden for him. "My greatest wish is that school leaders and other class teachers allow me to make mistakes. When I have a problem, don't have expectations that are too high or place too much pressure on me, but help me analyse and solve the problem."

Zandra: "I think as an educator I must give students positive energy and I propose to integrate teaching and education."

Like Hebe and Sonia, Zandra tried to integrate language teaching with the learning of culture. Back in the 1980s, she was teaching the 9th grade in a rural school. The students were low achievers. To improve their learning, besides teaching them basics and listing language points for them to remember, "I held a Christmas celebration for them. I bought a Christmas tree. They decorated it and put on a performance. They enjoyed it. They would like you very much and everyone was studying English every day (PN17)." In recent years, Zandra would teach about author's life and social background and organize activities such as News Report in One Sentence (for the 10th grade), Duty Report (for the 11th grade), Drama Week (for the 11th grade), and Reading Novels (for the 12th grade).

Zandra tried to establish a close connection with her students because "I always believe that getting along with students is more important than teaching". "Since 2011,

I would use my own money to invite the 10th grade for a hotpot dinner. The class teacher was really nice to them and they were so touched." "Once a student had wisdom tooth. Though I never cooked for myself, I bought pork chop and turnip, cooked for the student and two of his classmates. They felt that the teacher treated them very nicely." "Once a whole class of students looked displeased because they did badly at an exam. I bought a snack for every one of them (to cheer them up) and asked them to smile (PN24)." Though Zandra said that "the students' feeling (about her kindness) was not so intense as their predecessors", the students loved her very much. "They found my birthday from my ID and they prepared over a month. Everyone knew about it except me. I could feel that they were planning something. And they held a preparatory meeting. On that day, the twin sisters said they wanted to ask me a question. And they kept asking until 7 o'clock when it got dark. Then they asked me to go out. There were candles lighted all the way from my office to their classroom. They decorated the classroom and invited my former students back to school. They put on a performance, made a nine-tier cake and sent me many gifts. I was really touched, and I remember a student said in the QQ post, 'a lifetime of romance spent for my beloved teacher's birthday celebration'. I thought they did understand gratitude. They might not understand it in the 10th grade, but a foundation was laid for the love between teacher and student then, and they gradually understood it in the 12th grade."

Zandra explained why she thought gratitude and interpersonal relationship was important. "As a teacher, I must guide them and let them understand that they cannot achieve anything without help and support from others. They should be grateful. Today's students seem to be knowledgeable. They know computers and many other things. But actually, many of them are innocent and naïve. They seem to know (gratitude and social responsibility) but they don't really understand. So, I think we must teach them. But moralizing can only cause aversion and we must use appropriate methods." Zandra reminded her students when they won a scholarship. "I told them last year. 'Your improvement also depended on the help and support from your teachers and classmates'. And they understood. Yesterday I saw them put a small cake on every

teacher's desk to express their gratitude."

Zandra explained how she guided the twin sisters. "There were a pair of twin sisters from a rural school. They knew how to study, but they were simple and didn't know the way of the world. They didn't like to speak and didn't know how to treat their guests when we visited their home. When they arrived, I showed them to their dormitory, helped them make bed, bought slippers for them. They didn't know these things. You had to teach them little by little. After they accepted me, I started to be strict with them. They gradually became outward and willing to participate in all kinds of activities. They won many awards and shared the bonus with classmates." (PN19)

Zandra also tried to integrate language teaching with emotional education. "I think ELT should be connected with emotional education. In a groupwork report, a student said that he/she used to take parents' love for granted, but when his/her grandpa passed away, he/she realized that he/she lost grandpa forever. Another student asked what the most regrettable thing in his/her family relationship was. He/she answered, 'My greatest regret is that I didn't stop my parents from divorcing.' And he/she choked on tears. I felt very sad too and wanted to change the topic, but I realized it was not good and I said, 'There are things we will understand when we grow up. Maybe you could do something, but you could not make the decision for them. If your parents were wise (when they made the decision), it was not your (decision or fault). Now, you can still feel the love from your parents, and this is enough.'" (PN22)

Zandra also tried to integrate language teaching with patriotic education. "In a groupwork report, a student was talking about Japan. I told them that there were many patriotic education (programs) when I was a student. I still didn't like Japan. I thought we should love our country. I would not buy anything made in Japan. The student contradicted me. 'You are one-sided. Do you use iPhone?' I said yes. 'Do you know that many parts of iPhone are manufactured in Japan?' I thought I should not suppress him. So, I said I still could not get over it. 'I will remember your words and think about this'. That summer, I went to Japan because of this. Later I shared my experience in Japan with my students in a class meeting, talking about what we could learn from

Japan, what Chinese students could do to make us stronger, rather than just hate and resent. Three years later, there was a speech contest to commemorate the *September 18th Incident*. One of my students made the speech *Be a Sober Patriot* and won the first prize." (PN23)

These problems are about Zandra's goals to improve low achiever's learning by teaching language with culture, build a close teacher-student relationship, and strengthen gratitude, family love, and patriotism. She noticed these problems and attached importance to them. Zandra's strategy features **integration**. She integrated these goals with that of language teaching and she integrated multiple methods to achieve these goals. She held Christmas celebration and organized scheduled activities such as hotpot dinner, Duty Report (News Report), Drama Week, Reading Novels, Groupwork Report, girl's meeting, boy's meeting. And she interacted with her students and guided them in these activities. She also kept an eye on them and provided all the help they needed. And she would be strict with the students after building a close relationship with them.

The strategy allows Zandra to develop a personalized curriculum based on her educational beliefs and her observation of today's students so that she can overcome the limitations of the exam-oriented education. What concerns Zandra more is not the students' ability to acquire knowledge and information, but their ability to take care of themselves and the ability to get along with others and build an emotional connection with them. The strategy's effectiveness can be proved by the close relationship between Zandra and her students and the change in her students and in herself.

I was wondering whether there was a conflict between the multiple goals of Zandra's personalized curriculum and the exam-oriented goal of the school's curriculum. Zandra said "Duty Report costs about 20 minutes in every lesson. It is surely not included in NCEE, but they are not in conflict with each other. Duty Report can help with their exams in a way. And I told the students upon arrival that I wanted them to have more than just good exam results. There are many ways to learn a language, such as memorizing a lot, reading a lot, performing (dramas) or communicating with

others (in the language). And I give them a lot of training (such as listening and reading) for NCEE." But she also complained, "The quality of new students (in our school) dropped distinctly since 2008. Chinese Literature and EFL are the most difficult subjects for the students from rural schools. I used to teach easily without delivering extra lessons. But now I have to teach them more about the basics. I said (to the students) 'You're really like amnesiacs.' I know they don't have amnesia. In fact, they haven't learnt the grammatical concepts in lower secondary schools. I feel pitiful for them and I'm really dissatisfied about the textbooks in lower secondary schools." (PI47)

John: "His family didn't have money for his treatment. I sent him to hospital and paid for him."

"Upon graduation, I volunteered to support the minority areas and came here. Then I saw how backward it was. In the first six months, I had some doubts and hesitations, but I stayed for 32 years. In 1989, there were many middle schools in the county. I was teaching in two schools for a lack of teachers, and the students studied very hard then. I remember a student in the 9th grade. He lived in a small mountain village six kilometres away from the school. His family was very poor. His father passed away. He lived with his mother and three brothers. He travelled every day between home and school. At noon, he went home for lunch and time was not enough for him to attend the afternoon classes on time. So, I told him to stay and eat with me at noon. I saw him working hard. At the weekends, I told him to stay with me so that I could tutor him. Two months from Zhongkao, he caught pneumonia. His family didn't have money for his treatment. I sent him to hospital and paid for him. Sometimes I went to visit him. After about one month, he recovered. Later, he passed the exams and went to professional secondary school (which was more difficult than going to upper secondary schools at the time)." (PN32)

This problem is about a student facing financial difficulties, broken family and illness in a poverty-stricken area. John's strategy features **support**. He provided tutorial, free meals, accommodation and medical expenses for the student. In a neighbourhood that everyone was poor, with not much peers around (John was the only EFL teacher in

the school for a long time. Today there are only three long-standing EFL teachers in the school. The other two came many years later than John) and inconvenient transportation and communication, John didn't have much choice but to help the student by himself. The strategy is immediately effective, but the limitation is clear. John did not have enough resources that could improve the situation fundamentally for his students.

Zoey: "I was very patient. I started to investigate what had really happened."

"After graduation, I went to teach lower secondary school students in a neighbouring county. I worked as an EFL teacher and class teacher there. The students were thoughtless. They often got involved in fights with knives. I was an inexperienced class teacher then. My class was a so-called 'Internet class'. The students seemed to have good exam results and behaviours, but not really. Some of them ganged up with their brothers in higher grades. For this, other teachers usually would call the students to the office and criticize them. I didn't. I was very patient. I started to investigate what had really happened. I found that there were conflicts between the two families. I will not talk about the details because I must protect their privacy. Usually, we will criticize the one who beat others. But if you look into it, you'll find him to be the victim. So, I asked a student to extend my (sympathy) to him (i.e. the victim). He didn't expect that the teacher cared about him rather than criticized him. He was touched, became grateful to me and reclaimed himself. He changed from a mischievous (student) to (an upright one). I was touched and had a sense of achievement, though this may be nothing to others. Usually, if you beat someone, there must be a reason, but you're often labelled as mischievous and bad (no matter what the reason is), so you want to behave like that in your rebellious teens. I used a new strategy (because I don't want to see my students going that way.) I'm happy that it succeeded." (PN30)

The problem is about a student involved in a fight. Zoey's strategy features **inquiry**. Rather than criticizing the fighter immediately, she looked into the incident secretly by student informants, and extended sympathy to the student in private. The strategy is based on her belief that there must be a reason behind a fight, and it is wrong to label a student as mischievous or bad easily because they may abandon themselves

if you wrong them at the rebellious age. The strategy is also related to Zoey's opinion about solving a problem. "Sometimes you think you've solved the problem, but others may feel uncomfortable about the results. In other words, the problem is only seemingly solved rather than actually solved. In this example, many teachers will handle the problem by criticizing the fighter and believe that they have solved it, but the scar will remain in the student's heart."

Yevette: "Then I selected simple texts, asked questions as tasks, divided them into groups for discussion, and asked them to report the results to their classmates."

"They said they could not remember the words, but I believe they didn't do it wholeheartedly and forgot what they learnt very quickly. Another problem is that they don't know how to use what they've learnt because their English is very poor. They showed great interest at learning English, but if you asked them a question, their answer was always wrong. For example, I showed them a picture of a computer monitor and asked what it was in Chinese, and they said it was a frame. And their interest waned when learning became difficult and there was a lot for them to remember."

"So, I give them a dictation every day (so that they can memorize more words), ask everyone to come to me to read (so that she can correct their pronunciation), and ask them to start from simple sentences and imitative writing (so that they can learn how to write), but they still cannot complete the task and often fudge an answer perfunctorily. Then I selected simple texts, asked questions as tasks, divided them into groups for discussion, and asked them to report the results to their classmates. The report includes retelling the text in their own words, pointing out the language points in the text, and answering the questions I asked before they read. The numbers of boys and girls are similar in the class. So, I let them sit beside each other and make sure that there are both good and poor learners in a group and everyone can answer a question. This is very effective. The students are willing to learn now. They will ask their classmates when they have questions. I'm proud that my students made progress. They learn to use phonics and can have group discussion and finish the tasks by themselves. They are developing the self-learning ability, though they still do badly at exams and

often answer questions by guessing." (PN34)

The problem is about improving low proficient learner's EFL learning. Yevette's strategy features **organization**. She organized dictation, reading, imitative writing and group discussion to improve student's vocabulary, pronunciation, writing and speaking. The strategy is effective in improving student's interest in EFL learning. "They are willing to learn now, and they start to ask questions." But there are some limitations. For example, whether Yevette will organize discussion "depends on whether there is enough time and whether the text is suitable for discussion." The strategy affects learners differently. "They need to assign tasks in a group by themselves. It is more difficult for boys. The girls will usually do the retelling and the boys will point out language points and answer simple questions." Though the students started to ask questions, they still did badly in exams and Yevette said, "Let's try our best and wait and see. It's better than doing nothing." It seems that Yevette is not very confident about this strategy. "I can only say that I tried my best to let everyone participate in learning."

The strategies used in teacher's problem solving

From the narratives, it can be found that the participants used 13 kinds of strategies to solve the problems they encountered in practice and they often integrated these strategies into a comprehensive one so that they could deal with the complex changes of a problematic situation.

Table 4.11 Strategies used in the reported problem-solving narratives

Problem types	Strategies	Strengths	Weaknesses
Learning problems	Tutorial	Providing extra tailored learning opportunities	Teacher's lack of time and energy
	Punishment	Correcting misbehaviours	Risks of inflicting physical and psychological damage
	Reasonable communication	Improving teacher-student understanding	Ineffectiveness of changing student's attitude and opinions
	Emotional communication	Establishing empathy and emotional connection	Difficulty of conducting emotional communication

	Material support	Providing food, accommodation and medical expenses for impoverished students	Teacher's lack of resources
	Non-material support	Providing opportunities for student development	Risks of being unfair to other students
	Inquiry	Collecting sensible information from insiders	Difficulty of obtaining inside information
	Integration	Developing a curriculum with personalized educational objectives	Conflicts with national or local curriculum
	Organization	Organizing learning activities to develop self- and group-learning ability	Lack of time and proper texts for discussion
	Customization	Focusing teaching on learner differences	Risk of teaching behind schedule
Teaching problems	Brainstorm	Developing new methods of teaching and assessment	Risks of wasting time and making mistakes
	Exploration	Searching for new knowledge and information	Unavailability of useful knowledge and information
	Self-reflection	Developing a better understanding about oneself and the problem	High costs of triggering self-reflection
Environment problems	Exploration	Finding better and more materials for teaching and learning	Unavailability and unreliability of materials
	Organization	Finding more time for EFL teaching	Conflicts with national or local curriculum

These strategies can perform different functions such as improving learner's knowledge, behaviour, attitude, motivation, learning habits and learning strategies, reducing their anxiety, frustration and poverty, improving teacher's knowledge, attitude and understanding, improving teacher-student, parent-teacher, and parent-child relationship, and reducing the lack of materials and time for teaching. Some strategies have multiple functions and can be adopted with different kinds of problems. For example, the participants made explanations, gave advice, offered apologies, provided encouragement, expressed sympathies, etc. by communication.

And there are different ways of using the strategies. In the report, teacher-student

communication can be either reasonable or emotional, public or private, explicit or implicit, honest or deceitful.

The process of teacher's problem solving

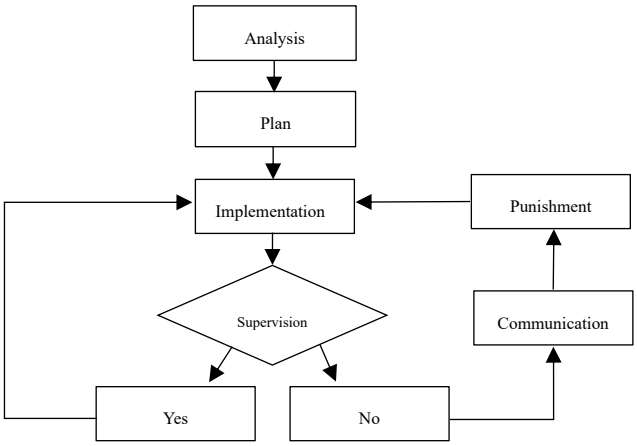
There are sequenced steps for adopting a strategy: planning, implementing, supervising, evaluating and correcting.

Table 4.12 Sequenced steps of teacher's problem solving

Planning	Select from a known list of strategies and adapt it for the current problem Devise a new strategy based on exploration or brainstorm
Implementing	Follow a strategy strictly Change the strategy or combine other strategies to deal with the change of the problem
Supervising	Make sure that the strategy is properly implemented
Evaluating	Determine the effects of the current strategy
Correcting	Revise the current strategy based on the result of evaluation Seize the opportunity of solving a difficult problem

For example, Frank analysed the student's problem, made a tutorial plan including self-learning, instruction and Q&A for the student, implemented the plan, supervised the student, and criticized and punished him when he failed to stick to the plan.

Figure 4.1 The sequenced steps of Frank's strategy for solving PN1



But other participants who adopted a similar strategy may follow different steps because of the differences between particular problems. For example, Sean encouraged

his student before he made a plan for him (PN15). Thus, the sequenced steps of a strategy can be different according to the differences between teachers, students and problems.

There are problems requiring immediate response and the strategies adopted by the participants were not carefully planned but hastily improvised. For example, Sarah tolerated and ignored the student's insolence, discovered and appreciated his merits, made a decision to support him and explained her reason to his classmates and perhaps to herself too (PN8). These actions happened in a brief instant and were impulsive, but to Sarah's surprise, the result proved that they were effective with the problem and appropriate for her and her student.

There are other problems that seem to depend more on teacher's decision making than careful planning. For example, about the student's pneumonia, John could not find help and he needed to make a choice about paying for the treatment or not rather than a plan (PN32).

The factors affecting teacher's strategy use

These strategies are very important for teacher's problem solving. It can be found in the participants report that a distinctive strategy leaded to the success of problem solving (Sarah, Gavin, Zandra, John, Yevette, Zoey), a lack of effective strategy caused the failure (Frank, Sean), and a change of strategy turned failure into success (Hebe, Sonia, Donald). But in addition to the variation and improvisation in strategy use caused by the differences between problems, there are many factors affecting teacher's strategy use.

Student's response to teacher's strategies is one of these factors. While Sonia criticized her students for not finishing words writing, they contradicted her (PN14). Under such a circumstance, the strategy became ineffective and the teacher needed to change it immediately. Cooperation is another factor. When Sean asked the parents to come to school and the school leaders to endorse his right of disciplining the student, they didn't help him as he needed. So, Sean had to confiscate the cell phone by himself, but the plan failed in the end with the student's resistance and the sudden attack of the

seizure (PN16). Timing is another factor. Sonia's student was cautious about his teacher and refused to listen to her, but she successfully seized the opportunity to talk to him when he was frustrated about the exam (PN13). This opportunity is critical for Sonia's strategy to work. All of these factors affect teacher's strategy use and make teacher's problem solving difficult. And a teacher needs a lot of experience to become adept at using problem-solving strategies and their variations.

Strategy selection and use are also affected by the teachers themselves. For example, young teachers may not have the resources or experience to provide adequate support to students, a married teacher with kids has less time to give students tutorial, a teacher that stresses communication with students is less likely to punish them, an EFL teacher is less likely than a class teacher to be skilled at dealing with students, and a reasonable or introvert teacher's problem solving will be different from that of an emotional or extrovert one and vice versa.

These factors and their influence on teacher's strategy use reveal that teachers are not free to use all strategies and successful problem solving cannot be ensured only by the knowledge of different problem-solving strategies.

The duality and multi-perspectiveness of strategy evaluation

In fact, every strategy has strengths and weaknesses. In the reports, an ineffective strategy may become effective if it is used at another moment, in a different way, or by another teacher. And an effective strategy may also become ineffective if it is used in the same way. For example, Donald said, "the results (of using these strategies) may be different because different teachers have different temperaments" (PI31). But these possibilities cannot be verified because strategy use is transient. So, it is possible to solve a problem with different strategies or combination of strategies. And the failure of problem solving may be caused by different reasons such as the adoption of a "wrong" strategy, bad implementation of a good strategy, the lack of resources, or the late occurrence of a problem-solving opportunity. Then, it becomes evident that no strategy can be always better than others and the key is to select an appropriate one for a particular problem and the related teachers and students. This means that strategy

evaluation should focus on both the observable effects and its appropriateness for teachers and students. Appropriateness has already been discussed in the above paragraphs. One example is that Yevette cannot ask her colleagues to point out her deficiencies in delivering public lessons because "the atmosphere prevails that everyone minds their own business" (PI69). On the other hand, the effects of a strategy are evaluated by the teachers as problem solvers. Their estimation of the effects is related to their problem-solving goals and it is subjective to some degree. For example, Zoey thought it was common for other teachers to solve the problem by punishing the fighters, but she wanted to solve the problem on a deeper level (PN30). So, while other teachers tried to prevent fighting between students, Zoey was more concerned about whether a teacher wronged a student in the process. This means that the effects of a strategy can be determined differently by teachers, students, parents and public opinions. And it is possible that they make different and even conflicting evaluations about the effectiveness of a teacher's strategy use.

The indicators of the style of teacher's problem solving

By observing the differences in participant's problem-solving process, it can be found that there are several indicators for the style of teacher's problem solving. These indicators are dependence, flexibility, controlment, objectiveness, and perseverance. They can show a problem solver's tendency to make plans dependently by exploration or independently by brainstorm, to implement plan strictly or improvise intuitively, to supervise the process closely or loosely, to evaluate the result by subjective or objective standards, and to continue, pause or give up problem solving when there are difficulties. Here are some examples for these indicators:

- Dependent: "Usually I will skip through academic journals. If the problem is practical or I cannot solve it, I will ask my mentor for help." (Donald)
- Independent: "Usually, my habit is to solve problems by myself. I rarely ask others for help. I guess this is not so good." (Sarah)
- Flexible: "I didn't talk to him directly because I talked with him privately before and it was ineffective. I thought I could make use of this opportunity.

So, in an evening study hall, when I was analysing the students' exam papers including his, I said (to the whole class) …" (Sonia)

- Inflexible: "This (i.e. spending a lot of time for tutorial and supervision) is almost the only way. In the current education system (exam-oriented), and with the undeniable fact that the students had problems in their earlier education, we can only start with the basics for the low-proficient learners from rural areas, which needs a lot of time." (Frank)
- Closely controlled: "I made study plans for him every day…. After giving him assignments, sometimes I found that he didn't finish them when I did the examination. Then, I would give him 'a little' punishment." (Frank)
- Loosely controlled: "When they deal with something (such as class management), I tell them that it is their business. They've grown up now. They have responsibilities. I cannot make decisions for them. I hope they can see things, think about them and do them by themselves." (Gavin)
- Objective: "Later, he passed the exams and went to professional secondary school." (John)
- Subjective: "I shared (the regret and guilt about her work transfer) with a close friend, and I felt a bit better. If I kept this to myself, I might focus on the details because I cared about it (teacher-student relationship), and one day they could become a serious problem." (Zoey)
- Continuing: "There are some problems that no one knows how to solve. But we can find a strategy by discussion. Though it may not be a solution, but we can at least find a measure…. I have a thick skin. I will continue to ask others. If I cannot get an answer, I'll ask somebody else." (Donald)
- Pausing: "A problem is a fact. There are reasons behind it. If I cannot find a solution, it means that the problem is unsolvable for the time being. So, I let the problem exists…. Let's put them aside. We don't need to hurry…. But I can try my best to reduce its negative influence on the students. This is the only thing that I can do. There is no such thing as solving these problems

completely…. The problems are still developing, such as student's addiction to cell phone or idolization of movie stars…. When it goes into the next phase, the problem may disappear or a new one arises." (Gavin)

- Giving up: "I was so frightened, and I changed my mind at the moment. I could never change such a student, and I gave up…. I felt hopeless…. I really wanted to change him." (Sean)

4.3 Teacher's support seeking

In the reported stories, teachers encountered difficulties in the problem-solving process. They would ask for help or try to overcome the difficulties by themselves. It is interesting to find out when they need help, what they need, whom they will turn to, how they approach them, whether they accept the support, how they evaluate the effectiveness of support, and what they will do if support is unavailable.

Support seeking reported by participants

In the narrative interview, the participants faced difficulties such as not knowing what to do, making hard choices, lack of inside information, and negative emotional experience. They turned to peers, mentors, school leaders, students, parents, family and friends for help. These supports were usually very important for and even decisive to the result of their problem solving. But sometimes, a teacher would reject other's suggestions and made his/her own decision. The participants thought the received support to be effective, but sometimes effective support was unavailable.

Table 4.13 Support seeking reported in the problem-solving narratives

teacher	problem	difficulty	supporter	support	acceptance	effectiveness
Hebe	How to criticize students?	I don't have teacher's prestige with them.	mentor	"to be strict from the beginning"	adopted	ineffective
Gavin	An offensive letter written by a student	to reject the student or not	colleagues spouse	"to return the student to school"	rejected	\
Donald	A student was disciplined by school for smoking	Do I need to call the parents to my office? Do I need to send him home?	mentor	"definitely yes, for informing the parent and setting an example for others"	adopted	effective
Sonia	A student contradicted me when I criticized them in class.	I was shocked and didn't know how to deal with this.	colleague	"to apologize for teacher's mistake and ask the student to correct his"	adopted	effective
Sean	A student addicted to cell phone games	The student refused to hand in his cell phone.	school leaders parents student's uncle	No support as Sean needed	\	\
Zoey	A student involved in a fight	What really happened?	students as insiders	inside information	accepted	effective
Zoey	Her class didn't want her to transfer to another school.	the guilt of leaving the students	friend and colleague	consolation	accepted	effective

The participant teachers also reported their support seeking in semi-structured interview. They needed support when they didn't know how to solve a problem, when the problem was too difficult or when their attempts failed, when they suffered from negative emotions, and when they needed cooperation for important tasks such as delivering public lessons. Teachers usually turned to mentors, experienced colleagues, peer colleagues, family members, school leaders and student's parents for help. They also used the Internet to find support. They thought that the support they received was effective, but sometimes the support might only be ostensibly, broadly or partly effective. And their greatest needs included the understanding of teachers and education, guidance of experienced teachers, sincere friends, candid and competent colleagues and school leaders, tolerance of their mistakes, support for teachers from parents and public opinion, learning opportunities, support for teacher's right to discipline students, and a database of real cases of teacher's problem solving. These needs revealed the deficiencies in the support for teacher's problem solving in their schools even if there were induction programs, mentoring systems, distance learning technologies, and ICT for peer support.

When support was unavailable, the participants from the first school would pause their problem solving. Most of those from the second school would continue their attempts to find solutions. And most of those from the third school believed that they could solve almost all the problems. This difference revealed the participant's general belief about the availability of support and the extent to which a problem could be solved. The participants from the first school had the strongest belief that support would be generally unavailable, and those from the third school had the weakest belief. On the other hand, the participants from the first school had the weakest belief that problems could generally be solved, and those from the third school had the strongest belief.

But some teachers preferred to solve problems by themselves for different reasons such as the lack of collaboration and time in school or they had greater independence in problem solving.

Table 4.14 Support seeking reported in semi-structured interview

teacher	time of need	supporter	way of finding support	effectiveness	reactions if unsupported	most needed support
Frank	disobedient student	class teacher, parents	face-to-face	effective (ostensibly)	pausing	less misunderstanding about teachers and education
Frank	delivering public lessons	mentor, colleagues	face-to-face	effective		
Hebe	not knowing how to solve a problem	Internet, colleagues	online or face-to-face	effective	pausing	to be guided by experienced teachers
Gavin	no such needs recently	competent, honest and close colleague (if needed)	\	\	pausing (positively)	sincere friends, colleagues and leaders; online knowledge systems
Sarah	when I feel unbearable (about my health)	school leaders, family (mother in law, husband, daughter)	face-to-face (assisting and taking care of Sarah)	effective (partly)	pausing	people more competent than me
Donald	not knowing how to solve a problem or it is urgent	mentor, class teachers, Internet	face-to-face, online	effective (broadly)	continuing	allow me to make mistakes and help me when I do
Sonia	unknown (preferring to solve problems by herself like Hebe and Sarah)	mentor, peer colleagues	face-to-face	effective (mostly)	continuing	a database of problems and their solutions
Sean	when I cannot solve it by myself	experienced colleagues, Internet	face-to-face, online	effective	pausing	public opinion and legal support; support from parents, school and society
Zandra	when I face a difficulty or when I don't know, which is rare	colleagues, Internet (teacher's chat group)	face-to-face, online	effective	continuing	real cases of teacher's problem solving

Simon	delivering public lessons	experienced colleagues	face-to-face, online	effective	(almost all can be solved)	collective lesson preparation
Zoey	not knowing how to solve a problem	colleagues, Internet (teacher's chat group)	face-to-face, online	effective	(almost all can be solved)	learning content knowledge and improving student's comprehension
John	difficult problems	colleagues, Internet	face-to-face, online	effective (partly)	(asking how to solve problems)	public opinion to be fair about teacher's right to punishment
Yevette	doubt about content knowledge	colleagues (John), Internet	face-to-face, online	effective	(almost all can be solved)	learning opportunities, time for learning, information and resources for teaching

The third source of data is teacher's chat log, which showed their autonomous support seeking for problem solving. According to Lei, Tang and Maresova (2018), 65% of the questions were about finding teaching resources and 24% content knowledge (Table 4.3). Only 5% and 1% of the questions were about their need for pedagogical and technological knowledge.

Teachers could post a question publicly in the chat group, ask a particular member in private chat, or search the chat group's uploaded file folder for what they needed. Teacher's use of the chat group was related to their duties. The average number of questions asked in the holidays was 5.1 per day, and it rose to 9.1 in the beginning of the new semester.

Only 64% of the questions were answered. The reasons might be that the teachers who could answer the questions were offline or the questions were flooded by other posts in the chat group. Most questions were responded within five minutes. 25% of the questions were answered within one minute; 56% in five; 66% in ten; and 75% in fifteen.

The teachers expressed their satisfaction with 34% of the answers. They gave dissatisfied responses to 42% of the answers and made no responses to the rest of the answers. Sometimes, the answers were unconstructive. For example, a teacher asked about how to practice stratified teaching. But the answers provided personal opinions rather than the knowledge about the method or the detailed report of practicing it.

E395 "Is stratification effective? It's more likely to increase burden."

E396 "Stratification is ineffective."

E397 "It's easier said than done. The teacher will shoulder more burdens. And the result is just so-so."

And usually, the teachers would not have in-depth discussions about a question. There were only 7 entries in a Q&A cycle averagely, and the number in 66% of the Q&A cycles was below average. Considering the fact that most questions were about finding teaching materials, it is not difficult to understand this lack of discussion.

But teachers approved the chat group and believed that it could provide effective support for their problem solving.

E1607 “It’s really good for me to join in this chat group.”

E483 “Thumbs up for our chat group.”

They never complained about its effectiveness in public. No one left the chat group and the number of members kept increasing and reached the upper limit of 2,000 and it never dropped down.

Their approval was related to the fact that they were free to ask questions to a large number of colleagues who were willing to help; there were 10.9 GB of resources in the file folder of the chat group which were uploaded by themselves and the top ten popular files reached 4,787 downloads; the materials were relevant and correct because they were selected, edited or produced by peer teachers.

So, the chat group could provide highly relevant support for the lack of knowledge and materials for teaching. And the quality of the support was ensured by the expertise of the answerers in the chat group. The teachers could use the chat group to solve the problems of personal interest and they could use it for their own convenience. And the administrators provided services to attract teachers and maintain the functioning of the chat group. They recruited new members, recommended teaching materials, uploaded resources, encouraged contributions, organized offline meetings and established group chat rules.

But few questions about pedagogical and technological knowledge were asked and answered in the chat group because the members were homogeneous. They were all confronting the problems of lacking teaching resources or content knowledge, or they were concerned about them. And the chat group was less effective in providing support for the problems of lacking pedagogical and technological knowledge. Also, it was not the best choice to find support for the other types of problems listed in Section 4.1.

Now it is time to combine these data.

Table 4.15 Teacher’s support seeking

Difficulties	Lack of knowledge Lack of teaching resources Lack of inside information Making hard decisions

	Experiencing negative emotions Completing important tasks Failing in problem solving
Needs	Guidance of experienced teachers A database of teacher's problem solving Learning opportunities Tolerance of teacher's mistakes Understanding of teachers and education More support from friends, colleagues, parents and public opinions
Supporters	Colleagues Internet Family Friends Students Parents Oneself
Channels	Face-to-face Distance Public Private
Supports	Knowledge Teaching resources Inside information Opinions Emotional support Housekeeping Lesson rehearsals Suggestions
Acceptance	Complete acceptance Partial acceptance Rejection
Effectiveness	Effective Broadly, partially, or ostensibly effective Ineffective

And we should not forget that some teachers preferred to solve problems by themselves and they reacted differently if they could not find support.

Based on these data, the process of teacher's support seeking becomes clear.

Table 4.16 The process of teacher's support seeking

Steps	**Actions**

Difficulties	Confronting difficulties
Needs	Identifying needs
Supporters	Selecting supporters
Channels	Contacting supporters
Supports	Receiving supports
Acceptance	Accepting supports
Application	Solving difficulties with supports adaptively
Effectiveness	Evaluating effectiveness
Feedback	Providing feedback
Optimization	Optimizing problem solving and support seeking

And the differences between teacher's support seeking revealed the indicators of the style of teacher's support seeking. The teachers had a tendency to focus on a certain kind of difficulties and supports. They preferred using different standards to select supporters. They preferred contacting supporters in different ways. They tended to accept supports in different ways. They tended to react differently if support is unavailable. They preferred different standards to evaluate the effectiveness of support. They preferred to provide feedback in different ways.

Table 4.17 The indicators of the style of teacher's support seeking

Focus	Lack of knowledge Lack of teaching resources Lack of understanding Lack of cooperation Lack of emotional support
Choice	Convenience Experience Competence Intimacy Frankness
Communication	Face-to-face Distance Public Private
Effectiveness	Cognitive Practical Emotional
Feedback	With Without

	Socializing Learning
Optimization	Content Method

Here are some examples.

- Hebe focused on the difficulties and supports about teaching methods, but Donald focused more on those about student management.
- Gavin selected supporters by frankness and competence, Donald convenience and experience, and Zoey intimacy.
- Sonia preferred finding support from her mentor and colleagues; Hebe preferred to find support from the Internet.
- Donald evaluated the effects of support by the improvement of his understanding about the situation (PI25) and the results of problem solving (PI27); Zoey by her emotional experience (PN31).
- In the chat group, there were teachers who expressed gratitude to the answerers.
- Yevette's colleagues were not able to point out her deficiencies in teaching and help her, and she found that sitting in teaching competitions was disruptive (because she would listen to the same lesson repeatedly taught by different teachers) but very helpful.

4.4 Understanding and supporting TPS

Based on these results, it is possible to arrive at a deeper understanding about teacher's problem solving.

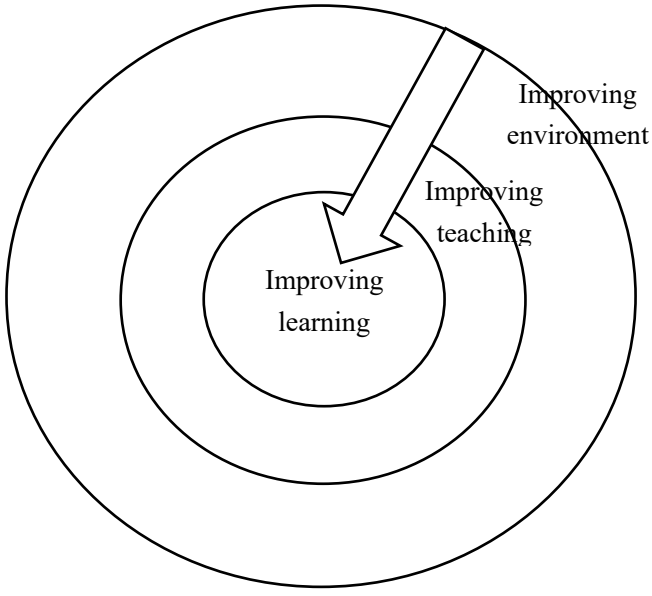
Teacher's definition of problems

Many problems were reported by the participants. These problems might also be called by them as difficulties, challenges, or tasks. No matter what they are called, there can be a goal-directed cognitive-affective-behavioural process through which a teacher deals with them (D'Zurilla, 1988; Heppner & Krauskopf, 1987, p. 375).

Different from mathematical or cognitive problems, it is a teacher's dissatisfaction rather than the unknown or the difficulty that really makes a situation a problem because the latter two may be irrelevant to teacher's goals and will not become their target of problem solving. For example, Zandra attached much less importance to her need to write research papers than to her student's lack of gratitude. And a problem exists when a teacher thinks that he/she must do something to improve the situation because that's what they believe a teacher should do. The teacher can have a clear or unclear goal. He/she can know how to solve the problem or not. And the process can be difficult or easy for him/her.

The reported problems were categorized by participant's primary problem-solving goal. It seems that there is a relationship between these goals. And based on the connection between problems types and problem solver's proudness and regret, it is assumed that improving learning lies at the core of teacher's goals, improving teaching is the intermediate goal, and improving environment is the peripheral goal. From this perspective, teacher's problems are always related to students and their learning. And the illustration of these goals presents a "map" for teacher's learning and professional development. And teachers can plan their own "route" on the "map".

Figure 4.2 Teacher's problem-solving goals



When teachers define a problem, they are trying to understand it and make a decision about it. A problem (situation) is constantly developing and the teacher continues to redefine it. While different problem types have been studied separately, it is still necessary to study them as a whole because they are interconnected diachronically and synchronically. When teachers confront a problem, they are also confronting its interconnections with other problems. When they solve it, they also need to deal with these interconnections.

Teacher's problem solving

Different problem-solving strategies that teachers actually used were found. But it is difficult to learn and use these strategies because strategy use is affected by many factors such as teacher's personality, duty, identity, teacher-student relationship, parent's cooperation, the availability of resources, and the costs and risks of solving a problem. But by adapting other's strategies, teachers can develop their own strategies that are more appropriate for their problems, their students and themselves.

Improving student's learning is teacher's primary goal. Solving this kind of problem does not mean to find an answer to a question or to devise a strategy that can lead to the answer. These are the important steps in the problem-solving process but finishing them does not mean that the problem is solved. The answer or strategy must be used in practice to take effect. For teachers, the problem is solved when student's learning is improved as expected. And problem solving for improving student's learning is in essence a cooperation between teachers and students on learning, which can be led by the teacher or the student. In other words, problem solving is teacher's attempt to change a dissatisfied situation into a satisfied one. This practicality of teacher's problem solving makes strategy development and implementation integral.

It seems that teachers do not set an upper limit to their problem-solving goal when the goal is improving student's learning. They can keep giving tutorials to low proficient learners until they graduate, and they will supervise student's learning and be ready to find and solve new problems in the process. This means that teacher's problem solving can centre around students besides separate problems, and it can be a long-term

process that ends with student's graduation. A proof for this is that when teachers had the freedom to tell any problem-solving stories they wanted, they always started their stories by "there was a student…" rather than "there was a problem…" and sometimes they told several consecutive stories about a student. So, a teacher can consider multiple problems about a student as a consecution and deal with them continuously. Thus, teacher's problem solving can end with gradual results (i.e. partly solved), while mathematical and cognitive problem solving ends with either-or results.

Teacher's problems are often related to a variety of other problems (or difficulties) such as poverty, leftover children's lack of family love, emotional damage of divorce on students, parent's lack of parenting skills, the quality of education in lower secondary schools, language and culture diversity. Thus, teacher's problem solving can go beyond teacher's responsibilities and expertise and get out of their control and this is why they need external support.

Teacher's problem solving is transient because every problem and every problem-solving attempt is unique. And only after a problem is solved, the effective strategy can be identified as a solution for the problem. But before a similar problem is solved by the same solution, it is only a strategy. This means that the effectiveness of a strategy cannot be predicted.

During the problem-solving process, there are a lot of factors in the situation that cannot be controlled by the teacher or anyone else. Thus, the relationship between strategy and problem is probable. And a strategy can have a high or low probability to be effective with a problem, and it is possible to estimate the probability.

Problem solving can give meaning to teachers and exert profound influence on them and their students. It can reveal the unrealized deficiencies or the dilemma confronting teachers, offer learning opportunities, strengthen their beliefs or opinions, trigger self-reflection, change their attitude, or help them to build a strong emotional bond with students. And even failed problem-solving attempts can bring positive influence on teacher's learning and professional development.

Table 4.18 The meaning of teacher's problem solving

Example problem(s)	Meaning of problem solving
PI5	The problem revealed a dilemma confronting Frank. He was put between his belief that tutorial and punishment was the only option he had and the public opinion that punishment should be banned. Frank needed to find a way to walk out of it. He needed to know that punishment was not the only option and the colleagues in his school were using other effective strategies that he could learn and use with his students.
PI9	The problem revealed a deficiency for Hebe. She needed to realize that building a good teacher-student relationship was an integral part of being a teacher. It was more than a responsibility and could be a reward for a teacher. It was a new field for her to learn. It could facilitate her teaching and help her grow into a better teacher.
PN5	The problem-solving result resolved Gavin's doubt and convinced him that teachers and students were equals. A teacher could teach well with an emotional connection to his students and could win student's love and respect by equal communication. The teaching profession was about dealing with people.
PN8	The result gave Sarah an opportunity for learning and developing her own educational belief and method. She felt fortunate to make the emotional decision and based on the experience, she developed a method of teacher-student communication that featured finding merits and praising students.
PN12	The failure triggered Donald's self-reflection. He made a complete change of attitude, and the failure became a resource for his future problem solving.
PN13	The problem solving gave Sonia an opportunity to learn how to communicate with the kind of students who intentionally kept a distance from her.
PN16	The failure changed Sean's mind and made him believe that he could never change such a student and he could not receive support under such a circumstance.
PN25, PI42, PI43	By problem solving, Zandra built a strong emotional bond between her and her students, which could link them up throughout the rest of their life. She said, "sometimes they are more obedient to us than to their own parents" and she described her main problem-solving goal as "to accompany the students wholeheartedly and professionally in the last session before my retirement".

There are implications of the success and failure of participant's problem-solving attempts. Their success implies that teacher's problem solving is more likely to succeed by:

- building a teacher-student relationship featuring mutual respect, understanding and love

- discovering and appreciating student's merits
- understanding and supporting students
- teaching based on individual differences
- organizing activities that motivate learning
- learning by exploration
- thinking independently and innovatively
- devising and following a reasonable plan with step-by-step process
- being brave to improvise in problem solving when it is necessary
- changing strategy timely and flexibly with the development of a problem
- keeping problem solving under supervision
- making self-reflection

Their failure implies that it is less likely to succeed with:

- the ignorance of a problem or a student
- the lack of knowledge and experience needed for problem solving
- the lack of alternative strategies or the lack of flexibility in strategy use
- the lack of self-reflection
- teacher's indulgence to the students
- the lack of understanding of students or the lack of communication with them
- the lack of resources (e.g. time) needed for teacher's problem solving
- the lack of cooperation
- student's and parent's disrespect, distrust, misunderstanding or opposition to the teacher
- the lack of support against teacher's stress or anxiety

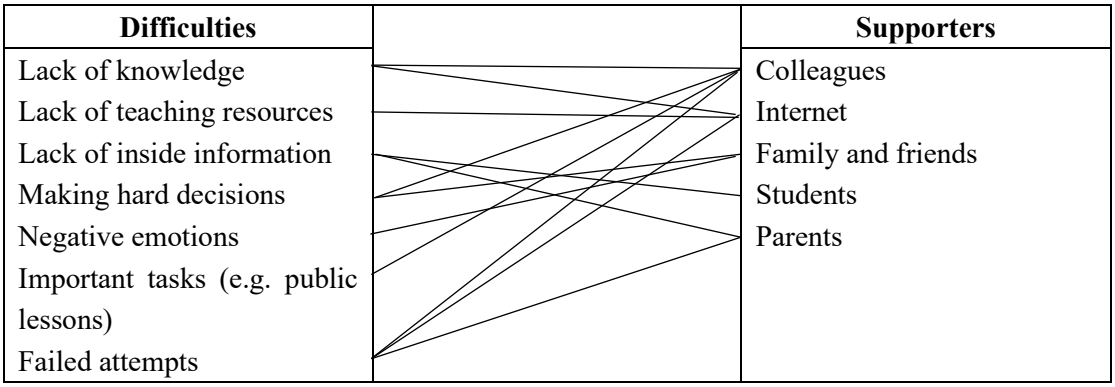
And, teachers believe that there are some problems, such as when student's addiction to cell phone games or their idolization of movie stars affect learning, that cannot be solved, but their influence can be reduced. These problems originate from the conflicts between work and play, maturity and adolescence, and the socialization and individualization by education.

Teacher's support seeking

When there is a difficulty, teachers will try to find support to overcome it. While supporting cognitivist's problem solving focuses on helping problem solvers internalize cognitive skills and strategies, teacher's support seeking is the communication initiated by teachers to acquire resources needed for overcoming the problem-solving difficulties. And a teacher can seek support from others or themselves.

Teachers have established connections between the difficulties and the supporters they turn to.

Figure 4.3 Connections between problem-solving difficulties and supporters



In fact, teachers have established connections between problems, goals, difficulties, needs, channels and supports. And these connections constitute a support system for teacher's problem solving. Usually a teacher will focus on one or several problem types, and they will establish connections with particular supporters. For example, Hebe focused on finding innovative teaching methods. She frequently used vocabulary learning apps and websites of American TV series for new content for her students, and she attended ELT workshops, forums, teaching and research activities, and demonstration lessons for inspirations to herself.

Table 4.19 The support system for teacher's problem solving

Teacher as problem definer	**Teacher as problem solver**	**Situations**	**Teacher as support seeker**	**Connections**	**Supporters**
Problems	*Goals*	*Difficulties*	*Needs*	*Channels*	*Supports*
Learning	Improving	Lack of	Knowledge	Face-to-face	Knowledge

problems Teaching problems Environment problems	learning Improving teaching Improving environment	knowledge, resources, understanding, cooperation, emotional support	Resources Understanding Cooperation Emotional support	communication Distance communication	Resources Understanding Cooperation Emotional support

Teachers use ICT frequently to support their problem solving. They use it to acquire, adapt, produce, store, and exchange resources. They also use ICT as a problem-solving tool. For example, Donald used academic search engines (CNKI) to retrieve journal articles. He reported that "I download them, read them, make notes, and store them in the computer". Yevette downloaded teaching materials from a popular website, adapted them for her teaching, and put them into two categories according to her teaching schedule and test items in NCEE. Zandra and Zoey used QQ chat groups to download resources and consult colleagues from other schools. Hebe and Sonia used dubbing and streaming apps to arouse student's interest and facilitate their learning. Simon made use of distance learning technologies and adapted online courses and teaching materials to facilitate teaching. So, ICT introduces a digitalized support system for today's teachers.

But there are some limitations. Teachers used ICT more for finding resources and knowledges, but less for discussion and collaboration. Though there are many online platforms where teachers can find resources. The platforms are homogeneous, and most of them focus on teaching resources and content knowledge. The quality of the online resources is uneven. And online resources for overcoming difficulties in student management often provide general principles that are difficult to turn into step-by-step plans. When there are plans, it is still difficult to implement them because of the uncontrollable factors in particular problems and the incompatibility caused by the individual and situational differences between problems. When teachers need support, it seems that the school is often too small, and the Internet too big. And sometimes, teachers may not know how to ask specific questions and "get unspecific answers" (PI31).

Asking mentors or using the chat group for help are also typical ways of seeking support. But it seems that teachers have not established an effective mechanism for their communications. It seemed that they did not realize the importance of establishing and maintaining the support system. Their reports often highlighted one or several connections between some difficulties and supports, rather than an organized system that could provide support for all kinds of difficulties. When they encountered deep-rooted and interconnected situations, they could not find effective support quickly and had to respond without thorough preparation (PN14). When they failed, they tended to believe that the problem was unsolvable because they had already tried their best. Sometimes, they tried to find positive meaning from failed attempts for self-protection but ignored the need for learning and improving their support system.

Based on the understanding of teacher's support seeking, the principles of building an ICT-assisted support system for teacher's problem solving were proposed.

- Teachers should be placed at the centre of the system. They should build the system with available resources and use it to support their and other's problem solving.
- The system should be able to satisfy diverse needs for teacher's problem solving. It should provide connections to all kinds of resources including those provided by professionals such as technicians, psychiatrists and lawyers.
- The system should be able to function in accordance with various problem-solving styles.
- The system should be able to operate within a mechanism that facilitate the effectiveness and efficiency of teacher's support seeking. The mechanism should work for the establishment, application, maintenance and development of a system.
- The system should make full use of popular ICT to improve convenience and reduce costs for support seeking.

Part V Discussion

As explained in Pat III, several methods have been used to combat threats to validity in this research. Since the interview was conducted in Sichuan dialect, the transcription was carefully examined to avoid errors and it took more than one month for the examination. Respondent validation was used in the process of interview by asking "do you mean …?" or "could you please give an example of …?" as a technique to avoid misinterpretation. A framework of process, product and style was proposed to explain data by combining the frameworks and perspectives of mathematical, cognitive and social problem solving. Research design and findings were discussed with and examined by expert education researchers and teacher educators to ensure theoretical validity. To combat researcher bias, during the process of data collection and analysis, I stuck to the principle that what the teachers believe to be true is more important than what is actually true; and my purpose was not to evaluate teachers but to encourage them to speak without reservation. I let teachers decide which problem-solving stories they would like to report, listed all the negative cases, used their original words as much as possible in the report, and compared their stories and answers. I also talked about the research with my wife (veteran teacher in one of the sample schools) and friends (doctoral students, education researchers, college teachers) and collected feedback from them. Different methods were used to collect and analyse data from different sources to ensure validity of the research. Internal and external generalization can be achieved by examining the credibility of teacher's report, recognizing the results of this research by the readers of this report, or establishing a theory about teacher's problem solving and support seeking (Maxwell, 1992; Chen, 2000).

In the process, I could feel that almost all the participant teachers were willing to tell their stories, they enjoyed communicating with me, and they had a need for communication with peers. They didn't hide their mistakes, opinions and feelings from me, though the information might be "unfavourable" for them and their schools. Only John reported that he had no regrets, and his speech rate was lower in the interview than

in the warm-up that he offered to introduce the general situation of education in the area to me for about half an hour. I guess that he thought it was disadvantageous to talk about his regrets, but I do not doubt about the truthfulness of his stories and answers because the stories that he felt satisfied or proud should not be unfavourable to him and his school. With colleagues in the office and without a promise of interests, I think that he was less likely to exaggerate in his reports. Besides, there was no conflict between his reports and those of his colleagues.

Some of the reported stories are not about the duties of an EFL teacher but of a class teacher, which is not considered as a threat but as an advantage to the validity of this research. More than half of the participants have multiple duties, and half of them have the duties of both EFL teacher and class teacher. The freedom of report can help us to have a better understanding of TPS and TSS (teacher's support seeking) by revealing their choices.

Some reported stories happened when teachers were teaching lower secondary schools many years ago, but again, this is considered to be an advantage to the validity of this research. Important information about teacher's problem solving can be found from their choice of stories for report. For example, Gavin chose to report a recent problem-solving story over the old story of teaching the "worst" class ever in his school, believing that it was meaningless to talk about the past while the situation is quite different now, and his belief in equal communication between teacher and student is chronologically consistent. Gavin's choice suggested that he confirmed the "correctness" of his educational beliefs and the effectiveness of his strategy in the past and he confirmed them again with today's students.

On the contrary, John chose to report stories happened in the distant past when his strategy was clearly effective. This may be related to the fact that there are a lot of support for local teachers and students now and the old story was more typical than the new ones. After thirty years, there are more choices for poverty-stricken students in the area such as applying for National or Prefecture Grant, funding from non-profit organizations, and fundraising on the Internet. There are volunteer teachers coming

regularly from partner schools, universities and institutions. And there are live or recorded online courses provided by the best schools in the province. And John's choice suggested that he believed that poverty was still the central problem in the area but providing support by making personal sacrifice was the only and last resort he had for safeguarding his students against the problem.

At the very beginning of this research, I have tried to obtain informed consent and voluntary participation by writing an introduction about myself and this research and an explanation about participant's rights while I could not approach one of my candidates in person, but the formality intimidated him, and he refused to participate. Then I realized that in my culture, it would be better to obtain participation by goalkeepers and consent by oral communication. I used anonymity to protect participants' confidentiality. I also explained that audio recording was necessary because I needed to "remember" their reports for data analysis and their reports would be anonymous, and that I believed publishing these stories would not harm them but would support them by drawing attention and improving understanding.

Unfortunately, due to limited access to participants and lack of time, the samples in this research did not include teachers from the top upper secondary schools in the province, whose admission score were much higher than the selected sample schools.

In addition, the results may not be applicable to schools in different education systems with different cultures and traditions. For example, discussions with teachers in Uppsala gave me an impression that the interviewers established a clear boundary between professional problems and personal problems, while the participants in this research did not.

Part VI Conclusion

This research adopted a descriptive, bottom-up approach to improve the understanding about teacher's problem solving and support seeking. It took teacher perspective and a holistic view and stressed the differences between problems and individuals facing them.

Earlier studies on problem solving often focused on the assessment and training of problem-solving skills. But teacher's problems are different. Teachers are facing a particular group of problems related to their goals of improving student's learning, their teaching and the environment surrounding them and their students. These problems are real-life situations connecting themselves and others, which are dynamic, interconnected with other situations diachronically and synchronically, open to multi-perspective interpretations, and unpredictable and uncontrollable to some degree.

Teachers seldom identify themselves as problem solvers. For them, solving these problems is an integral part of teaching and being a teacher. It is a challenge that can give meaning to their and their student's life and work. Teacher's problem solving is not achieved by finding a solution, but by helping their students to make progress in learning, by building a lifelong bond with students and parents, by finding meaning from the success or failure of problem-solving attempts, or by defining themselves as the kind of teacher or person they want to be through making hard decisions or choices.

Strategy development and implementation are critical for successful problem solving, but they are not enough. There are a lot of factors that can affect teacher's problem solving and it is difficult to control them. When teachers encounter the difficulties caused by the factors, they will try to overcome them by seeking supports. ICT-assisted support seeking empowers teachers with more resources they need for problem solving. And it is very important for teachers to build an integrated support system for themselves and their colleagues. ICT can help teachers with the establishment, application, maintenance and development of a system by enhancing effectiveness and efficiency, improving convenience, reducing costs, and conforming

to individual TPS and TSS styles.

This research has investigated the process, product and style of teacher's problem definition, problem solving and support seeking. The results can be used by teachers to develop or improve their support systems. In the future, it is necessary to make large-scale survey to examine these results and conduct experiments to test the effectiveness of the support system.

Table 6.1 The process, product and style indicators of teacher's problem definition, problem solving and support seeking

	Process	**Product**	**Style indicators**
Problem definition	Representing situation Gaining understanding Making decision	Learning problems Teaching problems Environment problems Quasi problems	Attitude (PS) Activeness Self-confidence Interpretation Responsibility Estimation State of mind
Problem solving	Planned: Making a plan Implementing it Supervising the process Evaluating effects Correcting the plan Unplanned: Noticing a problem Making observation Deciding to help Taking immediate actions	Tutorial Punishment Communication Support Inquiry Integration Organization Customization Brainstorm Exploration Self-reflection	Dependence Flexibility Controlment Objectiveness Perseverance
Support seeking	Confronting difficulties Identifying needs Selecting supporters Contacting supporters Receiving supports Accepting supports Solving difficulties Evaluating effectiveness Providing feedback Improving PS and SS	Knowledge Teaching resources Understanding Cooperation Emotional support	Focus Choice Communication Effectiveness

References

2018 GDP rankings of cities in Sichuan. (2019, February 11). Retrieved June 12, 2019, from http://www.sohu.com/a/294008168_675629

2018 GDP rankings of provinces in China. (2019, February 15). Retrieved June 12, 2019, from http://www.sohu.com/a/294861043_100180890

Admission score of the upper secondary schools in Chengdu. (2018, July 12). Retrieved June 12, 2019, from http://www.sohu.com/a/240787501_528995

Adrian, M., Lyon, A. R., Oti, R., & Tininenko, J. (2010). Developmental foundations and clinical applications of social information processing: A review. *Marriage & family review*, *46*(5), 327-345.

Ai, S. (2017). Out of the alternation: Teacher-student relationship from the perspectives of symbiotic environment. *Education Science*, 33(5), 57-63.

Ai, Z. & Liu, H. M. (2018). Review on the Current Situation and Feature of European and American Teacher Education Research. *Modern Education Management*, 2, 77-82.

Anderson, G., Arsenault, N. (1998). *Fundamentals of Educational Research*. London: Routledge, https://doi.org/10.4324/9780203978221

Antonietti, A., Ignazi, S., & Perego, P. (2000). Metacognitive knowledge about problem-solving methods. *British Journal of Educational Psychology*, 70, 1 − 16.

Azad, G. F., Kim, M., Marcus, S. C., Sheridan, S. M., & Mandell, D. S. (2016). Parent-teacher communication about children with autism spectrum disorder: An examination of collaborative problem-solving. *Psychology in the Schools*, *53*(10), 1071-1084. https://doi.org/10.1002/pits.21976

Bahtiyar, A. & Can, B. (2016). An investigation of problem-solving skills of pre-service science teachers. *Educational Research and Reviews*, 11 (23), 2108-2115.

Becker, G. (1990, July). Self-control in analyzing problem solving strategies. In: Booker, G., Cobb, P., & de Mendicuti, T. N. (1990 Eds.). Proceedings of the Annual Conference of the International Group for the Psychology of Mathematics Education

with the North American Chapter 12th PME-NA Conference, Volume 3. Mexico.

Bell, A. C., & D'Zurilla, T. J. (2009). Problem-solving therapy for depression: a meta-analysis. *Clinical psychology review*, *29*(4), 348-353.

Bell, B., & Gilbert, J. (1994). Teacher development as professional personal and social development. *Teaching and Teacher Education*, 10, 483–497.

Bellhouse, D. R., & Stafford, J. E. (2001). Local polynomial regression in complex surveys. *Survey Methodology*, 27(2), 197-203.

Berliner, D.C. (2004). Expert teachers: their characteristics, development and accomplishments. In R. Batllori i Obiols, A. E Gomez Martinez, M. Oller i Freixa, & J. Pages i. Blanch (Eds.), *De la teoria….a l'aula: Formacio del professorat ensenyament de las ciències socials* (pp. 13–28). Barcelona: Departament de Didàctica de la Llengua de la Literatura I de les Ciències Socials, Universitat Autònoma de Barcelona.

Bickman, L., & Rog, D. J. (2009). *The SAGE handbook of applied social research methods*. Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781483348858

Blanchard-Fields, F., Mienaltowski, A., & Seay, R. B. (2007). Age differences in everyday problem-solving effectiveness: Older adults select more effective strategies for interpersonal problems. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, 62(1), P61-P64.

Blum, I. H., & Valli, L. (1988). Using research knowledge to improve teacher education. A problem solving approach. Final Report-Project Portrayal. OERI/NIE Contract #400-85-1062. November.

Bransford, J.D., and B.S. Stein. (1993). *The IDEAL Problem Solver (2nd ed.)*. New York, NY: W. H. Freeman.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative research in psychology*, 3(2), 77-101.

Britz, J. (1993). "Problem solving in early childhood classrooms. ERIC Digest." ERIC Identifier: ED355040. Retrieved September 11, 2018 from https://files.

eric.ed.gov/fulltext/ED355040.pdf.

Bruner, Jerome (1991). The Narrative Construction of Reality. *Critical Inquiry*. 18(1), 1–21. doi:10.1086/448619.

Bürgisser, P. (2000). Completeness and reduction in algebraic complexity theory. Algorithms and Computation in Mathematics, 7. Berlin: Springer-Verlag.

Cakir, M. (2017). Investigating Prospective Teachers' Perceived Problem-solving Abilities in Relation to Gender, Major, Place Lived, and Locus of Control. *Universal Journal of Educational Research*, 5(6):1030-1038.

Carlson, M. P., & Bloom, I. (2005). The cyclic nature of problem solving: An emergent multidimensional problem-solving framework. *Educational studies in Mathematics*, 58(1), 45-75.

Carsten, B. (1989, November). Carsten's Corner. *Power Conversion and Intelligent Motion*, 38.

Cassidy, T., & Long, C. (1996). Problem-solving style, stress and psychological illness: Development of a multifactorial measure. *The British Journal of Clinical Psychology*, 35, 265–277.

Chang, E. C., D'Zurilla, T. J., & Sanna, L. J. (2004, Eds.). *Social problem solving: Theory, research, and training*. Washington, DC: American Psychological Association.

Chen, G. (2019). Latest statistics: education development 2018. Retrieved June 15, 2019, from http://mp.weixin.qq.com/s?__biz=MzAxOTE1NzE2Ng==&mid=2651528674&idx=1&sn=7341aae3ea871b5c353908a483306f96&chksm=8034e423b7436d35245ff1c809f2bc54b923ce1a4b758161c7dd95573229b3e9bddce1fa5ae1&mpshare=1&scene=23&srcid=0423lQuLKTDMV4X0sOwCLpov#rd

Chen, X. (2000). *Qualitative research in social sciences*. Beijing: Educational science publishing house.

Cheng, X., & Sun, X. (2010). Issues and challenges with English language teacher education and professional development in China. *Foreign language learning theory and practice*, 3, 1-6.

Chengdu municipal people's government. (2019, Feb. 17) Chengdu's resident population reaches 16.33 million in 2018. Retrieved June 15, 2019, from https://baike.baidu.com/reference/128473/8846DNBAljc52Cz7TMU-jGI-KPX3TbIRHbI0UZRwrTFdJCnQBCeAHgcMyTM_x5NWqLeXmMGu5_CrcwcnptypRu2oDUcuHB5o7jFQR2c3qcAr76zr4f2EfNoLxznWQun979qm3GnRnHw06LkTrlVwPnaoo8wFonKT1LqQK40

Chinaveh, M. (2010). Training problem-solving to enhance quality of life: implication towards diverse learners. *Procedia-Social and Behavioral Sciences*, *7*, 302-310.

Clarke, D., & Hollingsworth, H. (2002). Elaborating a Model of Teacher Professional Growth. *Teaching and Teacher Education*, 18, 947-967.

Cohen, L., Manion, L., Morrison, K. (2000). *Research Methods in Education*. London: Routledge, https://doi.org/10.4324/9780203224342

Corcoran, T. B. (1995). Helping teachers teach well: Transforming professional development. *CPRE Policy Briefs / Consortium for Policy Research in Education*. New Brunswick, NJ: Rutgers.

Creswell, J. W. (2007). Research design: Qualitative and quantitative approaches. (2nd ed.). Thousand Oaks, CA: Sage.

Creswell, J. W. (2014). Research design: Qualitative, quantitative and mixed Methods Approaches (4th ed.). Thousand Oaks, CA: Sage.

Creswell, J. W., & Poth, C. N. (2017). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Thousand Oaks, CA: Sage.

Csapó, B., & Funke, J. (2017, Eds), The nature of problem solving: Using research to inspire 21st century learning, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264273955-en

D'Zurilla, T. J. (1988). Problem-solving therapies. In K.S. Dobson (Ed.), *Handbook of cognitive-behavioral therapies*. New York: Guilford.

D'Zurilla, T. J., Maydeu-Olivares, A., & Gallardo-Pujol, D. (2011). Predicting social problem solving using personality traits. *Personality and individual Differences*, *50*(2), 142-147.

D'Zurilla, T. J., Nezu, A. M., & Maydeu-Olivares, A. (2002). *The Social Problem-Solving Inventory-Revised (SPSI-R): Technical manual*. North Tonawanda, NY: Multi-Health Systems, Inc.

de Bono, E. (1967). *The use of lateral thinking*. London: Cape.

Deng, C., & Wu, D. (2018). Study on the Fuzziness of Teachers' Moral Boundary. *Research in Educational Development*, (10), 14.

Drent, M., & Meelissen, M. (2008). Which factors obstruct or stimulate teacher educators to use ICT innovatively?. *Computers & Education*, *51*(1), 187-199.

Du, J. (2018). On the construction of new teacher-student relationship: Based on Habermas's communicative action theory. *Journal of Henan University (Social Science)*, 4, 129-135.

Du, L. (2013). Empirical analysis on non-English major ethnic minority undergraduate's foreign language learning anxiety. *Heilongjiang researches on higher education*, 2, 141-144.

Dulaney, S. K. (2010). Cedar middle school's response to intervention journey: A systematic, multi-tier, problem-solving approach to program implementation. ProQuest LLC, Retrieved from https://digitalcommons.usu.edu/cgi/viewcontent.cgi?article=1534&context=etd

Eacute, J., & Esteve, M. (2000). The transformation of the teachers' role at the end of the twentieth century: New challenges for the future. *Educational review*, 52(2), 197-207.

Education system in China. (n. d.). Retrived from https://www.scholaro.com/pro/Countries/china/Education-System

Evans, B. R. (2012). Problem solving abilities and perceptions in alternative certification mathematics teachers. Paper presented at NERA Conference Proceedings. Retrieved from http://digitalcommons.uconn.edu/nera_2012/1

First-rank provincial model upper secondary schools in Sichuan. (n. d.). Retrieved June 12, 2019, from https://baike.baidu.com/item/%E5%9B%9B%E5%B7%9D%E7%9C%81%E4%B8%80%E7%BA%A7%E7%A4%BA%E8%8C%83%E6%8

0%A7%E6%99%AE%E9%80%9A%E9%AB%98%E4%B8%AD/18482865?fromtitle=%E5%9B%9B%E5%B7%9D%E7%9C%81%E4%B8%80%E7%BA%A7%E7%A4%BA%E8%8C%83%E9%AB%98%E4%B8%AD&fromid=2507059

Frensch, P., & Funke, J. (1995, Eds.). *Complex Problem Solving*. New York: Psychology Press, https://doi.org/10.4324/9781315806723

Fullan, M. (2007). The new meaning of educational change, 4th Edition. New York: Teachers College Press.

Fullan, M. G. (1987). Implementing the implementation plan. In M. F. Wideen et I. Andrews (dir.), *Staff development for school improvement* (p. 218-219). Lewes: Falmer Press.

Funke, J. (2010). Complex problem solving: A case for complex cognition? Cognitive Processing, 11, 133–142. doi:10.1007/s10339-009-0345-0.

Gandara, P., Maxwell-Jolly, J., & Driscoll, A. (2005). Listening to teachers of English language learners: A survey of California teachers' challenges, experiences, and professional development needs. Policy Analysis for California Education, PACE (NJ1).

Gao, H. (2016). A study on the connection between Master of Education program (English major) and high school English teacher research capabilities. *Foreign language learning theory and practice*, 1, 59-63.

Gardiner, A. (2008). The art of problem solving. In: Gowers, T., Barrow-green, J., & Leader, I. (2008, Eds.). *The Princeton Companion to Mathematics*. Princeton, NJ: Princeton university Press.

German, T. P., & Barrett, H. C. (2005). Functional fixedness in a technologically sparse culture. *Psychological Science*, 16(1), 1-5.

Gick, M. L. (1986). Problem-solving strategies. *Educational Psychologist*, 21, 99-120.

Gigerenzer, G., Todd, P.M., & the ABC Research Group. (1999). *Simple Heuristics That Make Us Smart*. New York: Oxford University Press.

Gloeckler, L., & Cassell, J. (2012). Teacher practices with toddlers during social problem solving opportunities. *Early Childhood Education Journal*, 40(4), 251- 257.

Greeno, J. G. (1978). Natures of problem-solving abilities. In W. K. Estes (Ed.), *Handbook of learning & cognitive processes: V. Human information* (pp. 239-270). Oxford, England: Lawrence Erlbaum.

Gregory, A. (2010). Teacher learning on problem-solving teams. *Teaching and Teacher Education*, 26(3), 608-615.

Greiff, S. et al. (2017). Adaptive problem solving: Moving towards a new assessment domain in the second cycle of PIAAC. OECD Education Working Papers, No. 156. Paris: OECD Publishing. Retrieved from http://dx.doi.org/10.1787/90fde2f4-en

Greving, H., & Sassenberg, K. (2015). Counter-regulation online: Threat biases retrieval of information during Internet search. *Computers in Human Behavior*, 50, 291-298.

Gu, Q. (2010). Teaching problem archives: professional development by problem research. *Primary and secondary school management*, 5, 24-27.

Gubrium, J. F., & Holstein, J. A. (2009). *Analyzing narrative reality*. Thousand Oaks, CA: SAGE Publications, Inc. doi: 10.4135/9781452234854

Guerra, N., Flores, B. B., & Claeys, L. A., (2009). Case study of an induction year teacher's problemsolving using the LIBRE model activity. *New Horizons in Education: Journal in Education*, 57(1), 42-57.

Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational Researcher*, 15(5), 5-12.

Guskey, T. R. (1995). Professional development in education: In search of the optimal mix. In T. R. Guskey & M. Huberman (Eds.), Professional development in education: New paradigms and practices (pp. 114-131). New York: Teachers College Press.

H county. (n. d.). Retrieved May 2, 2019, from https://baike.baidu.com/item/%E9%BB%91%E6%B0%B4%E5%8E%BF

Hawley, W, & Valli, L. (1999). The essentials of effective professional development: A new consensus. In G. Sykes & L. Darling-Hammond (Eds.), Teaching as the learning profession: Handbook of policy and practice (pp. 127-150). New York: Teachers College Press.

Heitzmann, R. (2008). Case study instruction in teacher education: opportunity to develop students' critical thinking, school smarts and decision making. *Education, 128*(4), 523–542.

Helfferich, Cornelia (2009, 3rded). Die Qualität qualitativer Daten. Manual für die Durchführung qualitative Interviews. Wiesbaden: VS Verlag für Sozialwissenschaften.

Heppner, P. P., & Petersen, C. H. (1982). The development and implications of a personal problem-solving inventory. *Journal of Counseling Psychology, 29*(1), 66-75. http://dx.doi.org/10.1037/0022-0167.29.1.66

Hertzog, H. S. (2000). When, How and Who Do I Ask for Help? Novices' Perceptions of Learning and Assistance. Paper presented at the Annual Meeting of the AERA. New Orleans, LA.

Hew, K. F. & Knapczyk, D. (2007). Analysis of ill-structured problem solving, mentoring functions, and perceptions of practicum teachers and mentors toward online mentoring in a field-based practicum. Instructional Science, 35(1), 1-40. http://dx.doi.org/10.1007/s11251-006-9000-7

Hou, H. T., Sung, Y. T., & Chang K. E. (2009). Exploring the behavioural patterns of an online knowledge-sharing discussion activity among teachers with problem-solving strategy. *Teaching and Teacher Education*, 25(1), 101-108. Retrieved from https://www.sciencedirect.com/science/article/pii/S0742051X08001212

Hsu, S. (2004). Using case study discussion on the web to develop student teacher problem solving skills. *Teaching and Teacher Education: An International Journal of Research and Studies*, 20, 681-692. https://doi.org/10.1016/j.tate.2004.07.001

Huang, L. (2018). Discipline: from criticism to restoration. *Contemporary Education Sciences*, (11), 34-39.

Huang, P. J. (2008). Review of the Use of QQ in Education. *Heilongjiang Science and Technology Information*, 23, 180, 257.

İçen, M., & Öztaskin, Ö. B. (2017). Social Problem Solving Levels of Pre-Service Social Studies Teachers. *Educational Research and Reviews*, *12*(4), 220-229.

Introduction to text analysis. (n. d.) Retrieved June 19, 2019 from https://guides.library.duke.edu/c.php?g=289707&p=1930856.

Jahreie, C. F. (2010). Making sense of conceptual tools in student-generated cases: Students teachers' problem-solving. *Teaching and Teacher Education, 26*(6), 1229–1237. doi: 10.1016/j.tate.2009.12.002.

Jiang, X., Lyons, M. D., & Huebner, E. S. (2016). An examination of the reciprocal relations between life satisfaction and social problem solving in early adolescents. *Journal of Adolescence*, *53*, 141-151.

Jimoyiannis, A., & Komis, V. (2007). Examining teachers' beliefs about ICT in education: Implications of a teacher preparation programme. *Teacher development*, *11*(2), 149-173.

Johnson, R. B., & Christensen, L. B. (2004). Educational Research: Quantitative, Qualitative, and Mixed Approaches. Boston, MA: Allyn and Bacon. http://dx.doi.org/10.3102/0013189X033007014

Jonassen, D. (2011). Supporting problem solving in PBL. Interdisciplinary Journal of Problem-based Learning, 5(2), 95–110. http://dx.doi.org/10.7771/1541-5015.1256

Jonassen, D. H. (1997). Instructional design models for well-structured and ill-structured problem-solving learning outcomes. *Educational Technology Research and Development*, 45, 65–90.

Jonassen, D. H. (2000). Toward a design theory of problem solving. *Educational technology research and development*, 48(4), 63-85.

Jung, I. (2005). ICT-Pedagogy Integration in Teacher Training: Application Cases Worldwide. *Educational Technology & Society*, 8 (2), 94-101.

Kale, U., & Whitehouse, P. (2012). Structuring video cases to support future teachers' problem-solving. *Journal of Research on Technology in Education*, 44 (3), 175-202.

Kaya, D., Izgiol, D., & Kesan, C. (2014). The Investigation of Elementary Mathematics Teacher Candidates' Problem Solving Skills According to Various Variables. *International Electronic Journal of Elementary Education*, 6(2), 295.

Kellogg, R. T. (2003). *Cognitive psychology (2nd ed.)*. California: Sage Publications,

Inc.

Kelly, P. (2006). What is teacher learning? A socio-cultural perspective. *Oxford review of education*, 32(4), 505-519.

Kerness, S. (2014). *Defining and building excellence: a model for professional development at aretė charter school.* (Doctoral dissertation, University of Central Florida Orlando, Florida).

Kilpatrick, J. (1985). A retrospective account of the past 25 years of research on teaching mathematical problem solving. In E. Silver (2013, Ed.), *Teaching and learning mathematical problem solving: Multiple research perspectives*. Hillsdale, NJ: Lawrence Erlbaum.

Kinay, I., & Bagceci, B. (2016). The investigation of the effects of authentic assessment approach on prospective teachers' problem-solving skills. *International Education Studies*, 9(8), 51–59. doi: https://doi.org/10.5539/ies.v9n8p51

Kinnunen, P. (2017). Validity in qualitative research. Retrieved May 20, 2018 from http://www.cs.hut.fi/u/aura/kurssi/Quality_of_qualitative_researf_meeting3.pdf

Klement, M., Dostal, J., & Bartek, K. (2017). Perception and Possibilities of ICT Tools in the Education from the Teachers´ Perspective. Univerzita Palackého v Olomouci Publications.

Knowles, M. S., Swanson, R. A., & Holton, E. F. III (2005). *The adult learner: The definitive classic in adult education and human resource development (6th ed.).* California: Elsevier Science and Technology Books.

Koçyiğit, S., & Zembat, R. (2013). The Effects of Authentic Tasks on Preservi ce Teachers' Attitudes towards Classes and Problem Solving Skills. *Education al Sciences: Theory & Practice, Spring*, *13*(2), 1045–1051. Retrieved from https://files.eric.ed.gov/fulltext/EJ1017236.pdf

Korthagen, F. (2017). Inconvenient truths about teacher learning: towards professional development 3.0. *Teachers and Teaching: theory and practice*, 23(4), 387–405.

Korthagen, F. A. J., Kim, Y. M., & Greene, W. L. (2013, Eds.). *Teaching and learning from within: A Core Reflection approach to quality and inspiration in education*. New

York/London: Routledge.

Koruklu, N. (2015). Personality and Social Problem-Solving: The Mediating Role of Self-Esteem. *Educational Sciences: Theory and Practice*, *15*(2), 481-487.

Kozma, R. B. (2005). ICT, education reform, and economic growth. Retrieved June 19, 2019 from http://www.sca2006.tic-educa.org/archivos/modulo_3/sesion_1/ICT_Education_Reform_Economic_Growth.pdf

Kumar, R. (2008). Convergence of ICT and Education. *World Academy of Science, Engineering and Technology*, 40(2008), 556-559.

Labov, W., & Waletzky, J. (1997). Narrative analysis: Oral versions of personal experience. *Journal of Narrative & Life History, 7*(1-4), 3-38.

Langer, S. K. (1953). *Feeling and form (Vol. 3)*. London: Routledge and Kegan Paul.

Le Maistre, C., & Paré, A. (2010). Whatever it takes: How beginning teachers learn to survive. *Teaching and Teacher Education*, 26(3), 559-564.

Lei, Y. & Maresova, H. (2018). The use of QQ in EFL teaching and learning: A literature review. *Trendy ve vzdělávání*, 11(2): 101-113. DOI: 10.5507/tvv.2018.021

Lei, Y. (2017, November). *EFL teachers' pedagogical problems: definition and classification*. Poster presented at Beginning Teacher in Changing Society, Olomouc.

Lei, Y., Tang, Q., & Maresova, H. (2018). Rethinking Development from the Teacher's Perspective: Questions Asked and Answers Provided in a Secondary School EFL Teacher's Online Community in China, *Edulearn18 Proceedings*, 4625-4633.

Lei, Y., Tang, Q., Liu, J., & Zhou, B. (2017, March). 11th Grade Teachers' and Students' Perception of the Challenges of Using QQ in EFL Teaching and Learning in China. Unpublished poster presented at education conference, 2017 March, Palacky University, Olomouc.

Lei, Y., Tang, Q., Liu, J., & Zhou, B. (2018). Teachers' and Students' Attitudes of Using QQ in EFL Teaching and Learning in China's High Schools. In Palva Vyhnalkova, Jitka Plishke (Eds.), *Proceedings of Dying of humanity? Educational challenges in the current school*, 2016. Conference (pp. 146-154). Olomouc: Palacky University Olomouc.

Lester, F. K. (1994). Musings about mathematical problem-solving research: 1970-1994. *Journal for Research in Mathematics Education*, 25, 660-660.

Li, C. (2012). The transition of the relationship between teachers and students: From ancient to modern times. *Educational Research*, 8, 113-119.

Li, L., Zhao, X. M., Le, X. X., Yang, K., & Duan, F. (2011). Review of The Use of Instant Messaging Software in Education. *Software Guide Education Technology*, 7, 76-79.

Li, X. (2004). Difficulties of and coping strategies for the transition of English teaching from primary to secondary schools. *Journal of teaching and management*, 16, 55-56.

Li, X. (2016). Overload of primary and secondary school teacher's work and effective adjustment. *Journal of the Chinese Society of Education*, 2016, (2).

Lim, C. P., & Khine, M. S. (2006). Managing teachers' barriers to ICT integration in Singapore schools. *Journal of Technology and Teacher Education*, *14*(1), 97–125.

Liu, D. (2016). Investigation and consideration on disciplinary right of primary and middle school teachers. *Teacher Education Research*, (2), 96-100.

Liu, F. (2012). School-based improvement of the transition of ELT from primary to secondary schools. *Education exploration*, 7, 57-58.

Liu, Q. (2017). Teachers morality with a characteristic of "ordinary people" and its paradox. *Contemporary education and culture*, 9(3), 47-53.

Liu, S. (2013). Literature Review of the Use of QQ in Online Teaching and Learning. *Distance Education in China*, 3, 33-38.

Livingstone, S. (2012). Critical reflections on the benefits of ICT in education. *Oxford review of education*, *38*(1), 9-24.

Luchins, A. S. (1942). Mechanization in problem solving: The effect of einstellung. *Psychological monographs*, 54(6), i.

Lv, Z. (1999). On the issue of "one-stop services". *Foreign languages teaching and research*, 1, 19-20.

Maag, J. W. (2006). Social skills training for students with emotional and behavioral disorders: A review of reviews. *Behavioral disorders*, *32*(1), 4-17.

Mackenzie, N., & Knipe, S. (2006). Research dilemmas: Paradigms, methods and methodology. *Issues in educational research*, *16*(2), 193-205.

Maier, N. R. (1931). Reasoning in humans. II. The solution of a problem and its appearance in consciousness. *Journal of comparative Psychology*, 12(2), 181.

Marchis, I. (2011). How Mathematics Teachers Develop Their Pupils' Self-Regulated Learning Skills. Acta Didactica Napocensia, 4, 9-14. Retrieved from https://eric.ed.gov/?id=EJ105588

Martinovic, D., & Zhang, Z. (2012). Situating ICT in the teacher education program: Overcoming challenges, fulfilling expectations. *Teaching and Teacher Education*, *28*(3), 461-469.

Matlin, M. W. (1998). *Cognition (4th ed.)*. NY, USA: Harcourt Brace College Publishers.

Maxwell, J. A. (1992). Understanding and validity in qualitative research. *Harvard Educational Review*, 62(3), 279–300.

Mayer, R. (2014). What problem solvers know: Cognitive readiness for adaptive problem solving. In: O'Neil, H. F., Perez, R. S., & Baker, E. L. (2014). *Teaching and measuring cognitive readiness*. New York: Springer.

McDonald, F. J., & Elias, P. (1983). *The transition into teaching: The problems of beginning teachers and programs to solve them. Summary report*. Berkeley, CA: Educational Testing Service.

McMurran, M., Crawford, M. J., Reilly, J., Delport, J., McCrone, P., Whitham, D., ... & Adams, C. E. (2016). Psychoeducation with problem-solving (PEPS) therapy for adults with personality disorder: a pragmatic randomised controlled trial to determine the clinical effectiveness and cost-effectiveness of a manualised intervention to improve social functioning. *Health Technology Assessment*, *20*(52).

Metallidou, P. (2009). Pre-service and in-service teachers' metacognitive knowledge about problem-solving strategies. *Teaching and Teacher Education*, 25, 76-82.

Metallidou, P., & Platsidou, M. (2008). Kolb's learning style inventory-1985: Validity issues and relations with metacognitive knowledge about problem-solving strategies.

Learning and Individual Differences, 18(2), 114-119.

Moss, C. M. (1997, April). *Systematic self-reflection: Professional development for the reflective practitioner.* Paper presented at the annual meeting of the American Educational Research Association, Chicago, IL.

Moussaid, R., & Zerhouni, B. (2017). Problems of pre-service teachers during the practicum: An analysis of written reflections and mentor feedback. *Arab World English Journal, 8*(3). DOI: https://dx.doi.org/10.24093/awej/vol8no3.10

Mutlu-Göçmen, N. & Güleç, S. (2018). Relationship between teachers' perceptions of mobbing and their problem solving skills. *Educational Research and Reviews*, 13(1), 51-59. DOI: 10.5897/ERR2017.3404.

Newell, A., & Simon, HA. (1972). *Human Problem Solving*. Englewood Cliffs, NJ: Prentice Hall.

Ng, C. & Tan, C. (2006). Investigating Singapore pre-service teachers' ill-structured problem-solving processes in an asynchronous online environment: implications for reflective thinking. *New Horizon in Education*, 54, 53-70.

Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of general psychology*, 2(2), 175.

Noom-Ura, S. (2013). English-teaching problems in Thailand and Thai teachers' professional development needs. *English Language Teaching*, 6(11), 139.

OECD. (2003). The PISA 2003 Assessment Framework: Mathematics, Reading, Science and Problem Solving Knowledge and Skills. Paris: OECD Publishing. Retrieved from http://dx.doi.org/10.1787/9789264101739-en.

OECD. (2004). The PISA 2003 Assessment Framework: Mathematics, Reading, Science and Problem-Solving Knowledge and Skills. Paris: OECD Publishing. Retrieved from http://dx.doi.org/10.1787/9789264101739-en.

OECD. (2013). PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy. OECD Publishing. http://dx.doi.org/10.1787/9789264190511-en

OECD. (2013a). OECD Skills Outlook 2013: First Results from the Survey of

Adult Skills. Paris: OECD Publishing. Retrieved from http://dx.doi.org/10.1787/9789264204256-en.

OECD. (2013b). PISA 2015 Collaborative Problem Solving Framework. Paris: OECD Publishing. Retrieved from www.oecd.org/pisa/pisaproducts/Draft%20PISA%202015%20Collaborative%20Problem%20Solving%20Framework%20.pdf.

OECD. (2013c). PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy. Paris: OECD Publishing. Retrieved from http://dx.doi.org/10.1787/9789264190511-en.

OECD. (2014). *PISA 2012 Results: Creative Problem Solving: Students' Skills in Tackling Real-Life Problems (Volume V)*. PISA. OECD Publishing. http://dx.doi.org/10.1787/9789264208070-en

OECD. (2015). Adults, Computers and Problem Solving: What's the Problem?. Paris: OECD Publishing. Retrieved from http://dx.doi.org/10.1787/9789264236844-en.

OECD. (2016a). Teachers' ICT and problem-solving skills: Competencies and needs. Education indicators in focus, EDIF No. 40. Retrieved June 12, 2018 from https://doi.org/10.1787/5jm0q1mvzqmq-en.

OECD. (2016b). *Education in China: A snapshot*. Paris: OECD Publishing. Retrieved June 12, 2019, from https://www.oecd.org/china/Education-in-China-a-snapshot.pdf

Ormrod, J. (1999). *Human learning (3rd ed.)*. Upper Saddle River, NJ: Prentice Hall.

Osborn, A. F. (1953). *Applied imagination*. Oxford, England: Scribner's.

Palraj, S., DeWitt, D., & Alias, N. (2017). Teachers Beliefs in Problem Solving in Rural Malaysian Secondary Schools. *Malaysian Online Journal of Educational Technology*, 5(4), 45-57.

Pannels, T. C. (2010). The effects of training preservice teachers in creative problem solving and classroom management. (Unpublished doctoral dissertation, University of Oklahoma, Norman, OK.)

Patel, S. (2015). The research paradigm–methodology, epistemology and ontology–explained in simple language. Retrieved June 12, 2019, from http://salmapatel.co.uk/academia/the-research-paradigm-methodologyepistemology-and-ontology-

explained-in-simple-language.

Pelgrum, W. J. (2001). Obstacles to the integration of ICT in education: Results from a worldwide educational assessment. *Computers & education*, *37*(2), 163-178.

Pessoa, L. (2009). Cognition and emotion. *Scholarpedia*, 4(1):4567. Retrieved May 20, 2020 from http://scholarpedia.org/w/index.php?title=Cognition_and_emotion&action=cite&rev=91134.

Polya, G. (1945). *How to solve it: A new aspect of mathematical method*. Princeton, NJ: Princeton University Press. (Reprinted 1957, Doubleday, Garden City, NY). Retrieved from https://math.hawaii.edu/home/pdf/putnam/PolyaHowToSolveIt.pdf

Problem. (n. d.). Oxford dictionaries. Retrieved April 20, 2016 from https://en.oxforddictionaries.com/definition/problem

Pugach, M., & Johnson, L. J. (1988). Peer collaboration: Enhancing teacher problem-solving capabilities for students at risk. Paper presented at the annual meeting of the American Research Association, New Orleans. Retrieved from https://files.eric.ed.gov/fulltext/ED292800.pdf

Radnitsky, G., & Bartley, W. W. (1987, Eds). Evolutionary Epistemology, Rationality, and the Sociology of Knowledge. La Salle: Open Court.

Rao, J., Ye, J., & Guo, J. (2015). A loss of ruralities in Chinese education and a loss of education in rural China: A case observation on a village in the mountainous area of north China. *China agricultural university journal of social sciences edition*, 32(2), 18-27.

Reid, K., & Kleinhenz, E. (2015). *Supporting teacher development: literature review*. Canberra: Department of Foreign Affairs and Trade.

Rickard, A. (2005). Evolution of a teacher's problem solving instruction: A case study of aligning teaching practice with reform in middle school mathematics. *Research in Middle Level Education Online*, 29(1), 1-15.

Rubinstein, M. F., & Firstenberg, I. R. (1995). *Patterns of problem solving*. Englewood Cliffs: Prentice Hall.

Sacks, A. (2013, October). The problem-solving power of teachers. *Educational*

Leadership, 71(2), 18-22.

Sahin, N., Sahin, N. H., & Heppner, P. P. (1993). Psychometric properties of the Problem Solving Inventory in a group of Turkish university students. *Cognitive Therapy and Research*, 17, 379-396.

Schifter, D., Russell, S. J., & Bastable, V. (1999). Teaching to the big ideas. In M. Solomon (Ed.), The diagnostic teacher (pp. 22-47). New York: Teachers College Press.

Schoenfeld, A. H. (2010). *How we think: A theory of human decision-making with educational applications*. New York: Routledge.

Schoenfeld, A. H. (2013). Reflections on problem solving theory and practice. *The Mathematics Enthusiast*, 10(1), 9-34.

Shao, C., & Hu, Z. (2018). The subordinate structure of the relationship between teachers and students. *Journal of Educational Studies*, 14(2), 12-18.

Sheridan, S. M., & Kratochwill, T. R. (1992). Behavioral parent–teacher consult ation: Conceptual and research considerations. *Journal of School Psychology*, 30, 117–139. Retrieved from https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1090&context=cyfsfacpub

Silins, H. (1994). Leadership characteristics that make a difference to schools. Presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA. Retrieved from https://files.eric.ed.gov/fulltext/ED383086.pdf

Silverman, R., & Welty, W. M. (1990). Teaching with cases. *Journal on Excellence in College Teaching*, 1, 88-97.

Simon, H. A. (1981). *The sciences of the artificial*. Cambridge, Massachusetts: MIT Press.

Stansbury, K., & Zimmerman, J. (2000). *Lifelines to the classroom: Designing support for beginning teachers*. San Francisco: WestEd.

Statistical Communique of Chengdu's National Economic and Social Developme nt in 2018. (2019, March 21). Retrieved June 12, 2019, from https://www.scol.com.cn/sjbtt/201903/56844245.html

Statistical Communique of H County's National Economic and Social Development in 2017. (2018, March 21). Retrieved June 12, 2019, from http://www.heishui.gov.cn/dwzwgk/tjxxdwzwgk/201803/t20180321_1347254.html

Stecher, B. M., & Mitchell, K. J. (1995, April). Portfolio-driven reform: Vermont teachers' understanding of mathematical problem solving and related changes in classroom practice. CSE Technical report No. 400. L.A., Calif.: CRESST/UCLA.

Sukamolson, S. (2007). Fundamentals of quantitative research. *Language Institute Chulalongkorn University*, *1*, 2-3.

Sunal, D. W., Haas, M. E., Saltz, M. & Decosta, S. B. (1989, March). Teacher thinking: Effects of intervention instruction on basic teaching and problem solving skills. Paper presented at the Annual Meeting of the American Educational Research Association, San Francisco, CA. Retrieved from https://files.eric.ed.gov/fulltext/ED306217.pdf

Temel, S. (2016). Perceived problem solving skills: As a predictor of prospective teachers' scientific epistemological beliefs. *Educational Sciences: Theory and Practice*, 11(3):111-118.

Temel, V. (2015). The problem-solving skills of the teachers in various branches. *Educational Research and Reviews*, 10(5):641-647.

Tencent latest financial report 2019. (2019, March 21). Retrieved June 12, 2019, from https://zhuanlan.zhihu.com/p/59986430

Tinio, V. L. (2003). ICT in education. Retrieved June 19, 2019 from http://www.eprimers.org/ict/page2.asp

Toll, C. A. (2017). A Problem-Solving Model for Literacy Coaching Practice. *The Reading Teacher*, 70(4), 413-421.

Tolson, B. L. (2013). *How culture influences teacher self-reflective problem solving behavior and self-efficacy: experiences of White female teachers working through relationship with Black students in a Mid-Western American city.* (Doctoral dissertation, University of Hawaii at Manoa, Honolulu).

Turgut, O., & Ocak, G. (2017). The Examination of the Relation between Teacher Candidates' Problem Solving Appraisal and Utilization of Motivated Strategies for

Learning. *Journal of Education and Training Studies*, *5*(10), 76-85.

Tversky, A., & Kahneman, D. (1973). Availability: A heuristic for judging frequency and probability. *Cognitive Psychology*, 42, 207-232.

Underwood, T. (2012). Where to start with text mining. Retrieved June 19, 2019, from https://tedunderwood.com/2012/08/14/where-to-start-with-text-mining/

VanLehn, K. (1989). Problem solving and cognitive skill acquisition. In: Posner, M. (Ed.). Foundations of Cognitive Science, 527–579. Mahwah, NJ: Erlbaum.

Veenman, S. (1984). Perceived problems of beginning teachers. *Review of educational research*, 54(2), 143-178.

Verderber, É., Szivák, J., & Vámos, Á. (2016). Understanding Professional and Pedagogical Problems and Reflections of Teachers by Professional Capital Model. *Some Issues in Pedagogy and Methodology*, ISBN 978-80-89691-35-7. 23. DOI: 10.18427/iri-2016-0061.

Villegas-Reimers, E. (2003). Teacher Professional Development: an international review of literature. Paris: UNESCO/International Institute for Educational Planning.

Votava, J. (2006). Analyses of teachers' problems in the European context. *MARIBOR PROCEEDINGS*, 44-54.

Walker, O. L., & Henderson, H. A. (2012). Temperament and social problem solving competence in preschool: Influences on academic skills in early elementary school. *Social Development*, *21*(4), 761-779.

Wang, C. (n. d.). Introduction to QQ Chat Log Analyzer 2.0. *Wang Can's Personal Website*. Retrieved May 2, 2019, from http://wangc.net/qq/

Wang, Y., & Chiew, V. (2010). On the cognitive process of human problem solving. *Cognitive systems research*, 11(1), 81-92.

Wang, Y., & Ruhe, G. (2007). The cognitive process of decision making. *International Journal of Cognitive Informatics and Natural Intelligence (IJCINI)*, 1(2), 73-85.

Wang, Y., Wang, Y., Patel, S., & Patel, D. (2006). A layered reference model of the brain (LRMB). *IEEE Transactions on Systems, Man, and Cybernetics (C)*, 36(2), 124–133.

Wang, Z. (2013). Integrating resources for the EL teacher training model in national

training programs. *China higher education*, 17, 59-60.

Whiting, C. S. (1958). *Creative Thinking*. New York: Reinhold.

Wiley, J. (1998). Expertise as mental set: The effects of domain knowledge in creative problem solving. *Memory & cognition*, 26(4), 716-730.

Wilson, J. W., Fernandez, M. L., & Hadaway, N. (1993). Mathematical proble m solving. In P.S. Wilson (Ed.), *Research ideas for the classroom: High sch ool mathematics* (pp. 57, 78). New York, NY: Macmillian. Retrieved from htt p://jwilson.coe.uga.edu/emt725/PSsyn/PSsyn.html

Wilson, P. F., Dell, L. D., & Anderson, G. F. (1993). Root cause analysis: A tool for total quality management. Milwaukee: ASQC Quality Press.

Wu, C., Zhang, Q., Xu, Q., Liu, M., & Long, B. (2016). The interconnections and difficulties of law, conscience and common sense: Big data analysis of the social response to teacher's behavior of corporal punishment. *Journal of Educational Science of Hunan Normal University*, 15(4), 94-102.

Wu, Q. (2013). The conflict and the adjustment of the traditional and modern ideas about the relationship between teachers and students. *Journal of Educational Science of Hunan Normal University*, 6, 40-43.

X district. (n. d.). Retrieved May 2, 2019, from https://baike.baidu.com/item/%E6%96%B0%E9%83%BD%E5%8C%BA/5274260?fromtitle=%E6%96%B0%E9%83%BD&fromid=2794687#3_4

Yang, J., & Zhao, P. (2017). The investigation and suggestions on the salary of compulsory education teacher working in county area. *Journal of Northeast Normal University (Philosophy and Social Sciences)*, 6, 167-173.

Yavuz, G., Arslan, G., & ve Gulten, D. C. (2010). The perceived problem solving skills of primary mathematics and primary social sciences prospective teachers. *Procedia Social and Behavioral Sciences*, 2, 1630-1635.

Yerushalmi, E. & Eylon, B. S. (2013). Supporting teachers who introduce curri cular innovations into their classrooms: A problem-solving perspective. *Physic al Review Special Topics: Physics Education Research*, 9(1), 010121. https://d

oi.org/10.1103/PhysRevSTPER.9.010121

Zhang, C., & Xu, J. (2015). *Modern psychology and education statistics*. Beijing Normal University Press.

Zhang, J. (2009). Development and transition of primary and secondary school English language education from the perspective of curriculum. *People's education*, 19, 40-41.

Zhang, W., Cheng, Y., Zou, H., & Yang, Y. (2012). The influence of emotional intelligence and social problem-solving skills on the teacher-student relationship of secondary school students. *Journal of Psychological Science*, 35(3), 624-630.

Zhou, B. (2006). Transferring between the teaching problem and the topic of teaching research. *Shanghai education research*, 8, 50-51.

Zhou, Y., Yuan, P., Yang, L., Peng, J., & Jiang, Y. (2017). Analysis of online public opinion on corporal punishment incidents in primary and secondary schools between 2011-2015. *Contemporary Education Sciences*, (10), 57-61.

Zwicky, F. (1967). The morphological approach to discovery, invention, research and construction. In: *New methods of thought and procedure* (pp. 273-297). Heidelberg, Berlin: Springer.

Zwicky, F. (1969). *Discovery, Invention, Research - Through the Morphological Approach*. Toronto: The Macmillan Company.

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Appendix

Outline of Interview: Teacher's Problem Solving and Teacher Support

1. Introduction

Dear teacher,

Good day! This interview aims to investigate the process of teacher problem solving, the obstacles encountered during the process, and teacher's support seeking for overcoming the obstacles, hoping to improve the approach of supporting teachers as problem solvers. This interview takes about one and half an hour, please answer honestly and in detail. Your personal information will be strictly kept confidential. Thank you for your participation. If you have any questions or suggestions, please contact us at phone number 15281152899 or email 2723539@QQ.com.

2. Background information

Name: _____
Gender: _____
Age: _____
Education: _____
Major: _____
Years of teaching: _____
Professional title: _____
Concurrent position: _____

3. Questions

1) As a teacher, you must have encountered many problems in your teaching career. Please share with us one of your proudest problem-solving stories.

How did you perceive the abnormalities? How did you define the problem? How did you make the decision to engage the problem? What plan did you make? What actions did you take? How did you evaluate the results? What were the influences of this incident to you and the people involved (such as the influences on your mind, behavior and attitude)?

2) Please share with us another one of your most regrettable problem-solving stories?

How did you perceive the abnormalities? How did you define the problem? How did you make the decision to engage the problem? What plan did you make? What actions did you take? How

did you evaluate the results? What were the influences of this incident to you and the people involved (such as the influences on your mind, behavior and attitude)?

3) Do you look for problems as a habit?

If not, why? If so, what did you do?

4) Do you like or dislike looking for problems and solving them?

Why?

5) Do you think that you are good at problem solving?

Do teachers evaluate themselves by their knowledge, competence, awareness, information, motivation, belief, etc.?

6) What do you think about when you hear the phrase “problems encountered by teachers”? How do you understand the phrase?

By what standards do you decide whether a situation is a problem or not? For you, is there a difference between “problem”, “difficulty” and “challenge”?

7) What problems have you encountered during this year?

How do you categorize them? Which ones are most important for you? Which problems did you solve? Why you didn’t solve the other problems?

8) What factors have affected your problem solving?

What are the most important factors for you? Are these factors under your control? Why?

9) What resources and tools do you usually use to solve problems?

From where do you learn about these resources and tools? How do you obtain, adopt and maintain them? Can they meet your problem-solving needs? What are their advantages and disadvantages?

10) What supports have you received during this year?

Are these supports helpful for your problem solving? What are their advantages and disadvantages?

11) During the process of problem solving, under what circumstances will you seek support or help?

Who will you turn to? By what channels? Can you get timely, adequate and effective support from them? What will you do if you cannot?

12) What kind of support or help are most needed to improve your problem solving?

13) If you have enough time to deal with one problem wholeheartedly now, which one will you choose? Why?

14) Do you have any questions and suggestions about this research?

15) Please make a brief introduction to your education and work experiences.