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INFUSION OF CRITICAL THINKING INTO L2 CLASSES:

A CASE STUDY IN A CHINESE HIGH SCHOOL

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DECLARATION

I hereby certify that this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously and is not being currently submitted for any other degree at the University of Newcastle or any other institution.

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Signature:

Date:

DEDICATION

This thesis is dedicated to my parents, Shuming Lin and Buying Zhu, for instilling in me the values of hard work, perseverance and commitment.

I also dedicate this thesis to my one-year old daughter Muqing Elisa Yuan, my most precious treasure, my never-ending spring of life and joy, and my husband Jie Yuan, my soul mate and my strength.

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ABSTRACT

Previous research has indicated that the teaching of thinking skills has a positive influence on students' achievements and attitudes in the L1 context, and recent trends in L2 teaching have also highlighted the importance of promoting thinking skills, especially critical thinking. However, there is some controversy surrounding the applicability of teaching thinking skills in an L2 context, especially in an Asian ESL context. The intention of this case study was to investigate whether or not an infusion approach is applicable and helpful as a method of teaching thinking in a subject class. Two classes of students from the same high school participated in the study; one received infusion lessons and the other received traditional teaching by the same teacher. Data were collected from Chinese versions of the California Critical Thinking measurements and students' compositions in both pre- and post-intervention stages, and from self-evaluation questionnaires after the lessons in weeks one, four, seven and ten, as well as from post-intervention questionnaires and interviews conducted after the intervention. The results of the study contradict the claims of some scholars (Atkinson 1997; Fox 1994) who are hesitant about introducing critical thinking into Asian L2 classrooms, revealing the applicability and positive effects of teaching critical thinking in L2 classes on critical thinking and L2 writing. The thinking tasks in the lessons created a context conducive to critical thinking, which at the same time gave rise to opportunities for the students to create meaning in the target language. The students took advantage of the opportunities to practise critical thinking in their writing, which in turn influenced the content and their use of language in their written texts. The students demonstrated positive attitudes towards the lessons. The results indicate that the infusion approach is an applicable and helpful teaching method for integrating critical thinking into an L2 class. This study contributes particularly to the idea in pedagogy

that critical thinking skills can be integrated into L2 teaching, and that this has positive effects on students' thinking and language learning. In the area of research methodology, the results of this study showed that the Chinese versions of the CCTDI and CCTST can be used to assess students' critical thinking at high school level; however, it was found that high school students need more time to complete these tests: 5 and 10 extra minutes for each test respectively. The findings also provided data to establish a norm for the CCTST for Chinese high school students.

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List of Abbreviations

CCTDI	California Critical Thinking Disposition Inventory
CCTST	California Critical Thinking Skill Test
EFL	English as a Foreign Language
ESL	English as a Second Language
L1	First Language
L2	Second Language
NCEE	National College Entrance Examination
PIQ	Post-intervention Questionnaire
SCT	Sociocultural Theory
SEQ	Self-evaluation Questionnaire
SLA	Second Language Acquisition
S	Student
Ss	Students
T	Teacher

Chapter One – Introduction

1.1 Introduction

Researchers have emphasised the need to teach critical thinking skills to high school students, since these are essential skills if students are to achieve academic success at college and in their professional careers and social lives (Lizarraga et al. 2010; Swartz 2003; Swartz and Parks 1995). Marin and Halpern (2011) have appealed for the instruction of critical thinking to be a central part of general education at all high schools. Teaching critical thinking skills helps students to select relevant and useful information, to generate and evaluate the information received, to seek effective ways of achieving their aims, and thus to become better problem solvers and decision makers.

In this study the infusion approach was adopted to teach critical thinking skills in high school English writing classes in China and the effectiveness of the approach in this context was examined. This chapter first introduces the rationale for conducting the study and the context of the research; this is followed by an overview of current educational problems in this area in China. The subsequent discussion focuses on the significance, aims and research questions of this study. Finally, an outline of the thesis is presented.

1.2 Rationale of the Study

This study was inspired by the English teacher who taught the infusion lessons in the present study. She had noticed that some students were actually falling asleep in class,

and that others were showing negative attitudes towards learning English and recognised the need to help students to become more active and effective learners. She was therefore looking for more useful teaching methods to help her improve the teaching, and to contribute more to students' learning and their future life.

The development of students' thinking, and in particular their critical thinking, has been strongly recommended by many scholars and educators (e.g., Avargil et al. 2012; Aizikovitsh-Udi and Amit 2011; Behar-Horenstein and Niu 2011; Popil 2011; Nagappan 2001; Kimmel 1995; Swartz and Parks 1994). Thinking skills were included as learning goals in educational policy in England in 1999 (Qualifications and Curriculum Authority, 1999), in Hong Kong in 2000 (Education Commission, 2000), in Malaysia in 2003 (Abdullah et al. 2003) and in China in 2003 (Ministry of Education, 2003). However, in China there are inconsistencies between the requirements of the curriculum and the actual situation (see section 1.4). The intention of this study was thus to find a means to apply this aspect of the curriculum in actual teaching practice.

Moreover, in Chinese L2 classes, writing is deemed to be a problematic language skill, and both teachers and students show negative attitudes towards it (see section 1.4). Various studies (Gorjian et al. 2012; Gibson 2012; Shahini and Riazi 2010; Rao 2007; Liaw 2007) have revealed the positive effects of the teaching of critical thinking on cognitive development and L2 writing (for details see chapter 2, section 2.4.4). Therefore, this study set out to tackle this problem by integrating critical thinking with the teaching of L2 writing.

This study adopted the infusion approach to teach critical thinking. This approach is employed to teach thinking skills, in particular critical and creative thinking. It provides direct and explicit instruction on the thinking skills, and embeds this instruction into the teaching of school subjects, thus promoting thinking and a deep understanding of the subject. Infusion was first developed as an approach to teaching thinking skills by Swartz and Parks in 1994. Since then this approach has been adopted in many studies (Dewey and Bento 2009; Abrami et al. 2008; Davies 2006; Kirkwood 2000), and the results reveal that infusion lessons are helpful and practical (for details see chapter 2, section 2.5.2).

McGinness (2000) listed five benefits of employing the infusion approach, which are as follows:

- thinking skills can be matched directly with topics in the curriculum;

- content instruction is invigorated, thus leading to deeper understanding;

- classroom time is used optimally;

- teaching for thoughtfulness is directly supported across the curriculum;

- the transfer of learning can be more easily promoted and reinforced at other stages.

The rationales for adopting the infusion approach in the current study are as follows. First, since the aim of this study was to apply the curriculum's emphasis on critical thinking in an English class, it was important for the teaching to match thinking skills to the topics of the English lessons. Next, an infusion approach takes advantage of the school lesson timetable, allowing the teachers of subjects to target the development of thinking and the learning of subjects at the same time. Moreover, the infusion approach was carefully developed, and a handbook (Swartz and Parks 1994) which guides

teachers in designing their own lessons was provided. This is practical and easy to follow, especially for teachers who are making their first attempt. Moreover, the mechanism of infusion is to help students to internalise thinking skills and subject knowledge (Assaf 2009). The conceptual framework of infusion lessons (see chapter 2, section 2.5.1) corresponds well with sociocultural theory (SCT), which claims that effective learning arises during the process of internalisation and which has heavily influenced L2 pedagogy (see chapter 2, section 2.3). In addition, infusion lessons were first designed to integrate critical and creative thinking into the teaching of school subjects, and the aim of this study was also to teach critical thinking. An infusion approach was thus expected to be an appropriate and feasible method to adopt.

1.3 Context of the Study

Having clarified the rationale behind the study, it is important to introduce the context of the research. This study was conducted in an English class at a Chinese high school. At Chinese high schools, the National College Entrance Examination (NCEE) is the real aim of teaching and learning, and the English course is one of three main subjects to learn. In the latest English curriculum for Chinese high schools some changes were proposed, which emphasised the need to include critical thinking as one of the aims of English teaching, placed higher requirements on writing, and emphasised the need to improve and change teaching methods to adapt to the changes.

The National College Entrance Examination (NCEE)

High school education in China involves three years of study, with a graduation examination at the end of the second year. However, the NCEE, which is taken at the

end of the third year, is the real aim and motivation of students' high school study (Ding and Lehrer 2007).

The selection of students for college education is not determined by their performance over the three years of study in high schools, but only by the scores they obtain in the NCEE. Therefore, Chinese high school education is still exam-driven. Students' performance in exams is considered as an 'important indicator of students' accomplishment' (Luo and Wendel 1999: 61). The NCEE is not only the main motivation for students to study hard, but also the indicator of the effectiveness of teaching at high school (Luo and Wendel 1999), and high schools therefore try constantly to improve their students' scores in the NCEE in order to prove the effectiveness of the teaching.

English Course

English is one of three key subjects in high school education along with Chinese and mathematics. The 'English Language Curriculum Guidelines' is published by the Ministry of Education, and states the contents, aims, intended outcomes of and implementation guidelines for English teaching. The teaching of English is required to cover the content and achieve the aims and intended outcomes (Wang and Lam 2009). High school students are required to receive 36 hours of English teaching each term, and the teaching is based on the textbooks designed by the Ministry of Education (Ministry of Education 2003).

Changes in the English Language Curriculum

The latest high school English language curriculum was published in 2003 (Ministry of Education, 2003). Compared to the previous curriculum, published in 1993, changes in the aims, intended outcomes and methods of English teaching are particularly noteworthy, and are regarded as 'the culmination of a series of curricular changes' (Wang and Lam 2009: 70).

The latest curriculum proposed a more ambitious role for English courses. It emphasised the role of English as a communication tool (Ministry of Education 2003), with students being required to be able to use English to communicate with others. It is also expected that the teaching of English will contribute to students' personal development, future professional life and lifelong learning (Ministry of Education 2003).

Thinking, and in particular critical thinking, is emphasised in the English Language curriculum for the first time as an aim of English teaching (Wang and Lam 2009). The latest curriculum points out that the English course should not only focus on teaching the language, but should also aim to improve 'critical thinking ability, information gathering and analysis ability, problem solving ability' (Ministry of Education 2003: 4, translated by Wang and Lam 2009: 72-73).

Further, there has been a fundamental change in the intended outcomes of the teaching of writing. The 1993 curriculum required high school students to 'be able to rewrite a paragraph of an article in the textbook; to write a simple letter, note and notice in

appropriate formats; and to fill in a simple resume form' (translated from Ministry of Education 1993: 3). However, under the new curriculum the ability to form sentences is no longer sufficient. It emphasises students' thinking, and they are expected to be able to describe their personal attitudes and views using the correct linguistic structures and appropriate compositional organisation (Ministry of Education 2003). The new curriculum requires not only an improvement in students' writing ability, but also in their capability to articulate personal views, for which thinking skills are both important and necessary.

The latest curriculum also proposes that in order for teachers to adapt to these changes, there is a need to 'establish new concepts of teaching and improve teaching methods' (translated from Ministry of Education 2003: 18). It suggests that the teaching methods should be able to help students improve their critical thinking ability and develop a creative thinking spirit. It also suggests that teachers should promote collaborative learning and encourage students to learn from each other, thus creating an active, collaborative and interactive teaching and learning atmosphere (Ministry of Education 2003).

1.4 Statement of Educational Problems

Although the latest English curriculum was published ten years ago, there are still inconsistencies between the aims and intended learning outcomes stated in the curriculum and actual classroom teaching and learning.

English does not play the role of a communication tool. On the one hand, class sizes in Chinese high schools are large, the average size being between 50 and 60 students (Chang 2004). It is thus difficult for a teacher to interact with each individual student. On the other hand, educators point out that Chinese high school English teaching is teacher-dominated and shows a narrow focus on defined knowledge in textbooks (Zhang 2007; Hu 2005a, 2005b; Chee Mok 2000; Sharpe and Ning 1998). The target language is only a subject to learn, and the classroom thus lacks communication and interaction (Rao 2002). This is in contrast to the curriculum, which emphasises the role of the English language as a communication tool, and the creation of an interactive and communicative environment in English classes.

The actual teaching has not emphasised thinking skills as important aims of English courses, and the English classes fail to encourage critical thinking. This can be attributed to the influence of the Chinese culture, the pressure of the NCEE and the absence of helpful teaching methods.

Firstly, as claimed by many scholars, influenced by the 'Confucian heritage' of Chinese culture (Mason 2008; Bush and Haiyan 2000), the teacher is seen as a 'fount of knowledge', and students are expected to show respect for the authority of the teacher (Delamont 2006; Littlewook 2000; Ouyang 2000). In Forestier's (1998) study, a student from mainland China said that 'we are always taught to obey, not to invent'. This is still the case in current Chinese classrooms, as Wei et al. proposed: teachers in Chinese high school classrooms are stern in front of the students, and students obey the teacher without question (Wei et al. 2009). Therefore, students tend to accept what teachers say and are not encouraged to think critically (Simister 2004).

Secondly, as proposed by Luo and Wendel (1999), owing to the pressure of the NCEE, high school teaching only pays attention to those areas which closely relate to the learners' studies, and they are less interested in things that seem to have no direct relevance. As discussed in section 1.3, the NCEE is the real aim of high school teaching and studying. Teachers are expected to help students to improve the scores in the NCEE, and this also explains why the English teaching is focused solely on the knowledge that appears in the textbook, as mentioned above.

Thirdly, the teaching of English in China has been found to be less than helpful in facilitating the acquisition of critical thinking skills (Liaw 2007). The teacher-dominated, textbook-based, teacher-authority classroom teaching results in an over-emphasis on rules, linguistic details, accepted knowledge and obedience to authority, none of which can activate or motivate students to think critically (Rao 2006; Simister 2004; Littlewood 2000). Moreover, Mok's (2009) study revealed that teachers lacked knowledge of teaching methods and skills which could be used to develop students' thinking skills in class. He observed two English writing classes in a secondary school in Hong Kong, and the results revealed that teachers did not create either the opportunities or the space for critical thinking. Their questioning skills were poor and they did not allow the students enough time to think. He also proposed that the absence of a collaborative learning environment in the classroom was another reason for the failure.

Further, although the latest curriculum requires Chinese high school students to be able to express their personal views, L2 students were found to have difficulties in elaborating on and offering support for their views (Kenkel and Yates 2009; Lin 2007). In Cheng's (2009) study, high school students reported that sometimes they did not know what to write about. Xu (2008) and Lin (2007) found that Chinese high school students demonstrated worse performance in their writing than in other language skills.

Unfortunately, at the same time, both teachers and students have demonstrated negative attitudes towards writing. Teachers consider writing to be a complex and creative thinking process, so that improvement in writing cannot be achieved within a short period (Xu 2008). Their teaching therefore focuses on grammar, vocabulary and intensive reading (Lin 2006). Writing is more likely to be done in response to examination requirements and according to the type of homework set (Lin 2006). Students were found to have similar attitudes. In Lin's study (2007), 82.22% of the participating students (74 out of 90) thought that the improvement of English writing was helpful for improving overall English proficiency, while 55.56% (50 out of 90) reported that their purpose in English writing was to pass the exam, and 31.11% (28 out of 90) only used it for doing their homework. Some students regarded writing as a time-consuming practice (Lin 2007). Consequently, neither teachers nor students are willing to 'waste' their time on writing; it is a neglected aspect of English teaching.

1.5 Significance of the Study

As stated in section 1.4, there are some inconsistencies between the curriculum and the real situation in Chinese classrooms, and thus the significance of this study lies first in

the attempt to serve the dual goals of thinking development and language learning by employing an infusion approach (see section 1.2 for the rationale; for more details see chapter 2, section 2.5), which it was hoped would provide high school teachers with a more effective and helpful teaching method to adapt to the changes and achieve the aims of the latest curriculum.

This study also intends to bridge the research gaps that exist between the theories of teaching thinking in Asian L2 contexts and actual pedagogical practices (Liaw 2007). Studies have investigated the possibility of teaching and improving students' thinking through the teaching of school subjects, and have examined its effects in L1 (e.g., Marin and Hapern 2011; Lizarraga et al. 2010; Dewey and Bento 2009; Riley and Reedy 2005; Ping Lim and Yong Tay 2003; Kirkwood 2000) and L2 classrooms (e.g., studies on L2 classes in Iran: Gorjian et al. 2012; Hashemi and Ghanizadeh 2012; Ghanizadeh and Moafian 2011; Shirkhani and Fahim 2011; Shahini and Riazi 2010; a study of an L2 class in Spain: Gibson 2012). Asia-based studies on thinking skills have focused on assessing the current levels of students' critical thinking (Alagozlu 2007; Shin et al. 2006; Stapleton 2001; Davidson and Dunham 1997), but few of these have involved teaching experiments and an investigation of the effects of the experiments. It was thus necessary to investigate whether the effects that have been found in L1 and L2 classes in other countries would also be found in an Asian L2 classroom.

Moreover, the effectiveness of teaching thinking skills in L1 classes has been found at all ages, from primary school to college students (primary school: Campbell 2002, Dyfed Council 1994; high school: Marin and Halpern 2011, Miri et al. 2007; Lizarraga et al. 2010; college: Ozturk et la. 2008; Yang et al. 2008). However, studies in L2

classrooms have only been conducted at college level (see the studies mentioned above), and there is a notable absence of studies conducted in high school classrooms. As mentioned in section 1.1, scholars have proposed the need for and importance of teaching critical thinking to high school students. Therefore, the aim of this study was to fill a research gap by conducting the investigation in an L2 high school class.

In addition, the infusion approach is recommended by many scholars to integrate the teaching of thinking with that of school subjects. In the L2 classroom, the target language is the subject to be learned; thus, as mentioned in section 1.2, infusion lessons are expected to be helpful for L2 learners. However, so far they have only been used in L1 classes (e.g., Aizikovitsh and Amit 2010; Dewey and Bento 2009; Kirkwook 2000), and the applicability and effectiveness in L2 classrooms needs to be examined.

Therefore, in this study the intentions were to provide empirical evidence for L2 pedagogy, bridge the research gap related to the teaching of critical thinking in Asian L2 classes in real practice, and to investigate the applicability and effectiveness of adopting an infusion approach in an L2 class.

1.6 Research Aims and Questions

From the discussion above, it is apparent that current English teaching in Chinese high schools cannot accomplish the aims and requirements of the latest curriculum. Moreover, although the positive effects of integrating thinking skills into the teaching

of school subjects have been demonstrated, there is still a lack of empirical evidence for how successful the teaching of critical thinking in an Asian L2 class, especially in high school, would be.

Therefore, in this study an infusion approach was adopted to teach critical thinking in a Chinese high school English writing class. The purpose of the present study was to examine the applicability and effectiveness of this approach in Asian L2 classes and at high school level. The effects of the approach on students' thinking, writing and attitude were therefore investigated by attempting to find answers to the following questions:

Question 1. How does infusing critical thinking into an English writing class impact on high school students' critical thinking? In this research, critical thinking is taken to include both critical thinking skills and critical thinking dispositions (Giancarlo et al. 2004; Rapps et al. 2001; Ip et al. 2000). Therefore, this question was designed to investigate not only the development of critical thinking skills, but also whether or not the students were more willing to use critical thinking after the teaching intervention.

Question 2. How does infusing critical thinking into an English writing class impact on high school students' writing performance? This question was designed to investigate whether or not the teaching of critical thinking in an L2 class can assist L2 learning, as claimed by the literature.

Question 3. What are students' attitudes towards and perceptions of infusing critical thinking into their English writing class? This question stems from the view of Seedhouse that 'what is important is whether the learners themselves validate the activity and find it meaningful, whether they think it has a place in the language classroom and whether it matches their own language learning aim or not' (Seedhouse 1997: 340). The teaching is intended to help students to develop their thinking and to improve their learning, and the effects of a teaching method are thus determined to a certain extent by the students' improvements and achievements. Therefore, it is important to understand students' perceptions and attitudes.

1.7 Outline of the Thesis

Chapter 1 has introduced the rationale behind and context of this study. Educational problems related to the researched area have also been explained. The significance of the study was then described by identifying the research gaps, followed by a presentation of the research aims and questions.

Chapter 2 contains a review of the literature relevant to the study. First, an introduction to critical thinking is provided: what it is, whether or not it can be taught, and its effectiveness, as well as the methods used to assess it. The sociocultural theory of learning is then examined, followed by a discussion of why critical thinking should be taught in an L2 writing class by explaining the relationship between thinking and writing, L2 writing as a type of substantive writing and its relationship with critical thinking, as well as the effects of teaching critical thinking on L2 writing. The last section explains the conceptual framework of the study.

In chapter 3 the methodological basis of the study, which adopts the pragmatist standpoint, is introduced. This study was designed as an evaluative exploratory study with a single case design, and employed a mixed-methods approach to collect and analyse data. Data collection instruments, procedures and analysis methods are also reviewed. Then issues of reliability, validity and ethics are discussed.

Chapter 4 presents the findings based on the three research questions, to reveal the effects of the infusion lessons on students' thinking, writing, attitudes and perceptions.

In chapter 5 the findings are first related to the existing literature, and it is explained how infusion lessons create the context for critical thinking and help to achieve the reinforcement of thinking and language learning; the performance outcomes of this study are then discussed.

Chapter 6 reviews the aims and key findings of this study, followed by a presentation of the contributions of the research and an account of the limitations of the study. Finally, some suggestions are put forward for future research.

Chapter Two – Literature Review

2.1 Introduction

Although the importance of critical thinking is generally accepted, some controversy still surrounds whether or not it can be defined and measured, and whether or not it is possible to teach it in the Asian L2 context. Despite the fact that no consensus has been reached on the description of critical thinking, educators claim that it can be trained through the teaching of relevant skills and by cultivating critical thinking dispositions. The effectiveness of teaching critical thinking has been found in L1 classes with students of all ages, and among L2 college level students. Similar effects can thus be expected in an Asian L2 high school class.

In this chapter, first the definitions of critical thinking are discussed, and then methods used to teach it and to measure the results are considered. This is followed by a discussion of the learning process from a sociocultural perspective, before examining the potential effectiveness of teaching critical thinking in L2 writing classes. Finally, the conceptual framework of this study is explained.

2.2 Critical Thinking

This section starts with a discussion of what critical thinking is by considering the debate which has taken place on whether or not it can be defined. This is followed by a discussion of how it can be taught and assessed. The effectiveness of the teaching of thinking as revealed by previous studies is then examined.

2.2.1 What is Critical Thinking?

Critical thinking (CT) is not a new concept among many educators and researchers. However, a debate has been taking place for two decades on whether or not it can be clearly defined. Some scholars assert that critical thinking is a vague notion (McPeck 1990), and that it is a tacit part of socialisation and can only be developed in unconscious social practice (Atkinson 1997). Atkinson (1997) concluded that critical thinking is not a definable educational concept, based on the finding that many professors at an American university were unable to provide a clear definition when asked to in interviews. Davidson (1998), however, insisted that such findings only reveal that we still lack a clear understanding of critical thinking, rather than presenting evidence that casts doubt on its definability. Although it is difficult to define critical thinking and there is so far no standard definition, those who consider it to be an important concept have attempted to describe what it is.

Cottrell (2005) described critical thinking as a cognitive activity, focusing on argumentation, which requires the use of the mind. Facione (2000) characterised critical thinking as a self-adjusting process involving the use of cognitive skills to make judgements and to improve the quality of judgements. This process of the use of the mind often relates to reasoning, making judgements and reflection (Sternbery et al. 2007). When engaging in critical thinking, one needs to think reasonably and reflectively in order to decide what to believe and what to do (Norris and Ennis 1989). Sigel (1998) emphasised the notion that a critical thinker should be one who is moved by reason. These definitions portray critical thinking as a self-adjusting cognitive process in which the mind is used to make reasonable judgements. They also

emphasised the fact that reasoning, which includes the analysis of evidence and drawing conclusions from it, lies at the heart of critical thinking (Cottrell 2005).

Some scholars have defined critical thinking in terms of its most indispensable components. According to Glaser (1941, cited in Fisher 2001: 3), these components are attitudes, knowledge and skills, and he refers to 'an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experience, knowledge of the methods of logical enquiry and reasoning and some skill in applying those methods'. According to Swartz and Parks (1994), the principal components are goals, skills and attitudes. These authors emphasised the notion that the goal of critical thinking is to make critical judgements through assessing the reasonableness of ideas. The critical thinking attitude implies that judgements should be based on sound reasoning and, in thinking critically, one needs to be open-minded. They also listed skills which can be used to generate, clarify and assess the reasonableness of ideas, and further proposed a way to teach these skills: this is the infusion approach, which is the method used in this study (see section 2.5). These definitions demonstrate that, for people to be critical thinkers, an active and open-minded attitude, relevant skills and knowledge of how to use these skills are all needed.

Many educators and researchers have also believed that engaging in critical thinking requires the relevant skills and dispositions (Giancarlo et al. 2004; Fisher 2001; Ip et al. 2000; Facione et al. 1995), and it has consequently been suggested that these skills can be taught (Abrami et al. 2008; Lipman 2003; Swartz and Parks 1994).

'Skills are manifest in performance. Persons with stronger skills tend to be able to perform a range of tasks requiring those skills with fewer mistakes.'

(Facione 2000: 72)

According to Facione (2000), the possession of skills enables us to perform better. In the case of thinking skills, these can improve the quality of thinking and facilitate more effective thinking. Ennis (1991) proposed that critical thinking skills could be categorised into clarification skills, basic decision making skills, inference skills and the skills of supposition and integration. Swartz and Parks (1994) listed the skills used to assess whether or not ideas are reasonable, which include accurate observation and reliable resources for assessing basic information, the use of causal explanation, prediction, generalisation and reasoning via analogy to achieve inference, and the use of conditional reasoning to make deductions. Fisher (2001: 8) also described in detail the important critical thinking skills, which include the abilities to:

- Identify the elements in a reasoned case, especially reasons and conclusions;
- Identify and evaluate assumptions;
- Clarify and interpret expressions and ideas;
- Judge the acceptability, and especially the credibility, of claims;
- Evaluate arguments of different kinds;
- Analyse, evaluate and produce explanations;
- Analyse, evaluate and make decisions;
- Draw inferences;
- Produce arguments.

Although no consensual agreement on a taxonomy of critical thinking skills has been reached, this study adopts the core set of critical thinking skills proposed by McGregor

(2007), of which some or all have been included in the critical thinking taxonomy provided by other researchers (Wen et al. 2009; Cottrell 2005; Fisher 2001; Halpern 1998). These are also the skills stated in the Chinese high school English curriculum. The following descriptions of these skills are summarised from the authors mentioned above:

- Explaining and reasoning: ability to explain ideas by providing supporting reasons and to clarify these reasons in rational and logical ways.

- Analysing and synthesising: ability to seek and analyse data, identify and synthesise relevant and useful data that support conclusions.

- Generalising and summarising: ability to summarise useful data, and use them to draw general conclusions.

- Evaluating and judging: ability to evaluate the data and make reasonable decisions.

To be a critical thinker, however, having the necessary skills is far from enough. According to John Chafee (cited by Facione 2000), a critical thinker is not merely someone who is able to reflect, explore and analyse, but one who chooses to 'think in these advanced, sophisticated ways' (p. 65). In other words, in order to become a critical thinker, internal motivation, which is also widely known as a disposition, is needed (Miri et al. 2007; Giancarlo and Facione 2004). For the purposes of this study, a student with a strong disposition towards critical thinking is one who shows him or herself to be active and willing to 'engage in and persist at' challenging and complex thinking tasks (Halpern 1998). Additionally, appropriate attitudes, as proposed by Glaser (1941, in Fisher 2001) and Swartz and Parks (1994), and discussed above,

should not be ignored. These attitudes enable learners to be open-minded with respect to different views and all sources of data, and to make sound judgements and decisions based on suitable analysis.

In Facione et al.'s study, one student stated that 'We know how to think, thank you. But, frankly, we're just not interested' (Facione et al. 1995: 10). It is immediately obvious that, without the willingness to think critically, one will be less likely to do so in practice, despite having the ability. Facione (2000) thus advocated the importance of developing dispositions toward critical thinking, because 'knowing a person's disposition allows us to predict how the person is most likely to act or react in a wide variety of circumstances' (p. 63). A person who has critical thinking skills may fail to take the opportunity to display them, while a person with a disposition towards critical thinking will take the opportunity to engage in it even if his or her level of critical thinking skills is low (Ip et al. 2000).

In summary, critical thinking is important in the field of education, since it is an essential tool of inquiry, for solving problems and making good decisions (Simpson and Courtney 2002). Students should be actively involved in the learning activity and able to apply their knowledge to solve learning and social problems, and to analyse and organise information so they can make decisions. Moreover, through applying critical thinking in learning and social practice, students can become more open-minded and creative in finding out the best method of learning and solving problems (Tiwari et al. 2006). Therefore, the aim of this study was to develop students' critical thinking skills and increase their disposition towards critical thinking, both of which they would then be able to apply to their learning and social life.

Based on the discussion above, in this study, the definition of critical thinking proposed by Facione (2000) is adopted; as discussed above, in this definition critical thinking is considered as a self-adjusting process involving the use of cognitive skills to make rational judgements and to improve the quality of judgements. The aim of the present study was not only to develop critical thinking skills, but also to cultivate the relevant dispositions and to encourage the active engagement in (Halpern 1998) and appropriate attitudes towards critical thinking (Swartz and Parks 1994).

2.2.2 Can Critical Thinking be Taught?

In addition to the debate on its definability, the discussion about critical thinking has also extended to the issue of whether or not it can be taught, and if so, whether or not it can be taught in L2 classes in Asian countries. On one side are those who believe that critical thinking is too unclear a concept or too complex a process to be taught (Simpson and Courtney 2002; McPeck 1990), or that it can only be acquired unconsciously through social practice (Atkinson 1997). On the other side are those who have identified the relevant critical skills (see section 2.2.1) and advocate both the need to teach and the possibility of teaching critical thinking (Mason 2008; McGuinness 2006; Davidson 1998).

More specifically, resistance to the possibility of teaching critical thinking is often related to contexts, in particular, those of Asian countries and L2 classes. On the one hand, some scholars claim that critical thinking is itself a Western phenomenon (Ramanathan and Kaplan 1996a; Fox 1994), so it is difficult to teach to members of a

society where critical thinking does not exist. Ramanathan and Atkinson (1999) compared writing in English to writing in Chinese, and concluded that the style of writing in America emphasises critical thinking more than is the case with Chinese. They therefore suggested that critical thinking was more likely to exist in Western culture. Western students practise critical thinking in their social lives, while in the cultures of Asian students, silence, submission to authority, conformity and harmony are valued (Wen and Clément 2003; Stapleton 2001; Davidson 1998; Ramanathan and Kaplan 1996b), so that becoming a critical thinker is difficult. Moreover, in Asian countries, teacher is considered to be a person of authority in the classroom, and students are expected to be obedient to authority (Yang et al. 2006; Littlewood 2000; Liu 1998). As mentioned in chapter 1 (see section 1.4), China is no exception (Bush and Haiyan 2000; Holliday 1994). The teaching of critical thinking to Asian students will represent a challenge to the authority of teachers (Heyman 2008), because critical thinking encourages students to evaluate the information heard, rather than simply accepting it without question.

On the other hand, it may also be difficult for ESL or EFL students with low proficiency to engage in critical thinking in English classes. L2 students tend to use memorisation as their main strategy in learning English (Shahini and Riazi 2011). When they are writing in English, they often retrieve thoughts and linguistic forms from their memory and write these down (Larkin 2003). They are less likely to create meanings and reconstruct linguistic terms. As a result, their engagement in critical thinking can be impaired. For this reason Atkinson (1997) warned that teachers should be cautious about introducing critical thinking to ESL students.

The researcher of the present study takes the latter position (that is, that there is both a need to teach and a possibility of teaching critical thinking) and in this research an attempt was made to teach critical thinking in English language classrooms in China. As Davidson (1998) remarked, critical thinking may not be encouraged in some cultural contexts, but this should not lead to the conclusion that it does not exist in those societies. This view is supported by Stapleton (2001), who found that although Japanese students were not as good at critical thinking as Western students, they were able to think critically. He thus suggests that Japanese students had positive attitudes towards using critical thinking, but lacked instruction on how to improve the ability.

It should also be pointed out that the former position (namely, that critical thinking is too unclear a concept or too complex a process to be taught) fails to take into consideration the need to teach critical thinking in L2 classes and the benefits it may bring, especially in Asian countries. As Atkinson (1997) proposed, critical thinking is practised in students' social life in many Western countries, and thus there is less need for the teacher to create opportunities for students to rehearse and perfect it. However, in many Asian countries, as mentioned earlier, such opportunities would seem to be more valuable for students, owing to the lack of emphasis on critical thinking in their cultures. On the other hand, even if critical thinking is not universally valued in some Asian societies, no one denies its importance in the academic arena.

Furthermore, teaching critical thinking does not mean teaching it as a philosophical concept, since the content of critical thinking is unlimited (Facione 2000). The aim of teaching thinking is to teach 'for and about' it (Facione 2000: 80). 'Teaching about' refers to instruction in relevant skills and how to apply them to solving problems. The

aim of 'teaching for' is to expand the opportunities for, establish appropriate attitudes towards and enhance the students' willingness to use those skills and engage in critical thinking. Lipman emphasised the fact that for someone to be a critical thinker, practice is essential, since 'knowing more is not equivalent to thinking better' (Lipman 2003: 76). We cannot claim that a person is a critical thinker simply because he or she knows a lot about the concept of critical thinking. Lipman gives the example that if the teaching of critical thinking consists merely of giving students an understanding of what critical thinking is, this would be no different from the case of teaching students to ride bicycles by telling them the results of research into bicycle riding. One cannot engage in critical thinking simply by knowing what it is and how to do it; real action needs to be taken to practise in order to develop the ability.

Based on the above discussion, it is clear that teachers can teach students to think critically by introducing the relevant skills, cultivating their dispositions, and creating the opportunities for them to engage in this reflective, problem solving and decision-making process. This study also takes the position that critical thinking needs to be introduced in Asian countries and L2 classrooms. Therefore, the applicability and effects of teaching critical thinking are the concerns of this study; it is thus important to review the effects of teaching critical thinking that have been found in previous research.

2.2.3 What is the Effectiveness of Teaching Critical Thinking?

Advocates of critical thinking insist that critical thinking should be accorded priority in the curriculum (Hashemi and Ghanizadeh 2012). Because of the important role of

critical thinking, it seems crucial to investigate the effectiveness of teaching it. Various results of empirical studies have provided evidence of the effectiveness of teaching thinking skills at all ages in the L1 classroom and in L2 classes at college level.

A study by William (1993) revealed gains in children's reading ability, reasoning behaviour, confidence and persistence in critical thinking after teaching thinking in an L1 class. Similarly, the results of a study by Dyfed County Council (1994) also showed gains in children's thinking, language skills and self-confidence. In Campbell's (2002) study, children were found to be able to provide more reasons to explain their opinions. They were also found to be more willing to speak in front of the class and were tolerant of the ideas of others.

Studies completed in L1 high school classrooms have also revealed positive impacts. Miri et al. (2007) promoted higher-order thinking skills in high school science classes. A comparison of California Critical Thinking Skill Test (CCTST) and California Critical Thinking Disposition Inventory (CCTDI) results showed that the improvement in critical thinking and in the disposition towards using it in the experimental group was significantly greater than in the control group. Lizarraga et al. (2010) attempted to stimulate thinking among high school students through instructions focusing on 'thinking actively in an academic context' in a social science class. The results showed that the instruction in thinking could enhance reasoning, creativity and academic achievement.

According to Ozturk et al. (2008), problem-based learning enabled college students to be more active and open-minded critical thinkers. Students also showed an increased disposition to evaluate information. In Yang et al.'s (2008) study, CCTST results showed that Web-Based Bulletin Board discussions contributed to improvements in critical thinking among university students, who reported positive attitudes towards the instruction and further explained that interaction between peers allowed them to ask for help, share views and examine their own views. This study also found that students were more willing to share ideas and evaluate their own opinions.

Empirical studies have also supported the effectiveness of teaching critical thinking in university L2 classes (Gorjian et al. 2012; Gibson 2012; Shahini and Riazi 2011; Rao 2007). The results of these studies showed that teaching thinking could help L2 learners improve both thinking and language skills, and it also enabled students to recognise their linguistic and cognitive limitations. In these studies, the students were also found to be more active and persistent in performing tasks. Further discussion of these studies is presented in section 2.4.4.

When discussing the effectiveness of teaching thinking, the possibility of transfer and the longevity of the effects are noteworthy considerations. The former refers to whether or not the thinking skills learned in specific circumstances can be used in other relevant or similar circumstances (Johnson and Siegel 2010), while the latter refers to how long the effects last. Previous studies have found that learners who received instruction in thinking skills performed better in thinking and learning in other circumstances and other parts of the curriculum than those who did not (Yang et al. 2008; Zohar and Dori 2003; Compell 2002; Adey and Shayer 1994; Bransford 1986; Whimbey 1985),

although they did not find evidence to support the transferability of those skills across all subjects. Empirical studies also support the notion that students can still maintain the thinking ability in the three years following the intervention (Yang et al. 2005).

Some researchers expect a transfer of thinking skills across all of the school curriculums, in order to create a 'thinking curriculum' (McGregor 2007; McGuinness 2000, 1999). However, Johnson and Siegel suspect that this general transfer to any other context may be 'too good to be true' (Johnson and Siegel 2010: 16), since for thinking in some areas, specific knowledge may be needed. For example, one cannot discover the differences between healthy and diseased organs merely by using analysis and evaluation skills with no relevant medical knowledge. Therefore, the transfer of thinking skills can be expected to occur most readily in closely similar fields (Glevey 2008; White 2002).

In summary, the above discussion has shown that the teaching of critical thinking has been found to be effective for students' thinking and learning development, behaviour and attitudes in L1 classrooms in primary and middle schools as well as at college. Similar positive effects have also been found in L2 classes. However, studies in the L2 area have focused on college students. There is an absence of empirical evidence of the effectiveness of teaching critical thinking to L2 learners at other levels or of different ages. This study therefore investigated whether high school L2 learners also benefit from the teaching of critical thinking skills.

2.2.4 How can it be Assessed?

Those scholars who cast doubt on whether or not critical thinking can be defined also doubt whether or not it can be assessed, claiming that such a vague concept cannot be measured (Pithers and Soden 2000). In this research, however, the opposite position was assumed, since, as shown in the discussion in section 2.2.1, it is possible to define the concept. Effective assessment is important for research into the teaching of thinking since it will contribute to the validity of measurable results. It also allows for a comparison of results within and between groups.

Some assessments measure critical thinking by tests involving multiple-choice questions. The Watson-Glaser Critical Thinking Appraisal (WGCTA) is distinguished by its long history, having been first designed in 1937, with US and UK versions being further developed in 1980 and 1991 respectively (Hassan and Madhum 2007). Although many studies of college students have benefited from its contribution in providing valid and reliable results (Hergovich and Arendasy 2005; Brown et al. 2001; Girot 2000), one of its limitations is that it is concerned solely with the *ability* to think critically, and fails to investigate the *disposition* to do so (Ku 2009).

Facione et al. (1994) developed a set of tests to evaluate both critical thinking skills and relevant dispositions, including the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI). The former is a multiple-choice test, while the latter uses six-point Likert scales. These have been widely used in college (Blondy 2011; Wangensteen et al. 2010; Ozturk et al. 2008; Yang et al. 2008; Raymond et al. 2005) and high school (Miri et al. 2007) studies, and

have been proven to be valid and reliable (Phillips et al. 2004; Facione et al. 1994). Both the CCTST and CCTDI have been translated into Chinese and were revised by Luo and Yang in 2002 and 2001 respectively. The Chinese versions have also been used in studies of college students (Liu and Zhao 2010; Luo and Yang 2001) and high school students (Zhou et al. 2012; Qing et al. 2010; Zhou et al. 2007), with the results also supporting the validity and reliability of these tests. However, these tests also have their limitations (Facione et al. 1995). On the one hand, the CCTST may not motivate test-takers to engage in deep thinking. They can complete the test by guessing, and still arrive at correct answers. Takers of the CCTDI test may understand the purpose of the test and select desired responses in order to get high marks. In such cases, the CCTST can fail to reveal test-takers' actual ability in critical thinking, and the CCTDI can fail to reveal actual dispositions.

Facione et al.'s measurements of critical thinking are valuable for gaining insight into the disposition to think critically, since, as many studies have suggested, critical thinking disposition is a significant predictor of cognitive development (Rapps et al. 2001), school performance (Ip et al. 2000) and the development of critical thinking (Facione 2000; Facione et al. 1995). Rapps et al.'s (2001) study investigated four factors influencing cognitive developments and the results revealed that only critical thinking disposition was able to predict all the levels of cognitive development targeted. Ip et al.'s (2000) study suggested a significantly positive correlation between the strength of critical thinking dispositions and grade point averages (GPA). Facione et al.'s study (1995) revealed a greater development in critical thinking on the part of those students who had a strong disposition towards critical thinking when entering the

university than those with a weaker disposition on entering. Therefore, assessments which target both skills and dispositions are useful.

Other researchers began to assess critical thinking through the assessment of written texts produced by the participants. According to Lantolf (2006), writing is a way of vocalising or revealing cognitive activities and processes and thus makes them recordable; it is therefore an indication of whether or not learners have used critical thinking in real practice and of how they have used it. The Ennis-Weir Critical Thinking Essay Test (Ennis and Weir 1985) was designed for use with high school and college students and has been used in many studies (Williams and Worth 2009; Clifford et al. 2004; Yeh 2001; Dunham 1997). It targets students' ability to judge and formulate arguments, and the results reflect to some extent their ability in and disposition towards using critical thinking (Ku 2009). One limitation of the Ennis-Weir test is that it may not be able to reveal the actual critical thinking ability of EFL and ESL learners, especially those from Asian countries, since it was designed for native English speakers (Dunham 1997). The topics included may not be familiar to many EFL and ESL learners. Stapleton (2001) claimed that lack of familiarity with the topic of writing could restrict students in demonstrating their critical thinking ability.

Stapleton (2001) then proposed a model to identify key elements of critical thinking in argumentative writing in which the topic can be selected and designed by the researchers. These elements include an argument, defined as a claim with a supporting reason, evidence, opposing viewpoints, refutations and conclusions. Using this model, researchers can take the educational background, age and language level of writers into account, and then select more suitable topics for them to display their critical thinking.

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This model has been adopted by Alagozlu (2007) and is deemed to be a useful tool. However, more studies are needed to examine its reliability and validity.

In this study these views were combined, and the students' thinking was investigated using both the California tests and assessments of the students' written work. The aim was to assess both critical thinking skills and dispositions, and at the same time to investigate whether and how the students used critical thinking in their learning practice. This combination was expected to enhance the validity and reliability of the results of the present study by allowing the results of the two methods to corroborate each other (for further discussion see chapter 3, section 3.4.2).

2.3 Sociocultural Theory and Thinking skills

Before discussing how critical thinking can assist L2 learning, it is important to illustrate the mechanism of cognitive and learning development. This study takes the sociocultural theory (SCT) point of view, which is that effective learning takes place in meaningful interaction, and the process of learning is the process of internalisation. SCT emphasises the role of mediation in the process of cognitive development and effective learning (see below for further discussion), which involves the use of the human mind. The teaching of critical thinking is related to the ways in which the mind is used, and thus influences the mediation.

In the process of effective learning, mediation occurs twice. Mediation is a fundamental function of the human mind (Lantolf and Thorne 2007). It enables humans to interact

with themselves, each other and the world, and effective learning arises from this interaction (Wegerif 2004). It occurs first when learners interact with the world outside of their minds to acquire new knowledge and obtain assistance; the second time it occurs as part of the inner mental process of internalisation to achieve independent development (Kozulin 2002). In the field of education, this implies that instruction should be explicit; in other words, students should be given clear illustrations of what they are being asked to learn. It is essential for teachers to tell students about the knowledge that they do not know. This can be linked to research into the teaching of thinking which advocates that the development of thinking benefits more when teachers provide explicit instruction, rather than just promoting thinking without direct instructions (Abrami et al. 2008; Halpern 1999; Bangert-Drowns 1990). This study therefore emphasises the importance of including explicit instruction in both thinking skills and knowledge of the L2 in classroom teaching, which is also one of the characteristics of the infusion approach (for further discussion see section 2.5).

The second time meditation occurs is during the process of internalisation, which gives learners the ability to solve problems independently. Internalisation refers to the process whereby an individual 'moves from carrying out concrete actions in conjunction with the assistance of material artefacts and of other individuals to carrying out actions mentally without any apparent external assistance' (Lantolf 2000: 14). Once internalisation is complete, learners gain conscious control over the knowledge acquired. L2 learners acquire the target language through the internalisation of linguistic forms and knowledge. The process of internalisation includes gaining an understanding of new knowledge and forms, using these to achieve specific goals and modifying existing knowledge (Swain and Lapkin 1995; Nobuyoshi and Ellis 1993).

Learners can gain understanding of this knowledge through explicit instructions and modelling by teachers and practising during interactions. However, although learners can modify their existing knowledge with the help of artefacts and other people, it is first necessary for them to know what to modify: in other words, to be aware of their mistakes, problems and difficulties. This should also be applied to second language acquisition (SLA): learners should be encouraged to produce more output of the target language (Swain 2000), thus enabling them to notice their mistakes and limitations in the target language. In particular, they should be encouraged to practise so as to be able to use fully syntactic forms, for instance in writing, since this will expand the opportunities for them to notice their mistakes and limitations.

In SCT, language is the most common and powerful artefact that humans use to interact with the world, with each other and with themselves (Lantolf and Thorne 2006). We use language in the form of private speech as a way of mediating our mental processes. Private speech can become social when we use its patterns and meanings to communicate with others, and it can also be directed inward when we regulate our own mental functioning (Lantolf and Thorne 2007). Therefore, in the present study, English is not only the subject to be learned, but also a communication tool, which learners can use to verbalise and visualise their private speech. Combining the teaching of critical thinking with the teaching of L2 can facilitate meaningful communication in the target language, since the communication is focused on the discussion of a topic after thinking critically.

Vygotsky (1987) claimed that an essential mechanism for the internalisation of socially constructed forms, especially in SLA, is imitation (Lantolf and Thorne 2006). Imitation

is not about merely parroting or repetition (Lantolf 2006). Rather, it is a method of 'absorbing what is present in others and of making it over in forms peculiar to one's own temper and valuable to one's own genius' (Baldwin 1915, cited in Valsiner and van der Veer 2000: 153). In other words, imitation in L2 learning refers to noticing the components and rules of language in others' expressions and reconstructing these components in order to compose desired expressions. The application of this view to classroom teaching leads to the need for modelling and the promotion of the creation of meaning (Lantolf and Pavlenko 1995). The importance of modelling is emphasised in the teaching of both thinking skills (Facione 2000) and language (van Gelder 2001; Celce-Murcia 1991) in terms of how to use the skills, language and knowledge in real practice. Creating meaning requires the learners to reconstruct linguistic forms and knowledge in order to express their own ideas. This enables students to master the 'finite means' of producing the 'infinite possibilities of expression' (Chomsky 1966: 29). Integrating critical thinking with subject teaching in L2 classes encourages students to use the target language to express their critical and creative ideas; in other words, it encourages them to use the target language to create their own meanings.

Vygotsky introduced the concept of the Zone of Proximal Development (ZPD) to describe the distance between 'actual development level as determined by independent problem solving and a higher level of 'potential development as determined through problem solving under adult guidance or in collaboration with more capable peers' (Vygotsky 1978: 86). The concept of the ZPD emphasises the importance of assistance from adults and peers in the process of learning, and thus encourages collaborative learning. Since in many countries, including China, there are still large numbers of students in classes in high schools (see chapter 1, section 1.4), collaborative learning is

valuable. Collaborative learning provides opportunities for students to exchange ideas, and to seek and obtain help from each other. In this study, therefore, group discussion was used to promote interaction and collaborative learning. Although the concept of the ZPD emphasises the importance of assistance from others, in their study Swain and Lapkin (1998) found that those people who provided assistance did not necessarily have to be more capable. Therefore, in the present study the students were assigned to discussion groups according to their seating arrangement in the classroom: each student and his deskmate simply turned around and formed a group of four with the two students seated behind them (see chapter 3, Figure 3.1 in section 3.8.3), rather than reorganising them to form combinations of students with different achievement levels. This method allowed them to operate in an environment they were familiar with and to continue their discussion out of class.

Finally, in the process of development, metacognition is an important function of the process of internalisation. It regulates our mental processes and determines 'how we use knowledge to direct and improve the thinking and learning process' (Halpern 1999: 73). Learners can achieve self-regulation in their cognition and learning. This enables the capability of internalisation to be extended to subsequent learning (Centeno-Cortés and Jiménez Jiménez 2004). Some researchers have found that the teaching of thinking skills helped students to become aware of their learning process, and that it is conducive to fostering learning, especially for lower achievers (Kramarski et al. 2002; Quicke and Winter 1994; Powell and Makin 1994).

In conclusion, this study was based on SCT, and the aim of the intervention was to help students to internalise their thinking skills and L2. It was also designed in such a way

that critical thinking was used to encourage students to create meaning. The teaching methods employed in this study adopted the sociocultural viewpoint in many respects, including providing explicit instructions in both thinking and knowledge of L2, using group discussions to promote interaction and collaborative learning, and promoting metacognition (for more details see section 2.5).

2.4 Critical Thinking and L2 Writing

Having discussed what critical thinking is, how it can be taught and assessed, its effectiveness, and the sociocultural theory of learning, in this section the rationale for integrating the teaching of critical thinking with L2 writing is introduced.

2.4.1 Relationship between Thinking and Writing

In SCT writing is seen as the linguistic organisation of thinking (Lantolf 2000). Vygotsky (1987) defined writing as written speech, which externalises human thinking by using language (Surd-Büchele 2011). Therefore, the development of thinking and the improvement of writing go hand in hand.

Writing involves an exploratory and cognitive process whereby the writers discover and reconstruct knowledge, information and ideas to approximate their meanings (Lei 2008; Zamel 1983). Vygotsky (1987) argued that writing is a means of interaction, expression and understanding. The process of writing involves a process of understanding the relevant knowledge, information and thoughts, and using them to interact with potential readers or the self, the results of this process finally being expressed by using language.

Paul and Elder (2007) claimed that the purpose of writing determines how to write, and thus determines what kind of cognitive processes the writers should engage in. Writing which focuses on decision making, problem solving, the expression of arguments and explanation of opinions may involve a process of critical and creative thinking which helps the writer to compare choices, seek possible solutions, provide support and clarify ideas. In this way, engaging in writing can mean practising using the relevant thinking and cognitive skills, and thus it influences the development of relevant mental processes.

In turn, effective thinking can also contribute to effective writing. Writing is a cognitive process influenced by the higher mental functions with which it is connected (Surd-Büchele 2011). Since writing is written forms of speech, the results of thinking determine how the language is used. Critical thinking enables learners to gather relevant knowledge and thoughts, add personal understanding and values, and select and integrate useful information, and thus become more able to reconstruct knowledge in order to create meaning. This practice of creating meaning also promotes the internalisation of the target language. It is impossible for L2 learners to learn all of the possible expressions of a language. An effective mechanism of L2 learning is for the students to learn how to produce a variety of possible expressions in the target language (see section 2.3). Expressing a variety of thoughts in the target language helps learners to try to reconstruct the linguistic forms they know and insert them into their desired expression (Chapman 2006), thus gaining control over the target language.

Writing is also a process of metacognition, which can promote effective thinking (Larkin 2009). We use cognitive skills to complete a task, and metacognitive skills can be used to reflect on the process of cognition and help us to monitor and regulate this

mental process later on (Flavell et al. 2002). Hacker et al. claimed that writing can be seen as applied metacognition, stating that: 'Reading, re-reading and reviewing are monitoring strategies of our own thoughts. Editing, drafting, ideas generation, word production, translation, diagnosing and revision are used as control strategies of our own thoughts. The monitoring and control of our thinking is metacognition' (Hacker et al. 2009: 161). This is echoed by Paul and Elder (2007), who state that during writing (in their view, especially substantive writing, see sections 2.4.2 and 2.4.3) writers need to adjust and monitor their thinking in order to seek useful information and check its relevance and significance for achieving their goals in writing. The process of writing therefore encourages students to think and rethink their ideas, and gradually acquire more effective ways of adjusting and controlling their minds.

Metacognition is also important in improving writing. As discussed in section 2.3, metacognition helps writers to find better and more effective ways of thinking about their writing and developing ideas. More importantly, it encourages them to be open-minded when searching for new ways to think, accepting new knowledge and ideas, and learning from others (Paul and Elder 2007).

Based on the mechanisms of learning proposed in SCT and on the close relationship between thinking and writing, in this study critical thinking was integrated with the teaching of L2 writing in order to promote better thinking and better writing.

2.4.2 L2 Writing as Substantive Writing

Influenced by SCT, Scardamalia and Bereiter (1986) proposed that L2 writing should move from knowledge-telling to knowledge-transforming, in order for effective learning and writing to take place. The former refers to writing down the ideas 'retrieved from long-term memory' (Larkin 2009: 151), while the latter is regarded as more common in the process of writing used by expert writers, through reconstructing knowledge and language to create ideas in order to achieve the goal of the writing tasks.

A piece of good writing, as Paul and Elder (2007) proposed, should be something worth reading, and they call this substantive writing. They suggest that writers should think about two questions during writing: 'do I have a subject or idea worth writing about?' and 'do I have something of significance to say about it?' This means that substantive writing is a selective and reflective process. They also claimed that the purpose of the writing is crucial, because it determines how they should write. Paul and Elder (2007) listed six purposes of substantive writing: for sheer pleasure, to express an idea, to convey specific technical information, to convince the reader to accept an important position or argument, to challenge the reader to consider a new world view, and to express what is being learned (or has been learned) in a subject.

High school writing in China is one of these types. The latest English language curriculum in China clearly defined the purpose of high school English writing as being to express personal attitudes and ideas (Cheng 2009). The textbook also lists the functions of language in each module (each textbook contains seven modules). For example, modules one to seven in book five (which was used in the present study) state

that the functions of language are to give reasons, make deductions, report statements and suggestions, express likes, dislikes and preferences, express agreement and disagreement, and to express concerns. Therefore, it is apparent that Chinese high school writing is a type of substantive writing.

Thus, as mentioned above, in order to write something that is worth reading, two questions should be borne in mind: 'Do I have a subject or idea worth writing about' and 'Do I have something of significance to say about it'. Five intellectual acts are involved (Paul and Elder 2007: 11):

- Choose a subject or idea of importance

- Decide on something important to say about it

- Explain or elaborate the basic meaning

- Construct examples that will help readers connect what is said to events and experiences in their lives

- Construct one or more analogies and/or metaphors that will help readers connect what is being written about with something similar in their own lives.

Obviously, the process of substantive writing both requires and promotes knowledge transformation in writing. It requires writers to begin writing with a review of ideas and thoughts in their minds, and then to select one of these ideas or thoughts to write about. Writers need to integrate their knowledge, thoughts, experiences and personal values and beliefs in order to make their own decisions. The process of substantive

writing is not about copying linguistic forms and thoughts from memory, but about using and recomposing them into the writers' own ideas and expressions.

Although substantive writing is the main type of English writing taught in Chinese high schools, Chinese students, as well as some other L2 writers, have been shown to perform poorly. As mentioned in Chapter One that L2 learners often fail to elaborate on their ideas, make relevant claims and provide support (Kenkel and Yates 2009), and Chinese high school L2 writers found it difficult to explain their ideas and did not even know what to write about (Lin 2007). Atkinson (1997) pointed out that one reason for this could be that memorisation is the major learning strategy employed in Chinese and Japanese L2 classrooms. This is confirmed by the results of Lin's (2006) study. High school students reported that memorising model sentences and formulaic phrases was their main learning strategy. At the same time, her study also revealed that the most common strategy used by teachers in teaching writing was to predict the topics for writing which could occur in national examinations and to provide relevant model passages for students to memorise before the examination. Students then only needed to write down the thoughts and linguistic forms already prepared in their minds, instead of thinking about their own ideas and presenting them using their own modes of expression. Therefore, L2 writing in Chinese high schools is still based on knowledge telling, and thus performance in substantive writing is poor.

The teaching of substantive writing is therefore necessary and helpful; it can help students to transform knowledge and create meaning, and this promotes effective writing and language learning (see section 2.3). At the same time, it can also promote and be used to assess critical thinking, as discussed below.

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2.4.3 Substantive Writing and Critical Thinking

Paul and Elder (2007) claimed that the process of substantive writing is in many ways closely linked to the development of thinking, especially critical thinking, and metacognition. On the one hand, the process of substantive writing is related to evaluation of the ideas expressed and giving explanations that will demonstrate to the reader why the subject is worth writing about. These processes thus demand critical thinking. On the other hand, this process reflects the metacognitive nature of substantive writing, and thus helps students to develop effective thinking (see section 2.3). During this process, writers not only need to think about what to write about, but also to evaluate their thinking by assessing 'clarity, accuracy, precision, relevance, depth, breadth, logic, significance and fairness' (Paul and Elder 2007: 4). They need continually to reflect on and evaluate their own thinking process and the ideas produced, and monitor their thinking in order to produce better ideas and explanations.

A researcher can therefore use substantive writing to assess critical thinking (Paul and Elder 2006), and this reflects similar elements of critical thinking to those identified in Stapleton's (2001) model (see section 2.2.4).

Firstly, when writers introduce points related to the main idea to be written about, this indicates that they have used skills such as analysis and evaluation in order to come to a decision (Paul and Elder 2006). This is similar to an 'argument' in Stapleton's model which reveals one's ideas and opinions, although the latter is often used to respond to a controversial issue. Stapleton emphasised the fact that an argument should be a claim

with supporting reasons, or it cannot be defined as an argument. However, in substantive writing, when writers are demonstrating that their subject is worth writing about, the introduction of the main ideas is an indication of their use of intellectual evaluation, which is a type of critical thinking.

Secondly, when writers begin to explain why their ideas are important or worthy of note, this is an indication that they are using reasoning and explaining skills. This is similar to the 'reasons' in Stapleton's model, and demonstrates the writers' understanding that their arguments, opinions and ideas should be based on good reasons.

Finally, when writers construct examples and analogies, they are trying to clarify and strengthen their ideas. This is similar to providing 'evidence' in Stapleton's study; irrespective of how strong this evidence is, it shows the writers' understanding that their points need to be supported.

In this study, therefore, substantive writing was used to assess students' writing performance and use of critical thinking. As mentioned earlier, substantive writing is the main type of writing required in Chinese high school. It was thought that investigating how students use critical thinking for substantive writing would be more helpful than investigating how they use it for other types of writing, since it would reveal whether the use of critical thinking is helpful or practical in their normal writing practice, and thus the value and real benefit of teaching critical thinking in a Chinese high school L2 writing class.

2.4.4 Effectiveness of Teaching Critical Thinking in L2 Writing Classes

Critical thinking has proven to be helpful for the enhancement of writing performance in L1 classes. Some researchers deem argumentative/persuasive writing to be an activity of critical thinking. They have therefore investigated how the former influences thinking and writing. Crowhurst (1980) and Rubin and Piche (1979) found that argumentative writing could enhance syntactic development in terms of the use of increased numbers of subordinate clauses and encouraging learners to produce longer sentences. Nippold et al. (2005) found increased ability among learners in terms of thinking from different perspectives, and the use of more complex sentences and a richer vocabulary in writing. They also found that students became more critical and more able to use language to express their reasoning.

Studies in L2 classrooms have also revealed the positive effects of teaching critical thinking on the thinking, writing and behaviour of college students. Rao (2007) intended to develop college students' thinking and writing through training in brainstorming, and he found that after this training their individual writing included more creative ideas. The students were more actively involved in classroom activities, and this enabled them to become aware of the limitations in their thinking and language, which increased their motivation to learn more. Shahini and Riazi (2011) used philosophical questions to promote critical thinking in an EFL class. It was found that the experimental group gained higher scores in speaking and writing performance and the students became more active in discussions. In Gibson's (2012) study, decision-making activities were designed to teach critical thinking skills in an L2 writing class. The results revealed that the students recognised the inadequacy of their vocabulary,

and, because critical thinking promoted a deeper understanding of topics, the students sought more sophisticated vocabulary to express their insights and critical thoughts. Interestingly, the frequency of occurrence of grammatical mistakes did not change. In Gorjian et al.'s (2012) study, instruction in critical thinking was integrated with EFL teaching. The results showed that the increase in overall writing proficiency in the experimental group was significantly greater than in the comparative group.

Although there is as yet no empirical evidence regarding the impact of teaching critical thinking on the fluency of students' L2 writing, Chenoweth and Hayes (2001) revealed that increased experience with the target language could improve learners' writing fluency. They explained that the ability to write fluently enables writers to record their ideas before they forget them. This implies that a lack of fluency in writing is not always caused by low language proficiency, but rather that a lack of fluency in thinking can be a problem. On the other hand, the thinking tasks used in class promote meaningful communication and increase students' experience with the target language. In this study an infusion approach was adopted to teach critical thinking; the aim of this approach is to help students become more effective thinkers, and thus they were expected to become stalled in thinking of ideas less frequently, so that their fluency in writing would be increased.

Since the above studies have revealed that the effects of teaching critical thinking in L1 writing can also been found in the L2 writing of college students, the intention in this study was to investigate whether these effects could also been found in high school L2 students' writing.

2.5 Conceptual Framework of the Study

In this section the conceptual framework of the infusion lessons employed in this study is explained. This is followed by a review of the empirical evidence for the effectiveness of this approach. The thinking tasks selected for the present study are then introduced.

2.5.1 Explanation of the Conceptual Framework

Before discussing the conceptual framework, it is important to explain the meaning of 'infusion'. According to Swartz and Parks (1994), there are two main types of instruction in thinking: direct and curricular context-free teaching, or using methods which provoke thinking in the curricular context. The former refers to explicit instruction in how to use thinking strategies, and this type of instruction is often used in contexts separate from the rest of the school curriculum, with specially designed material (e.g., De Bono 2000; Blag 1991). The latter refers to the promotion of thinking by using methods such as, for example, collaborative learning, higher-order questioning, or inquiry learning, but without direct instruction in thinking strategies themselves (e.g., David and Taverner 2008; Macleod and Holdridge 2006; Peter et al. 2002). Infusion means to combine these two types of instruction by providing direct instruction on thinking skills and processes together with specific methods to promote thinking, which has been proven to be more effective than using either type of instruction individually (Marin and Halpern 2011).

This study adopted the conceptual framework for infusion lessons described by Swartz and Parks (1994), and used group discussions to activate students' thinking and learning (see Figure 2.1 below). In this framework it is clear that infusion lessons focus on the thinking process of learning, and are closely connected to SCT.

Figure 2.1 Conceptual Framework of Infusion Lessons

introduction
- Instruction on thinking skills and content objectives

thinking actively
- Teacher modelling
- Students complete thinking task in groups by using thinking skills and knowedge of subjects
- Students share group ideas with the whole class and the teacher provides feedback

thinking about thinking
- Teacher asks questions to guide students to reflect on their thinking process

applying thinking
- Teacher provides additional opportunities for students to apply the same kind of thinking to similar and different content to promote transfer

An infusion lesson begins with a clear introduction to thinking skills and content objectives. This should remind students of their prior knowledge and establish connections. The teacher should also demonstrate the significance of learning these thinking skills and explain the possible benefits. This can be linked to SCT

in that learners first learn new knowledge through interacting with the world outside of their minds. The teacher's introduction enables students to understand what they are to learn about and why they should learn it, and further, enables them to be clear about what should be internalised later on.

Next, the teacher helps the students to activate their thinking in the learning process. The teacher first models how to use these thinking skills to solve problems in learning. Then he or she asks the students to complete a thinking task through group discussion (for the types of thinking task used in this study see section 2.5.3). This interweaves the explicit thinking skills with the content of the subject (in this case, the English language), and makes a lesson an infusion lesson. It provides opportunities for students to make their first attempt to use the skills and knowledge which have just been taught, and helps them to initiate the process of internalisation. The use of thinking skills promotes a deep understanding of subject knowledge. Students need to engage in a task which encourages them to reconstruct knowledge in order to think of their own ideas. At the same time, the target language is also used as a communication tool for students to express their own ideas, and to exchange and discuss ideas with others. This contributes to effective language learning, which encourages learners to create meanings using the target language (see section 2.3). Group discussion also creates opportunities for them to offer help to or seek help from others, and thus promotes interaction and collaborative learning. After group discussion, students are invited to share their group ideas with the rest of the class, and the teacher provides comments. This creates opportunities for students to gain more inspiration from others, and to have their mistakes, if any, pointed

out to them. This also enables the teacher to guide students to progress to the next stage of metacognition.

In the metacognition stage, the teacher asks students some reflective questions about what kind of thinking they have applied, how they did this, and how effective it was (Swartz and Parks 1994). The students are then involved in metacognition, which can promote more effective thinking and learning, and which also contributes to internalisation (see section 2.3). Such reflective questions might include: what kinds of thinking did you engage in? How did you carry out this kind of thinking? Is this an effective way to engage in this kind of thinking? (Swartz and Parks 1994), and what is the difference between this way of thinking and the way you applied in the past? Would you use this method in the future? Why? (Assaf 2009). This stage is crucial in bringing about effective learning and encouraging metacognition (see section 2.3). It helps students either to seek a better way of thinking, or to be consistent in their use of similar thinking skills and processes.

Finally, the teacher needs to create more opportunities for students to apply similar thinking skills and processes to similar content, in order to promote near transfer, and to apply them to different content to promote far transfer. In the present study, near transfer was promoted through the use of a subsequent individual written task completed after class on a topic similar to that of the group discussion. Since the topic of writing is related to the topic of the thinking task in class, this facilitates near transfer, in which thinking skills are applied to similar contents, and at the same time requires the students to use complete

syntactic forms of the target language to express their ideas, which is crucial in the process of SLA (see section 2.3). Far transfer, which refers to the application of thinking skills in different contexts and topics, was promoted by repetition of the same type of task later in the term (for further discussion see section 2.5.3).

2.5.2 Effectiveness of Infusion Lessons

As mentioned earlier, to date no research has been conducted into the effect of infusion lessons in L2 contexts. However, infusion lessons have been found to be effective in terms of developing students' thinking and learning of school subjects in L1 contexts, and since in the L2 class the target language is the school subject to be learned, the results of these studies can point to the possible effects of such lessons in an L2 context. It is therefore pertinent to examine these results here.

Dewey and Bento (2009) investigated the impact of infusion lessons on the cognitive ability, self-perceptions and social-behavioural skills of primary school pupils. The results revealed that pupils in the experimental group could apply thinking skills to a range of contexts and use them to tackle different problems. They were also more able to use a greater range of vocabulary to express their thinking and were more likely to evaluate their own learning. The results also suggested that the infusion lessons enabled learners to become aware of what they did not know. The inquiry culture created in the lessons promoted open-mindedness, and thus enhanced learners' self-confidence in expressing their own ideas in class. Learners also reported that they learned to listen to others' ideas and were more able to share ideas in groups.

Kirkwood (2000) adopted an infusion approach to teach secondary school students. The results revealed students' positive attitude towards the infusion lessons. They created a supportive environment in class which allowed them to conduct discussion with others, compare possible solutions, and combine information and resources. It was also found that the infusion lessons could promote a deeper understanding of subject knowledge and more self-directions.

Aizikovitsh and Amit (2010) adopted an infusion approach to develop students' critical thinking in a university mathematics class. The results supported the efficacy of the infusion approach for the development of critical thinking skills and dispositions. The authors claimed that the infusion approach created a culture which fostered critical thinking, and this culture in turn encouraged students to investigate issues and evaluate information more deeply.

In this study, therefore, an initial attempt was made to adopt the infusion approach in an L2 class, and to investigate whether or not this approach is applicable in an L2 class and whether the effects found in an L1 class can also be seen in an L2 class.

2.5.3 Thinking Tasks

Several studies have revealed the usefulness of thinking tasks in promoting thinking and understanding (e.g., Qing el al. 2010; Yang et al. 2005; Centeno-Cortés and Jiménez Jiménez 2004). Specifically, Virjo et al. (2001) found that the value of these tasks was that they increased students' motivation and helped to make students aware of their learning needs. Students became more active in making contributions while

completing the tasks, and they also recognised the areas where they lacked knowledge and became aware of what they needed to know more about. This may contribute to internalisation if they subsequently learn more to help them understand their existing knowledge. Ozturk et al. (2007) also found that tasks based on problem solving and decision making promoted students' tolerance of the ideas of others and improved their evaluation of information. The results obtained from the CCTDI revealed that the increase in critical thinking dispositions in the experimental group was significantly greater than in the comparative group. Similar results were obtained by Tiwari et al. (2006), in that problem-based tasks promoted students' critical thinking dispositions, and this improvement was significantly greater than in students who only received traditional lecturing.

Three different types of task were selected for the present study: these were Odd One Out, Fact or Opinion and Six Thinking Hats. These tasks were repeated during the teaching intervention to promote far transfer. Since different thinking tasks emphasise different thinking skills, repetition should enable students to engage in similar thinking processes with different topics and content. Thus, the results of Ahmadian's (2011) study showed that repetition of the same tasks helped students to transfer their performance to a new task. Interestingly, his study also found that the repetition of tasks could enhance the complexity and fluency of L2 students' speech, but not its accuracy.

Odd One Out

Odd One Out focuses on the characteristics of things (Lin and Mackay 2004), which in EFL can be individual words, phrases or sentences. Students need to discover the differences and similarities between the items provided and choose the odd one out. The students complete the task by themselves using the knowledge learned in this or previous lessons. This is an easy and enjoyable task, which contributes to the consolidation of existing knowledge and understanding of the target language. It is a suitable task for students who have only just begun to take infusion lessons.

Fact or Opinion

The aim of the Fact or Opinion task is to develop critical thinking skills. Lin and Mackay (2004) suggest that it can be introduced in the early stages of a course to raise awareness of critical thinking. Students need to distinguish facts from opinions and give reasons for the judgements they make. This helps students to develop their own opinions (Leat 2001) and make effective decisions (Lin and Mackay 2004). It is a versatile tool for developing critical thinking, while at the same time it is also a highly challenging task for teachers to use, since the concept 'fact' relates to the nature of knowledge (Leat 2001). Therefore, this question should be defined and introduced to students at the beginning of the lesson (Lin and Mackay 2004).

Six Thinking Hats

Six Thinking Hats enables students to 'think in different ways rather than engaging in several different types of thinking simultaneously' (McGregor 2007: 140). Each hat

represents one different way of thinking (see Table 2.1 below). The white hat symbolises facts. The red hat deals only with emotions and feelings. The black hat concerns potential difficulties. The yellow hat refers to the positive characteristics of things, for example their value or benefits. The green hat is worn when providing suggestions and alternative proposals. The role of someone wearing the blue hat is to think about thinking by taking account of 'all the other hats in order to arrive at a solution' (Wyse and Dowson 2009: 86). When students 'wear' a particular colour of hat, they are expected to think in the way it represents.

Table 2.1 De Bono's Six Thinking Hats

Coloured hat	Type of Thinking	Focus questions
White hat	Focus on the facts, figures and information available.	-What information do we have? -What do we need to know? -What information do we need to get? -What questions do we need to ask?
Red hat	Descriptions of emotions, feelings, hunches and intuition without giving reasons.	What do I feel about this matter right now?
Black hat	Focus on what could go wrong. Identifying faults or weaknesses. Apply caution.	-Does this fit the fact? -Will it work? -Is it safe? -Can it be done?
Yellow hat	Focus on identifying the value or advantages of something. Focus on what benefits or savings there might be.	-Why should it be done? -What are the benefits? -Why it is a good thing to do?
Green hat	Focus on exploring of new and alternative proposals, suggestions and ideas.	-What can we do here? -Are there some different ideas/alternative things we can do?
Blue hat	Focus on thinking about thinking	-What are we here for? -What are we thinking about? -What is the end goal?

2.6 Summary

In this chapter, first the questions of whether critical thinking can be defined, taught and assessed were discussed, and the definition of critical thinking, methods and empirical evidence of the effects of teaching critical thinking, as well as assessments of critical thinking were introduced. Next, the mechanism and process of learning was discussed from the sociocultural perspective. The discussion then moved to the relationship between critical thinking and L2 writing, in order to illustrate the rationale for integrating the teaching of critical thinking with L2 writing; this was followed by a presentation of empirical evidence for the effectiveness of this integration on thinking and writing. The framework of this study, adopted from the infusion approach, was then explained before discussing the empirical evidence of the effects of infusion lessons and the selection of thinking tasks for the present study.

In the next chapter, the methodological basis of the study is described, including the design, sampling method and participants, the pilot study, data collection instruments and procedures, the data analysis methods, and finally, issues related to reliability, validity and research ethics.

Chapter Three - Methodology

3.1 Introduction

This study is a piece of evaluative exploratory research with a single case design. A pragmatic standpoint and a mixed-methods approach were adopted to enhance the reliability and validity of the results. In this chapter, the data collection instruments and the procedures used for data collection and analysis are described in detail. The reliability and validity of the study are also discussed, followed by a brief examination of relevant ethical issues.

3.2 Research Questions

The study involved the infusion of critical thinking into an English writing class at a Chinese high school, and the applicability and effectiveness of adopting this approach to teach English in that context was examined. It was thus decided to investigate the effects of the intervention by finding answers to the following questions:

Question 1. How does infusing critical thinking into an English writing class impact on high school students' critical thinking?

Question 2. How does infusing critical thinking into an English writing class impact on high school students' writing performance?

Question 3. What are students' attitudes towards and perceptions of infusing critical thinking into their English writing class?

3.3 Methodological Basis

The research was conducted in a normal English writing class at a Chinese high school to investigate the actual effects of teaching critical thinking, with the aim of revealing the truth through an examination of real practices. Therefore, this study took the ontological, epistemological and axiological positions of pragmatism.

Ontology concerns the nature of knowledge or what the truth is (Matthew and Ross 2010). Pragmatists regard knowledge as a tool for practical activity, and the truth should be based on the facts we discover from real practices (Creswell 2003). They suggest that research into education should be more practical and be able to provide concrete and empirical evidence to reflect the reality (Cornish and Gillespie 2009). Although there are claims in the literature for the importance and helpfulness of teaching critical thinking in L2 classes, the researcher of this study had noted little empirical evidence of the actual benefit of doing so. This was therefore taken as the starting point for the investigation, based on a ten-week teaching intervention in a normal high school classroom.

Epistemology is concerned with the justification and evaluation of knowledge, and it therefore influences the axiology and the choice of research methods (Carter and Little 2007). Axiology is the study of the value of knowledge (Creswell 2003), and

usefulness lies at the heart of pragmatist axiology. Pragmatism encourages application, in which a problem is noticed and the intention is to solve it. The researcher of this study was first inspired by a teacher who recognised the problems of her students and her own pedagogical problems (see chapter 1, section 1.2). At the same time, the researcher had also noted the potential effectiveness of teaching thinking in L2 classes. Therefore, this study was conducted to apply teaching knowledge to English language teaching, in order to help teachers and students tackle their problems.

In order to reveal the truth, research methods should be selected carefully. Pragmatists advocate mixed methods, which 'intertwine both qualitative and quantitative methods in a single study' (Lichtman 2010: 84), to collect data, in order to enhance the reliability and validity of a study. One difficulty in employing mixed methods is that a comprehensive understanding of the two approaches is required, since qualitative and quantitative approaches are essentially different. It is thus important to be aware of the strengths and weaknesses of both approaches before deciding to adopt a mixed-methods approach. These are discussed in the following paragraphs.

Qualitative researchers contribute to the understanding of social interactions and perceptions and hold the view that reality is constructed by the individuals involved (Lichtman 2010). They provide in-depth understanding and description of a phenomenon with rich detail (David and Sutton 2004). However, qualitative research studies are time-consuming, and have a tendency to reflect researchers' values and biases (Creswell 1994: 6). It may not be possible to generalise the results of purist qualitative research studies to other people or contexts, or to make quantitative predictions (Outhwaite and Turner 2007).

Quantitative research studies are based on the notion that reality can be measured objectively (Somekh and Lewin 2005), and deal with causes and effects with the use of hypotheses (Lichtman 2010). The results tend to be generalisable and allow predictions to be made. They provide relatively credible information to administrators, educators and politicians (Johnson and Onwuegbuzie 2004). The potential weakness of this approach lies in its neglect of the details of phenomena and participants' perceptions, since the focus is on hypothesis testing or generation (Johnson and Onwuegbuzie 2004).

It is evident that both purist qualitative and quantitative approaches have their strengths and limitations. Pragmatists thus suggest combining them and allowing the limitations of one to be overcome by the other, because there is no 'best tool' to reflect the reality, but 'each tool serves a particular purpose' (Cornish and Gillespie 2009: 802). In the other words, a research tool which is helpful for one study may not be appropriate for others. Pragmatists assess the suitability of a research tool for a particular study based on the design, purpose, context and sample of that study. This study benefited from this combination in gaining insight into and detailed information about students' perceptions and also a holistic understanding of the general effects of the intervention.

However, it should be noted that one weakness of pragmatism is that what is meant by 'usefulness' can be vague. Since pragmatists claim that the value of knowledge lies in its ability to guide practice and help to solve real problems, it is necessary for a

pragmatic researcher to explain what usefulness means in his or her study. In the present study, the usefulness of teaching thinking was revealed through an examination of the effects of infusion lessons on students' critical thinking and writing performance. At the same time (as mentioned in chapter 1, section 1.6), this study also took Seedhouse's view that the evaluation of the meaningfulness of an activity should be based on the learners' perceptions - whether they think it is helpful or not. Therefore, the learners' attitudes and perceptions were also deemed to be of value in this study.

3.4 Research Design

This section introduces the nature and design of the case study, as well as its advantages and limitations. It then explains the rationale for adopting a mixed-methods approach to analysing the data, and shows how this enhanced the reliability and validity of the current study.

3.4.1 Case Study

This study can be considered as an evaluative exploratory study with a single case design. 'Case study seeks to engage with and report the complexity of social activity in order to represent the meanings that individual social actors bring to those settings' (Somekh and Lewin 2005: 33). A case study focuses on social activities in real life and is sensitive to the context in which those activities happen. It provides an in-depth description, exploration and explanation of a real-life phenomenon in a particular situation (Lichtman 2010). Yin (2009) proposed three types of case study: descriptive, evaluative and exploratory.

A descriptive case study requires a descriptive theory which has been established before carrying out the study, and that the researcher is able to follow when conducting the study. The relevant theory and methodological framework to be used should be defined before the research questions are developed.

Evaluative research seeks to determine the 'worth and success' (Payne and Payne 2004: 80) of something. It emphasises change (Payne and Payne 2004: 81) by measuring inputs, outputs and processes. The present study is of the nature of evaluative research. To examine the effect of teaching thinking, it was necessary to consider the change in students' pre- and post-test performance. Only in this way could it be determined whether or not the students' critical thinking and writing could benefit from taking infusion lessons.

Four types of exploratory study were listed by Stebbins (2001), namely, investigative exploration, innovative exploration, exploration for discovery and limited exploration. Investigative exploration refers to examining or investigating a phenomenon, and is the method most commonly used in social research. The aim of innovative exploration is to achieve a particular effect or product. Exploration for discovery is similar to innovative exploration, but is, however, distinguished by considering 'everything of importance for describing and understanding the area under study' (Stebbins 2001: 3) as broadly and thoroughly as possible. The aim of limited exploration is to explore a specific phenomenon systematically, taking into account even those aspects that lie outside the researcher's specific field of interest. This study also has the characteristic of innovative exploration, since it involved initiating the attempt to teach thinking in an L2 class at a Chinese high school. Infusion lessons are also something new for

Chinese researchers. This study can thus be regarded as an evaluative exploratory study.

The advantages of a case study lie in the gathering of data from multiple sources (Yin 2009) to investigate a social phenomenon, and in the resulting provision of holistic, in-depth and detailed data (Lichtman 2010). These advantages contributed to the present study. On the one hand, the case study allows data to be collected from a variety of sources. This accords well with a mixed-methods approach and thus enhanced the validity and reliability of the results. On the other hand, it helped the researcher to gain a holistic insight into the measurable effects of teaching thinking in an L2 class, as well as a detailed understanding of what the students thought of the infusion lessons.

One disadvantage of the case study method is that it is time-consuming, since the aim is to obtain a comprehensive understanding of a social phenomenon (Popil 2011). Another drawback is that the results can be influenced by researcher bias (Grupe and Jay 2000). Many case studies employ interviews or open-ended questionnaires to gain a deep understanding, and thus author bias can be embedded in the interpretation of the findings.

Thus, an important consideration in a case study is the level of generalisation that will be possible from the study (Billings and Halstead 2005; Yin 2003) and it is unlikely that a single case study will provide a thorough portrait of the group researched. However, we cannot deny the value of a single case study since it is helpful for further studies by providing hypotheses, 'which may be tested systematically with a larger

number of cases' (Flyvbjerg 2006: 220), and since it ultimately contributes to theory testing and building. Therefore, it is necessary for a researcher to define beforehand what a 'case' means in his or her study, since this will affect the external validity of the case study by determining the generalisation scope of the results. Outhwaite and Turner (2007) suggested that a 'case' in a case study can be explained as 'a case of', and pointed out the value of a particular 'case'. Thus, it is essential for a researcher to define the scope of the case in his or her study in terms of the population it has been selected from. In this sense, the 'case' in this study consisted of infusing critical thinking into a Chinese L2 class.

The aim of this case study was theoretical generalisation, which, as claimed by Yin (2009), lies at the heart of case study research. As mentioned above, a case study tests a theory within its context in real practice. In the present study, an infusion approach was applied to teach critical thinking in an English class at a Chinese high school. The results provided empirical evidence of the effects of teaching thinking, thus making it possible to determine whether or not the teaching of thinking is applicable in a Chinese L2 context, where students are considered to lack experience of critical thinking and to be deficient in critical thinking ability, where harmony is particularly valued by the culture, the communication tool is their second language, and class sizes are large.

Many studies on the teaching of thinking have included a comparative or control class (see chapter 2, section 2.2.3). This can enhance the validity of the results. This study was originally designed to be of this type. However, the school and the tutor (each class has a tutor who is responsible for class management; this can be related to students' emotions, their performance in learning and their behaviour at school) rejected this idea,

for two reasons. On the one hand, after the researcher had explained the data collection instruments and procedures, they said they were too time-consuming. On the other hand, they worried about the possible negative impact on the feelings of that class (comparative). Data collection in the comparative class therefore included only the CCTDI and CCTST in pre- and post-intervention stages (for details of data collection procedures, see Table 3.1, section 3.8) with the consent of the school, tutor and students. The internal validity of this study may therefore be affected by the absence of other data collected from the comparative class (for further discussion see section 3.10.2).

3.4.2 Mixed-methods Approach

This study adopted a mixed-methods approach. This approach allows the use of a variety of data sources and research methods, and the limitations of a single research method can therefore be overcome by using others. All types of data are then analysed as a whole, which can strengthen the validity and reliability of the study.

Triangulation is one of the most beneficial features of the mixed-methods approach. Berg (2007) explained that triangulation refers to the use of multiple techniques to investigate a single phenomenon. The findings obtained from different techniques can therefore be used to cross-validate each other; in other words, the results obtained from using one technique may be either confirmed or contradicted by the results obtained from using the other technique (Creswell 2007). In this study, qualitative data were obtained to gain an understanding of the students' attitudes and perceptions, while quantitative data were used to assess their performance in thinking, writing and group discussion. The qualitative data thus helped to explain, clarify and coordinate the

findings from the quantitative data, while the support provided by the quantitative data at a statistical level increased the possibility of generalising the findings from the qualitative aspect of the research. It was hoped that this would ultimately contribute to producing a valid and in-depth understanding of the effects of teaching thinking in L2 classes. Moreover, the students' critical thinking was assessed by both the California critical thinking measurements and an examination of their written texts, which meant that the findings obtained from one measure could be crosschecked against those obtained from the other measure.

The use of mixed methods also helps researchers to 'address the relationship between macro and micro levels' (Yin 2009: 242). Quantitative research readily paints an overall picture of social activities focusing on their structured features, while qualitative research is especially efficient at investigating small-scale and individual behaviour. The combination therefore establishes a bridge between the macro and micro features of the phenomenon researched. In this study, the quantitative data produced holistic results showing the effects in a statistical sense, while the qualitative data provided more in-depth information in more detail and gave concrete evidence of the development of thinking and writing, as well as revealing students' attitudes and perceptions.

In the preceding paragraphs the strengths of the mixed-methods approach have been described. It is also important, however, for the researcher to be aware of the weaknesses of the approach, and these are as follows. First, in order to use this approach, researchers need to become knowledgeable about the different methods and approaches in order to understand how to combine them appropriately (Creswell 1994).

Further, conducting both types of research can be difficult for a single researcher (Johnson and Onwuegbuzie 2004), and also very time-consuming. In conducting this study the researcher received support from one of the revisers of the Chinese versions of the CCTDI and CCTST, who explained and guided the researcher in the administration of these tests, as well as from three English teachers at the high school where the study took place, who helped the researcher to design the lessons and conduct the study at their school, thus saving the researcher a great deal of time and effort.

3.5 Sampling and Participants

This study used purposive sampling, which is a type of non-probability sampling method. Researchers using purposive sampling choose 'subjects who, in their opinion, are relevant to the project' (Sarandakos 2005: 164). This sampling method is used when the researcher is looking for a sample that represents a broader group. This is important for enhancing the generalisability of the results of a case study (Teddlie and Yu 2007). However, this sampling method can be subjective since it is based on researchers' experience and judgement (Guarte and Barrios 2006). In the current study, to minimise the possibility of researcher influence, two classes of science students from a Chinese high school were selected, for two reasons. First, the classes were from a public Chinese high school, which uses standard textbooks and implements national curriculums published by the Ministry of Education of China. It was thus expected that it might be possible to generalise the results of the study to the possible effects of teaching thinking in L2 classes in all Chinese high schools. The second reason for choosing science students was that they are regarded as having lower English

proficiency and as being less motivated to learn English than high school students of arts subjects (Yang 2008).

89 second-year high school students aged from 16 to 17 participated in this study, of which 47 students were in the infusion class and 42 in a traditional teaching class. As mentioned in section 3.4.1, the traditional teaching class did not participate in all the data collection procedures owing to the concerns of the school and of their tutor. However, they still contributed to this study by completing the California critical thinking tests.

The overall mean scores of students in the infusion class in the final examination of their first year of study meant that the class was ranked thirteenth out of thirty-three classes and eighth out of thirty-three in English. The traditional teaching class was ranked tenth in both their overall mean scores and English mean scores. All the students in both the classes used in the present study had been taught by the same teacher (teacher A) since entering high school.

In this study, the tutors and teacher A suggested that it would better for them to administer the tests, writing and self-evaluation questionnaire in both the pre- and post- stages, so that the students could complete the tests and the writing in a familiar atmosphere (see section 3.8 for further details of data collection procedures). For ethical reasons, the infusion lessons were also taught by teacher A to ensure that the participants would receive the normal and usual high school education by being taught by their usual teacher. Therefore, the researcher sat in the class during the data

collection and infusion lessons, after explaining the purpose, content, administration time and requirements of the above data collection instruments to the teacher, and designing the infusion lessons. The interview was also conducted by the researcher.

3.6 Pilot study

A pilot study was conducted from 11th-15th October 2010. The aim was to capture the reality of a traditional English writing class in a Chinese high school, to enable the researcher to design infusion lessons that would be feasible and suitable for high school students. Moreover, data collection instruments should always be tried before the actual data collection in order to verify their suitability for the target subjects. The CCTDI and CCTST were tested to find out how long it took to administer them and whether or not they were comprehensible to high school students, since they were designed by researchers from Western countries and originally written in English. Semi-structured group interviews were also conducted to investigate whether the students could answer the questions and how they felt about being interviewed.

3.6.1 Classroom Observation

Two English writing lessons were observed, which were taken by two teachers. Teacher B had taught English at high school for more than 8 years, and had a Master's degree obtained in Singapore. Teacher C had taught English at high school for more than 15 years, and was the head of both English teaching and the research group at the school.

The results of the observation supported the finding of previous studies that the teaching in Chinese high school English classes is still teacher-dominated and textbook-based; the teachers failed to create opportunities for students to think critically, and limited the amount of time they were allowed for deep thinking (see chapter 1, section 1.4). Extracts 1 and 2 are examples of the interaction between teacher and students in the two classes.

Extract 1: (Teacher B and her students)
1	T:	What is '申请 '(apply) in English?
2	Ss:	Apply.
3	T:	What is its form of noun?
4	Ss:	(silent)
5	T:	Application
6	Ss:	Application

Extract 2: (Teacher C and her students)
1	T:	What are the key words to write a job offer? (What are the key
2		words? Do it quickly.)
3		(Students read the job notice in the textbook silently for two
		minutes)
4	T:	What are the key words?
5		(Teacher said the key words aloud together with students)
6	T:	OK. Remember, these are key words to write a job offer.

Extract 1 is an example of teacher B's interaction with her students. The students remained silent after the teacher repeated the question (lines 3 and 4), and she told them the answer immediately. Then the students repeated it (lines 4 and 6). The teacher did not ask further questions to guide or provoke their thinking, and thus failed to encourage her students to find out the answer by themselves. Extract 2 is an example of teacher C's interaction with her students. Teacher C asked the students to find out the key words used in a job offer. They were given two minutes to read the job

notice in the textbook individually, and afterward, the teacher read the key words from the book along with the students and told them to remember these words. Again, she did not illustrate the use of the words or guide the students to think about what these key words were used for or why they were important before instructing the students to remember them. At the same time, neither of these teachers created opportunities for individual students to present their ideas, although in teacher C's class, she could have asked the students to find the key words and discuss them in pairs or in groups, instead of reading the textbook individually and in silence.

Based on these findings, the researcher selected questions from Paul and Elder (2005) and Browne and Keeley (2004) that would help the teachers to encourage and provoke the students' thinking, and that also required students to complete the thinking tasks collaboratively through discussion, in order to encourage them to present and exchange their ideas.

3.6.2 CCTDI and CCTST

117 first-year students from the same high school took part in the piloting of the CCTDI and CCTST. The CCTDI was completed in class on the morning of 12th October 2010, followed by the CCTST, and these tests had to be completed within 15 and 45 minutes respectively, as suggested by the manual (see section 3.8.1).

89 (76.06%) students submitted the CCTDI answer sheets within 15 minutes, and 115 (98.2%) completed them within 20 minutes. Moreover, only 62 (52.99%) students were able to complete the CCTST within 45 minutes. Five additional minutes were

then provided, but this was only enough for 24 of the remaining students to complete it. In the end, 106 (90.59%) students had returned answer sheets after 55 minutes.

It was therefore decided that five and ten more minutes for completing the CCTDI and CCTST respectively should be allowed in the main study. Although the suggested administration time for the CCTDI in the Chinese manual is 15 minutes, it was decided to allow 20 minutes in this study. There were two justifications for doing this. First, the author of the original CCTDI suggested that 20 minutes was appropriate for the test-taker (Facione et al. 1994). Secondly, the findings of the study on the reliability and validity of the Chinese versions of both the CCTDI and CCTST were based on a sample of 318 Chinese college students (see section 3.8.1). High school students may take more time to complete the test. It was thus deemed reasonable to allow five more minutes for them to complete the CCTDI. Moreover, although the CCTST has been used with high school students in America, the students in the pilot study for the current research reported that they were not familiar with these types of question and had not taken this type of test before. They needed time to familiarise themselves with the test. Therefore, ten more minutes were given to the students to complete the CCTST.

3.6.3 Semi-structured Group Interview

Five first-year students were interviewed. The three main questions were intended to address students' attitudes towards and perceptions of current English teaching, and these were: a) Do you like current English lessons? Why? b) What do you expect to

learn in an English class? And c) Do you think current English lessons need to be improved? If yes, how?

The interviewees answered all the questions during the interviews, and they provided no negative feedback about the issues raised. It was therefore decided to conduct semi-structured group interviews, for two reasons. First, based on their understanding of their students, the teachers recommended that the researcher conducted group interviews, since the students had not been interviewed before and would be anxious about being interviewed alone. Secondly, the semi-structured interview can stimulate fuller responses, since the researcher can add relevant questions when needed (see section 3.8.4).

3.7 Teaching Intervention

The teaching intervention started in the first week after the pilot study. In the term when this study was conducted, the English teaching was planned to include nine modules in the textbooks (seven modules in textbook five and two modules in textbook six). Each module was completed in five or six English lessons, of which the last one was a writing lesson. The teacher infused critical thinking into these writing lessons. The intervention consisted of ten lessons, of which the first lesson was an introductory lesson. This lesson was designed as an infusion lesson and used the Odd One Out thinking task, which served as a transition to the infusion lessons.

The lessons were designed by the researcher and teacher A, who taught the infusion lessons. The traditional teaching class was taught by the same teacher in a traditional way. The English teaching and research group at the school hold a meeting every two weeks. The aim of this meeting is to improve the quality of teaching. Teachers exchange ideas about lesson plans, and discuss how to teach and what should be included in each module. The teaching of both classes covered all the required objectives.

According to the textbook guidelines, each module targets specific functions of language, which reflects the purpose of using language, and thus determines the literature, cultural and linguistic knowledge to learn, and the objectives of writing and speaking. As mentioned in chapter 2 (section 2.4.2), the students were required to use English to give reasons, make deductions, report statements and suggestions, express likes, dislikes and preferences, explain agreements and disagreements, and express concern. Critical thinking could be closely connected to these functions. Therefore, the thinking skills and tasks were selected to match these language functions. Examples of lesson plans are presented in Table 3.1; details of the design of the tasks may be found in appendix C.

Table 3.1. An Example of a Lesson Plan

Lesson Two - British English and American English	
Objectives	
English	**Thinking skills**
Knowledge:	**skills to learn:**
varieties of English and their features	explaining and reasoning
Function of language:	**supportive skills:**
compare and construct	analysing and synthesising
giving reasons	
Linguistic supports: I like… because, Since..., As…	
Introduction to the lesson	
Teacher first activates students' prior knowledge and thinking skills, and establishes	

Table 3.1 *(continued)*

their relevance and importance. Teacher then introduces the objectives of the lesson in terms of English and thinking skills. Next, teacher should explain why these thinking skills are important and how they can help English learning.

Thinking Actively
Teacher first introduces the thinking task (Odd One Out, see appendix C), and then models how to use knowledge, language and skills to complete the task. Students complete the task in groups through discussion before teacher invites some of the groups to share their ideas. Teacher needs to provide feedback (which can be corrections of mistakes when she notices any, providing support when she notices the need, or summarise the ideas of different groups when different groups present different ideas).

Thinking about Thinking
Teacher asks reflective questions to guide students to reflect on the kind of thinking they engaged in; for instance, which perspective they thought from, whether their way of thinking was effective, and if not, how to improve it. Teacher provides feedback about their reflection and encourages them to improve their thinking skills by reflection and practice.

Transfer
Teacher asks students to write a composition on a similar topic (We have learned different varieties of English in this module. In your opinion, which variety is the best to learn? Give your reasons (in at least 120 words)). Teacher suggests that students can use relevant thinking skills and thinking from different perspectives. Teacher also emphasises the fact that there is no best answer, and the writing should focus on explaining reasons.

In the preceding sections the researcher's standpoints and the design of this study, as well as the benefits obtained from the pilot study have been discussed. The following sections focus on the instruments and procedures of data collection, and the methods of data analysis. Issues of reliability, validity and ethics are then discussed.

3.8 Data Collection

In this section the data collection instruments and the process of data collection used are evaluated. The data were collected between 18th October 2010 and 21st January 2011, in three stages: pre-intervention, teaching intervention and post-intervention (see

Table 3.2). The pre- and post-CCTDI and CCTST were collected from both classes. Students' compositions were collected from the infusion class in the pre- and post-intervention stages. During the teaching intervention, 16 students completed Thinking Together Diaries after the infusion lessons in weeks one, four, seven and ten. In the post-test stage, 10 students volunteered to be interviewed after the final infusion lesson, and all of the students in the infusion class were asked to complete questionnaires.

Table 3.2 Overview of Data Collection Procedure

Instruments	Class	Data collected from	Pre-intervention	During intervention	Post-intervention
CCTDI and CCTST	IC	The whole class	*		*
	TTC	The whole class	*		*
Students' composition	IC	The whole class	*		*
	TTC	No			
Self-evaluation of group discussion	IC	Six students from four discussion groups		*	
	TTC	No			
Interview	IC	Ten students of two groups			*
	TTC	No			
Questionnaire	IC	The whole class			*
	TTC	No			

IC= infusion class, TTC= traditional teaching class

3.8.1 CCTDI and CCTST

Rationale

In this section the rationale behind using the CCTDI and the CCTST (see section 2.2.4 in chapter two) in the current study is presented, before introducing the design of these tests. Then, the data collection procedure is reviewed.

The CCTDI and CCTST were used to investigate students' critical thinking ability and dispositions (these tests are not allowed to become public without the permission of the original authors, and thus they are not included in the appendix of this thesis). The results of a comparison between pre- and post-tests would reveal whether or not the students' critical thinking had improved after the intervention, and a comparison between the two classes would reveal whether the students in the infusion lessons had improved more than those in the traditional teaching class. The results of both comparisons would reveal the effect of infusion lessons on the students' cognitive development.

These tests target both skills and dispositions, which are the indispensable ingredients of critical thinking (see chapter 2, section 2.2.1). These tests also provide measurable and objective results, which are in line with Davies' (2006) recommendation that the benefits of teaching thinking should be based on more measurable and objective results than previous studies, in which descriptive results have been obtained based solely on interview data, teachers' teaching notes or students' learning journals.

This study used the Chinese versions of the tests (see chapter 2, section 2.2.4), to enable the students to comprehend the items and demonstrate their real attitudes and ability. The Chinese versions of both the CCTST and CCTDI have been used to assess the critical thinking of Chinese high school and college students (see chapter 2, section 2.2.4), which have also been proved to be valid and reliable (Luo and Yang 2002, 2001). With regard to the CCTDI, the correlation scores for the subscales and the overall score were generally above 0.5 ($p<0.05$), while the correlation of the overall scores of 186 students between the first test and a retest one month later was 0.63 ($p<0.01$). Two split-half reliability tests also showed high correlations ($r=0.75$ and $r=0.80$, both $p<0.01$). For the CCTST, the correlation scores for the subscales and the overall score were also above 0.5 ($p<0.05$), and the Cronbach's Alpha coefficients were above 0.5 ($p<0.05$), which indicated a satisfactory level of internal consistency (Luo and Yang 2001).

The times for the administration of the CCTDI and CCTST suggested in the Chinese versions are 15 minutes and 45 minutes respectively (Luo and Yang 2002, 2001). Based on the findings of pilot study, the students were provided 20 and 55 minutes to complete these two tests respectively (see section 3.6.2).

It is worth pointing out that, in order to ensure that the tests would be able to assess what they were intended to assess, the contents of the Chinese versions were not modified for the Chinese context. One limitation of this is that Chinese test-takers may not be familiar with the forms and meanings of some expressions, making it more difficult for them to answer the questions. This could mean that the results of the tests might not reflect the real level of Chinese students' critical thinking. Therefore, this

study also investigated the students' critical thinking performance in their writing, allowing for cross-validation between the results obtained from the tests and those obtained from the assessment of their writing.

Design

The CCTDI consists of 75 Likert-style items concerned with seven aspects of critical thinking dispositions: inquisitiveness, systematicity, analyticity, truth-seeking, open-mindedness, self-confidence and maturity (for descriptions see appendix D). The questions in the CCTDI are answered on a six-point Likert-type scale, ranging in disagree-agree levels from 1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5=agree, to 6=strongly agree. The 75 items are intended to determine the extent to which a test-taker is willing to use critical thinking.

The CCTDI provides an overall score and scores on seven subscales: the higher the score obtained, the stronger the disposition towards critical thinking (see Table 3.2). For the subscales (see Table 3.3), a score of 30 or below reveals a weak disposition. Scores from 30 to 40 indicate a moderate disposition, while scores from 40 to 50 indicate a strong inclination; a score of 50 or above represents a very strong disposition. Overall scores below 210 reveal a weak disposition to use critical thinking. A tendency towards a moderate use of critical thinking is represented by scores from 210 to 280. Students who obtain scores between 280 and 350 are deemed to have a strong disposition to use critical thinking, and scores higher than 350 reflect a very strong inclination.

Table 3.3 Scoring System of CCTDI

CCTDI	Levels
Subscale	<30: weak disposition 30-39: moderate disposition 40-49: strong disposition ≥50: very strong disposition
Overall CCTDI	<210: weak disposition 210-279:moderate disposition 280-349: strong disposition ≥350: very strong disposition

The CCTST is a multiple-choice test which includes 34 questions. It is scored dichotomously, with four or five possible answers, of which only one is correct. It addresses five aspects of critical thinking: analysis, evaluation, inference, deductive reasoning and inductive reasoning (for descriptions see appendix D).

There is no baseline from which to establish good or bad scores in the CCTST (Luo and Yang 2002). It is more often used to estimate the position of the tested individual in a target population. Luo and Yang (2002) have appealed for more tests on Chinese students to contribute to the building of a norm for Chinese students, or for students in a particular province, school etc, in order to allow small-scale studies to evaluate how well or poorly their students have done compared to other students in the target population. Although Luo and Yang have provided a norm for referencing, it was established on the basis of research conducted with Chinese college students. However, according to Blondy (2011), CCTST scores can be used to compare the results of two groups. Since there is at present no norm for high school students in China, it is hoped that the results of this study will contribute to the establishment of such a norm.

Above, the rationale for using the CCTDI and CCTST and the scoring mechanisms used in these tests have been described. In the following section the procedures followed in conducting the intervention for this research are explained.

Procedure

Both the infusion and traditional teaching classes completed the CCTDI in 20 minutes in the first class (this was a normal, scheduled weekly class) on 18th October 2010, and the CCTST in 55 minutes in the last class (this was a weekly self-study lesson) on 20th October 2010. The post-tests were administered the week after the last thinking lessons in the same classes in which the pre-tests had been conducted.

The tutors of both classes suggested that it would be better to allow them to administer the tests, so the students would be able to do them in an atmosphere they were familiar with. The researcher therefore explained the purposes and contents of the three tests to the tutors, and emphasised the fact that the CCTDI and CCTST test papers would have to be collected in, as required by the revisers.

Before the test, the tutors explained the content and purpose of the tests to the whole class, emphasising the fact that there were no standard answers for the CCTDI, while the CCTST required them to think harder since there was only one correct answer for each question. To reduce their anxiety and encourage them to express their real attitudes, the teachers explained that the results of the tests would not affect their scores or performance in their studies, and that they would be analysed anonymously. The teachers also reminded them that the only thing they needed to do was to choose the

answer which matched their own views. Both test papers and answer sheets were collected punctually.

3.8.2 Students' Written Texts

Rationale

Students' written texts were used to assess the impact of infusion lessons on writing performance. At the same time, as discussed in chapter 2 (sections 2.2.4 and 2.4.3), students' written texts, such as argumentative writing and substantive writing, can also be used to assess critical thinking in terms of the elements reflected.

Since substantive writing is the main type of writing required in the English curriculum of Chinese high schools (see chapter 2, section 2.4.2), and the writing task in the NCEE (National College Entrance Examination) is also of this type, it was also used in this study to assess both critical thinking and writing, in order to reveal whether the students used critical thinking in their learning practices.

Design

The writing tasks were jointly designed by the researcher of this study and teacher A. Descriptions and requirements were in line with those in the NCEE. Based on the discussion with several English teachers, the students were given 30 minutes to complete the writing task. In the NCEE, students are allowed 100 minutes to complete the whole English test, with no specific time allocated to each part. However, the English teachers consulted for this research suggested that the students should complete the writing task in 20 to 30 minutes. In this study the students were given 30 minutes to

allow them more time to think and write, but still within the amount of time they might have in the NCEE. For the purposes of this research no limit was put on the number of words per text, in order to allow students to write down all the ideas they wanted to include.

The pre- and post-intervention writing tasks were thus designed as follows:

- **Pre-intervention Writing Task**

Do you ever think about your dream job or what you would like to do in the future? What is it? Give reasons to explain why it is your dream job. Write a composition of at least 120 words.

- **Post-intervention Writing Task**

Half of your high school life has passed. Have you learned anything from your high school experience? What is the most important thing you have learned? Give reasons to explain why it is important to you. Write a composition of at least 120 words.

Procedure

The pre- and post-intervention written texts were collected in the weeks before and after the intervention. The students completed the tasks in class independently. They were not allowed to communicate with each other or use a dictionary. To begin with, teacher A explained that the students' English writing would be collected and analysed along with other research data, but that this did not involve any evaluation of their school performance. Teacher A wrote down the description of the writing task on the blackboard and required the students to complete it in class within 30 minutes. After 30 minutes, the students handed in their writing to the teacher.

3.8.3 Self-evaluation Questionnaire

Rationale

A self-evaluation questionnaire was completed by the students in the infusion class in which they reported on their individual and group performance in the group discussions, as well as on their attitudes (see appendix E). The self-evaluation questionnaire was adapted from Dawes at al.'s (2000) Thinking Together Diary. It is a type of 'structured diary' (Bryman 2001), which can be used when 'the researcher is specifically interested in precise estimates of different kinds of behaviour' (Bryman 2001: 136). Group discussion is a crucial part of infusion lessons, since it creates opportunities for students to present their own ideas and exchange them with each other. The aim in this study was to investigate how their relevant attitudes and performances changed over time. Consequently, the students in the infusion class completed this questionnaire in weeks one, four, seven and ten immediately after the infusion lessons.

The Thinking Together Diary was modified into a questionnaire with six-point Likert scales by the researcher of the present study. On the one hand, this enabled the students to answer it more easily and saved time (Cohen et al. 2011). In Hurd and Xian's (2010) study, they added open-ended questions at the end of a Likert-scale questionnaire, but realised that less than 10% of students in a pilot study responded to these questions. The participants explained that it took too much time. On the other hand, Likert scales with five options include the neutral option: 'not sure', which gives the respondent the opportunity to answer the questionnaire randomly, or to choose the neutral item in order to avoid having to think too hard about their actual attitude (Dörnyei, 2003). This then makes it difficult to ascertain the inclination of the respondent. Therefore, for the

design of the questionnaire in this research, a six-point Likert scale was considered to be more suitable and helpful.

Although a Likert-scale questionnaire provides straightforward and time-efficient data about students' attitudes and behaviour, there is some risk of obtaining unreliable and unenthusiastic responses (Dörnyei and Taguchi 2009). To minimise this impact, sixteen volunteer students were involved.

Design

The self-evaluation questionnaire was designed to include 18 questions using six-point Likert scales, and four additional items were added to address aspects relevant to the study.

It consisted of two sections. The questions in the first section investigated how satisfied the students were with the group discussions in class in terms of individual involvement (questions 1-3), the use of critical thinking (questions 4-5), personal contribution (questions 6-7) and group performance (questions 8-12). The second part aimed to address their attitudes towards and perceptions of the group discussions, including the impact on their own thinking (questions 13-15), and feelings during group discussions (questions 16-18).

These items were added to the modified diary. Question 4 (I proposed my opinion/opinions) was added to investigate the students' evaluation of their use of

critical thinking to propose personal ideas in group discussions. Question 7, 'I listened to others and provided feedback' was intended to elicit information reflecting the students' personal contribution in group discussion. Question 13 (Group discussion provoked my thinking) attempted to find out whether or not the students thought group discussion provoked their thinking.

The self-evaluation questionnaire was translated into Chinese by the researcher, and checked by teacher A. It was presented to the students in both English and Chinese, in order to facilitate their understanding.

Process

The students were grouped according to their seating arrangement in class (see Figure 3.1). Students A, B, C and D formed group one and students E, F, G and H formed group two. This was done for two reasons. First, it was convenient for the teachers and enabled the students to interact with other students they were relatively familiar with. The students could also continue their discussions after class if needed. Secondly, although studies have revealed that in collaborative learning, students who offer help are not necessarily more capable (see chapter 2, section 2.3), according to the teacher (teacher A) who took part in this research, the school always arranged classes so that students of different cognitive levels (based on their overall scores in examinations) were deskmates, to encourage peer support

Figure3.1. Grouping method

Since this questionnaire was to be administered four times during the intervention, the teachers thought it important to allow the students themselves to decide whether or not they were willing to take part in all the procedures; thus, these questionnaires were completed only by students who volunteered to do so – a total of 16 students. It was also decided that they would use the break time between two lessons to complete the questionnaires.

Before the thinking lessons in weeks one, four, seven and ten, the teacher gave the questionnaire to the students, and asked them to complete it individually immediately after the lesson. They had ten minutes to do so (break time between two lessons is ten minutes), and the completed forms were then collected by the teacher.

3.8.4 Semi-structured Group Interview

Rationale

This study used semi-structured group interviews to investigate students' attitudes and perceptions. The interview is a direct and effective way to collect information and reveal what actually happened during an intervention (Silverman 2006; Kumar 2005; DeMarrais and Lapan 2004). A semi-structured interview includes some specific questions, but the interviewer and interviewees are free to depart from the questions whenever they feel it is necessary (Hartas 2010). It allowed the researcher of this study to interact with the interviewees by asking questions which were not included in the question list prepared beforehand when needed.

There is, however, a potential drawback to interviews, which is that the quality and quantity of information produced are influenced by the interaction between interviewee and interviewers (Kumar 2004). A good interaction can elicit more information appropriate to the research topic, while poor interaction may fail to produce rich and relevant information.

In this study, therefore, ten students were interviewed in two groups, in order to allow the dynamic production of data through the interaction between interviewees (Hartas 2010). At the same time, as suggested by the teachers (see section 3.6.3), any anxiety among interviewees was reduced by the presence of their peers.

Design

There were three sets of questions included in the interview. The first set of questions was concerned with previous writing lessons: for example, what had they learned in previous writing lessons and what had they expected to learn in writing lessons. The second set was about writing: Did they like writing, did they have any problems in writing, and if so, what were the problems. The third set of questions were about students' attitudes towards and perceptions of the infusion lessons; for example, whether or not they liked them and thought they were helpful, what was their favourite thinking task and why, and if they had any concerns about them or suggestions regarding the teaching of English in the future.

Process

10 students volunteered to be interviewed after the final infusion lesson (on the same day), of whom 6 participated in the self-evaluation questionnaire data collection during the intervention. The interviews were conducted in Chinese, which enabled the students to give more information and express themselves clearly. The students were divided into two interview groups according to the order in which they expressed their interest in being interviewed. The interviews were held in a classroom with an audio-recorder on the desk. The researcher explained the purpose and process of the interview, and emphasised the fact that the audio-taped data would be analysed anonymously by the researcher only.

Surprisingly, the students provided only short answers in the interviews, and sometimes they answered questions simply by nodding their heads. Several students reported their feelings later. One said that he became nervous when the audio-recorder was turned on. He had not experienced this before. It was also interesting that one student mentioned that he needed more time to think about the questions, but when other students provided an answer quickly, he would then provide a short answer so as to avoid wasting other people's time. The researcher discussed this with teacher A and proposed that an additional questionnaire was needed in order to collect more data on the students' attitudes and perceptions. A self-completion questionnaire was thus developed. This is described below.

3.8.5 Post-Intervention Questionnaire

Rationale

A self-completion questionnaire is a questionnaire which respondents answer by themselves, and it can be sent either by email or by post (Bryman 2012). It was used in this study because it would eliminate the effect of the interviewer and the other interviewees in the group interviews (see section 3.8.5) and gave the students more time to think and answer the questions (see appendix F).

One limitation of this type of questionnaire is the often low response rate (Bryman 2008). Some participants may simply not return it. To minimise the risk of this happening, the researcher did not send the questionnaire to the students immediately after the intervention, since their final examinations for the term were to be taken in the week following the last infusion lesson. This allowed the students to prepare for their final examinations without distraction and gave them more time and space to respond to the questionnaire. The questionnaire was then sent afterward by the teacher.

Design

The questionnaire was designed in Chinese, and presented to the students in both English and Chinese. The reason for this is that the infusion lessons were taught in English and the students may have been more familiar with the English expressions for some concepts. At the same time, the Chinese descriptions provided clear explanations to increase comprehension.

The questionnaire concerned the students' attitudes towards and perceptions of the infusion lessons, writing in English and their traditional writing lessons. The design of the questions was based on the main concerns of the semi-structured group interviews, and included twelve questions: 1) whether they had previously had English writing classes, and if so, what did they think of them; 2) what did they expect English writing lessons to be like; 3) did they expect to have activities in class; 4) whether or not they liked the infusion lessons and why; 5) which types of task they liked the most and why; 6) whether or not the lessons helped them to think, and if so, how; 7) whether the lessons helped their English writing, and if so, how; 8) if the lessons helped their English learning, and if so, how; 9) whether the group discussion helped their learning, and if so, how; 10) their comments on and opinions of the infusion lessons.

The self-completion questionnaire was administered after the intervention, and is thus referred to as the post-intervention questionnaire in the following discussion, in order to distinguish it from the self-evaluation questionnaire administered during the intervention (see section 3.8.3).

Process

The day after the final examinations, the teacher explained the aims and content of the questionnaire to the students in the infusion class, and asked them to complete the questionnaire at home by themselves and return it by email within one week. The teacher also emphasised the fact that their responses would be valued and respected, and that the data would be analysed by the researcher only and would remain anonymous. The teacher sent the questionnaire to all the students on the same day.

3.9 Data Analysis

In this section the methods used for data analysis in this research are introduced. The framework for the data analysis is presented in Table 3.4. The CCTST and CCTDI were used to assess the students' critical thinking and the results were analysed by SPSS using the Paired Samples T-test and Independent Sample T-test. The students' written texts were used to assess overall proficiency, accuracy, grammatical complexity and fluency, which were measured by the rating criteria of the NCEE, the percentage of error-free clauses, the proportion of clauses to T-units and the number of words produced within 30 minutes respectively. The students' written texts were also used to assess their critical thinking and were analysed according to the critical thinking elements reflected in them. The students' self-evaluations were used to assess their thinking performance in and attitudes towards group discussion, and these were analysed descriptively. The data obtained from the interviews and questionnaires were used to investigate the students' attitudes towards and perceptions of the infusion lessons, as well as their impact on the students' thinking and writing, and these data were analysed using a combination of deductive and inductive coding.

Table 3.4 An Overall View of the Data Analysis

Instruments	Data analysis	Research questions
CCTDT CCTST	SPSS: 00000Paired Samples T-test Independent Sample T-test	Thinking (Q1)
Students' written texts	Accuracy: percentage of error-free clauses Complexity: proportion of clauses to T-units Fluency: number of words produced within 30 minutes Overall Proficiency: NCEE rating criteria The Elements of Critical Thinking in Writing	Writing (Q2)
Self-evaluation	SPSS: Descriptive analysis	Attitudes (Q3)
Interview Questionnaire	Content analysis: Combination of deductive and inductive coding	

In this study, the qualitative data were used to provide in-depth and detailed information about a phenomenon; they provided concrete evidence of the students' thinking and writing performance and revealed their attitudes towards and perceptions of the infusion lessons. The quantitative data, on the other hand provided an insight into the results at the statistical level, thus providing supportive data for the qualitative results. The aim was to investigate whether the observed phenomenon was the result of the intervention, rather than simply occurring by chance with one or two students, and to enhance the validity of the results.

3.9.1 CCTDI and CCTST

The results obtained from the CCTDI and CCTST were analysed using the SPSS program. Data were collected from both two classes in the pre- and post-intervention stages. All students completed these tests, and thus the analysis included data from 47 students in the infusion class and 42 students in the traditional teaching class. A Paired Samples T-test and Independent Sample T-test were employed to compare the results.

A Paired Samples T-test is usually based on a group of individuals who experience both conditions of the variables of interest, and is suitable for examining any changes that occur in the group (Antonius 2002). This study used a Paired Samples T-test to measure the difference between the mean pre- and post-test scores of the students in each class, in order to reveal whether or not their critical thinking had improved after taking either the infusion lessons or the traditional lessons. For example, a comparison between the pre-and post-test CCTDI scores of the infusion class assessed whether or not there was a significant improvement in critical thinking disposition after taking infusion lessons. Likewise, a comparison between the pre-and post-test CCTDI scores of the traditional teaching class assessed whether or not there was a significant improvement in critical thinking disposition after taking traditional lessons. A comparison between the pre-and post-test CCTST scores of the infusion class assessed whether or not there was a significant improvement in critical thinking skills after taking infusion lessons, and a comparison between the pre-and post-test CCTST scores of the traditional teaching class assessed whether or not there was a significant improvement in critical thinking skills after taking traditional lessons.

An Independent Sample T-test is used in situations in which there are two experimental conditions and different participants have been used in each condition (Field 2009: 334). It is usually used to compare the means of two groups who have received different treatments (George and Mallery 2011). In other words, an Independent Sample T-test is used to assess whether or not the improvements in one class are significantly greater than in the other. In this study, comparisons were conducted between the gains of the infusion class in the CCTDI and CCTST with those of the traditional teaching class. The results would reveal whether or not the improvements in critical thinking skills and dispositions in the infusion class were significantly greater than those in the traditional teaching class, and thus determine the effects of intervention.

One limitation of using the T-test is that the results can only reveal whether or not there is a significant difference between two variables, and fail to reveal how big that difference is. However, in this study it was decided to use T-tests since they have been used in many studies which have employed the CCTDI and CCTST, so the results could be easily understood and compared.

3.9.2 Analysis of Written Texts

The students' written texts were used to assess the students' performance in writing and critical thinking. Data were collected from the infusion class in both the pre- and post-intervention stages. It should be mentioned here that the analysis was based on the data obtained only from those students who submitted their writing in both pre- and post-intervention stages in order to minimise the influence of individual differences. 27

students submitted their written texts in the pre-intervention task and 32 students in the post-intervention task; out of this total, 21 submitted in both stages. Therefore, the analysis was based on the written texts of these 21 students.

Overall Writing Proficiency

The students' writing proficiency was revealed by the holistic quality of their writing performance, which was marked using the NCEE rating criteria (see appendix G). Since the types, topics and requirements of the writing tasks in this study were in line with those of the NCEE, NCEE rating criteria (which were also used by the teachers to rate the students' compositions as homework, as well as their writing in the examinations during their high school study) were adopted. The total possible scores ranged from 0 to 25.

The written texts were rated by teacher B (see section 3.6.1), who had attended training for NCEE raters and was familiar with the NCEE scoring criteria. She had also been selected to be a rater for the NCEE in the previous two years (only three teachers at the school had been selected as raters). It should be pointed out that it was impossible to get a second rater for this research, since the teachers were concentrating on their teaching, and were thus not available for rating. It is, however, hoped that the validity and reliability of the results have been enhanced by the contribution of the above-mentioned qualified and experienced rater.

Syntactic Complexity

In this study complexity was measured by mean clause length and the numbers of clauses per T-unit. The mean clause length was calculated by dividing the total number of words by the total number of clauses, and the mean number of clauses per T-unit was calculated by dividing the total number of clauses by the total number of T-units. Although 'longer' or 'more complex' T-units do not necessarily mean 'better' T-units, syntactic complexity still reveals the development of the linguistic repertories that the learners are able to use appropriately to express themselves (Ortega 2003). Although T-units, C-units and AS units can be used as the basic units when analysing the syntactic complexity of language, C-units and AS-units are more often used to analyse spoken language (Foster el al. 2000; Craig 1998). Therefore, this study used the T-unit to analyse the students' written texts.

A T-unit is 'a main clause with all subordinate clauses attached to it' (Hurt 1965: 20). Mehnert (1998) further explains that a T-unit can be considered as a main/independent clause with dependent clauses, phrases and words embedded within it. This study adopted the definitions of Nippold et al. (2005), who defined an independent clause as a complete statement including a subject and a main verb, and a dependent clause as an incomplete statement, which although it includes a subject and a main verb, cannot stand alone.

Syntactic complexity can be measured by mean length of clause or T-unit, or mean number of clauses per T-unit (Ahmadian and Tavakoli 2010; Justice et al. 2006; Foster and Skehan 1996). This study assessed mean clause length and mean number of clauses per T-unit, because the former reveals the use of non-clausal phrases and the latter

reveals the use of dependent clauses (Wigglesworth and Storch 2009). One limitation that should be noted here is that the analysis focuses on syntax level alone, and does not provide insight into other factors such as organisation, coherence and cohesion (Hirano, 1989). However, this was still useful in the present study, since according to the curriculum, Chinese students begin to learn to create sentences containing dependent clauses at high school. It is essential and important to investigate their syntactic development.

The coding of clauses and T-units were performed by the researcher and teacher C following Nippold et al's (2005) and Polio's (1997) guidelines (see appendix H). We sat in the same room and started to code the students' texts. Copies of students' written texts were provided. We coded the same text at the same time individually, and then compared the results immediately. The total number of agreements and disagreements were marked, in order to assess the inter-rater reliability. When there was a disagreement, a discussion took place until an agreement was reached. The final agreements were the final results. Inter-rater reliability was then tested using Miles and Huberman's (1994) formula: inter-rater reliability=number of agreements/ (total number of agreements + disagreements). The results of the test indicated a 97% and 94% rate of agreement on clauses and T-units respectively. The total numbers of words were tallied by the researcher followed by Polio's (1997) guideline (see appendix H). The counting of words was completed by only one counter, since the process was straightforward and less likely to cause bias than the coding process.

Accuracy

In this study, accuracy was measured as the percentage of error-free clauses, which was calculated by dividing the total number of error-free clauses by the total number of clauses. It is important to investigate the accuracy of L2 writing, since it reveals whether or not students can use grammatically correct sentences to express their ideas in the target language. There are three main types of measures of accuracy: holistic scales, error-free clauses or T-units and error counts.

Some studies have assessed accuracy by employing a holistic scale (Polio 1997; Tarone et al. 1993; Hamp-Lyons and Henning 1991). Tarone et al.'s study rated accuracy on a scale of one to six. They provided a description of each scale item: for example, 6: essentially no errors in a pretty complete range; 5: wide range correctly used for the most part. Although to date no standard scale has been established, this type of measure is easy to use with clear descriptions of the scale items. One limitation of this type of measure, however, is that different raters may have a different understanding of and different judgements for each scale.

Other studies have counted the number of errors in each text; some of these studies are based on an error categorisation system (Chandler 2003; Frantzen 1995), while others are not (Kepner 1991). One limitation of using this measure is that some errors identified by one rater may not be considered as errors by other raters (Chandler 2003). Moreover, this type of measure fails to investigate the distribution of the errors, since one text may include 10 errors, but contain no error-free sentences, while another may include more errors, but contain several error-free sentences.

Another method is to count the number of error-free clauses or T-units. This study employed this type of measure and calculated the percentage of error-free T-units in each text. This method has been used in previous studies and been shown to be appropriate for judging the quality of students' writing (e.g., Ellis and Yuan 2004; Ahmadian and Tavakoli 2010). It is a more objective measure than the holistic scale. It is also more useful and clear, as distinct from syntactic complexity, since a text can be full of error-free T-units, but use simple sentences (Pilio 1997). However, one limitation is that this measure cannot distinguish between one and more than one error per T-unit.

Error-free clauses were also coded and counted by the researcher and teacher C (see section 3.6) using a similar process to that used in coding clauses and T-units (see the above paragraphs on 'Complexity' in this section). Polio's (1997) guideline for errors, which was designed to assess ESL writing (see appendix H), was adopted with minor changes. For example, this study took spelling errors into account, since these can influence the quality of writing and are crucial in L2 learning; spelling errors were not, however, counted by Polio. The inter-rater reliability rate of agreement for coding error-free T-units was determined at 91% rate of agreement. This indicates a high level of reliability, and it was hoped that this process would enhance the validity of the findings.

Fluency

Fluency of writing refers to the 'rate of production of text' (Chenoweth and Hayes 2001: 80). Connelly et al. (2007) explained that the definition of fluency could lead to different conclusions: in other words, the fluency of writing could be assessed by the length of the writing, or by the speed of flow of the language. Thus, fluency of writing can often be assessed by the average number of words, T-units and clauses per text produced over a given span of time (Wigglesworth and Storch 2009), or by the amount of time the writer took to produce a writing task of which the length was stipulated (Chandler 2003).

The former was deemed to be the more appropriate method for the present study, since no limit was placed on the number of words, in order to allow the students to produce all ideas they wanted to write down or that they thought were important. Therefore, this study assessed the average number of words produced in 30 minutes (see section 3.8.2). One limitation is that this measure investigated the fluency of writing holistically, but did not take into account how much time the writers took to think about the topic, create expressions in language, or the speed of their handwriting. The numbers of words in each text were counted by the researcher, as described above (see 'Syntactic complexity').

As mentioned above, the total numbers of words were counted by the researcher of the study.

The Frequency of Using Critical Thinking in Writing

The intention was to adopt Stapleton's (2001) model for this research. However, high school students' writing focuses on the expression of personal ideas, rather than on responses to controversial issues as in the case of argumentative writing. Stapleton's model was thus not suitable to use in its entirety. An adapted version that combined elements of Stapleton's model and Paul and Elder's (2007) five acts (see chapter 2, section 2.4.3), with minor changes, was therefore developed to identify the relevant elements of critical thinking in the substantive writing of the students who took part in this study. This allowed the researcher to assess the students' critical thinking and writing in the same written works, and thus to determine whether or not they use critical thinking in their actual practice, and how critical thinking could actually help them to articulate their ideas.

After reading the students' written texts, the researcher categorised four main functions of critical thinking in their writing, namely: proposing points, providing reasons, clarifying reasons and drawing conclusions. The frequency of use of critical thinking was therefore calculated by identifying these elements. Before explaining how these elements were identified, the common structure of the students' writing is illustrated in Figure 3.2 below.

Figure 3.2 Structure of Students' Writing
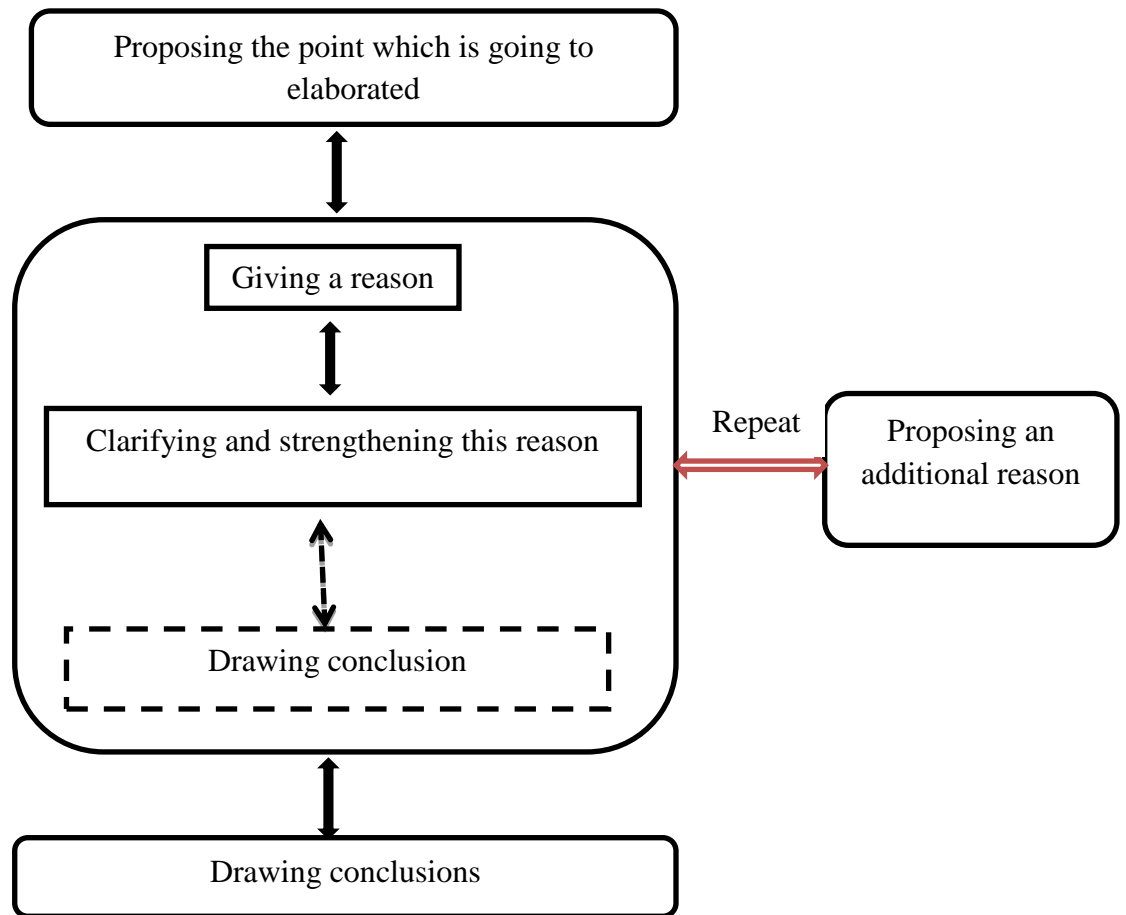
As shown in Figure 3.1, a point is proposed at the beginning of the writing. This is followed by a paragraph of discussion giving a supporting reason, which includes a statement of the reason with further clarifications. When the writers wish to provide more reasons, they repeat the process of stating a reason in the next paragraph. Sub-conclusions may be drawn at the end or after discussion of a reason or reasons. Some writers write about more than one point. In such cases, they present and elaborate their points one by one using a structure similar to that described above. The last sentence or paragraph is the conclusion. This clear structure of students' writing makes it easy to investigate how they used critical thinking to articulate their ideas.

For the purposes of this research, a 'point' was defined as a statement carrying information about personal views and ideas. In substantive writing, the key point proposed is always the result of selection and decision making, which involve the use of relevant critical thinking skills (Paul and Elder 2006, see chapter 2, section 2.4.3). A point is often introduced by using the markers 'I think' (Stapleton 2001). An example of a point made in one of the texts examined in this study is: 'I think that I want to be a fashion designer in the future'. Some students proposed more than one point: for example, 'I think I have learned lots of things, but three of them are the most important. Firstly, we should work hard in order to achieve our goals. … Secondly, we should be patient… Thirdly, we should learn how to get along with others'. In this case, this student provided three points.

A reason is a statement supporting the point (Stapleton 2001). It follows the point and can often be identified by the indicator words 'because' or 'the reason is' (Alagozlu 2007). An example of a reason in this study is: '(I think that I want to be a fashion designer in the future.) I will be able to design many different types of clothes for different types of people' (Please note: some alterations have been made to the students' English for the sake of clarity).

Students clarified their reasons in many ways, of which five ways can be linked to critical thinking: by presenting personal experience, providing examples, citing famous sayings, providing philosophical explanations and by precisely defining words. Among these ways, presenting personal experience and precisely defining words were adopted from Stapleton (2001), while providing examples was taken from Paul and Elder (2007). 'Philosophical explanation' in the present study was modified from 'logical

explanation' in Stapleton's model. The data obtained for this study suggested that 'philosophical' was more appropriate, since these statements were used by the students to explain the philosophical relationship between two phenomena (see example below, cited from students' writing in the present study). 'Citing sayings' in this study refers to proverbs and quotations from well-known people (see example below). Although these techniques differ in their strength, their presence revealed the students' recognition of the fact that an opinion or argument should be based on sound reasoning, thus reflecting the use of critical thinking (Stapleton 2011). Examples (all are cited from students' writing in the present study) are as follows:

- Personal experience: 'I was not good at maths. Sometimes I could not understand what the teacher said in class, so I could not finish the homework. I studied harder and harder. My maths improved through being hard-working'.

- Providing an example: 'I knew I should learn to be brave when I did not get along well with my friends, when I did not pass the test, when I was criticised by teachers, when I felt upset, when I found out how difficult it is to learn maths, when the first time came to hold a class meeting, when it was the first time to give a speech'.

- Citing sayings: 'No pain, no gain'; 'Helen Keller said: 'Toleration is the greatest gift of the mind.'

- Philosophical explanation: 'Those who win in the end are those who believe in themselves'.

- Precisely defining words: 'Persistence means the act of continuing to try to do something despite difficulty'.

A conclusion is a statement which is generalised from the previous discussion, in order to summarise the author's ideas, or concerning the main purpose of proposing the previous points and ideas (Cottrell 2005). It should be pointed out that a conclusion is not necessarily drawn at the end of a composition; it can also demonstrate the result of a writer's evaluation of an opinion: for example, 'quote people say: no pain, no gain. I agree with that'.

Stapleton (2001) pointed out that this method focuses on the number of critical thinking elements, in other words, the frequency of using critical thinking, without revealing the quality. It is however, useful for this study, since it reveals the students' willingness to use and performance in using critical thinking in their L2 writing practices.

The process of coding the data was completed by the present researcher and teacher A. As before, we both began to code the same text (by using copies of the text), and then compared the results once the coding of a piece of text had been completed. The number of agreements and disagreements were marked. Agreement was reached through discussion in cases of difference between the two of us. The numbers of points, reasons, clarifications and conclusions in each piece of writing were counted, and the results are displayed in bar charts to show changes in the students' use of critical thinking in their writing before and after the intervention. The inter-rater reliability rates of agreement for coding the points, reasons, clarification of reasons and conclusions were determined at 98%, 97%, 92% and 97% respectively.

3.9.3 Self-evaluation of Group Discussion

A self-evaluation questionnaire was used to assess the students' thinking performance in group discussions and their attitudes towards it. Data were collected from 16 students in weeks one, four, seven and ten. The aim was to reveal any changes in the students' performance throughout the intervention. Descriptive analysis was used to produce a mean score for each item, and the results are presented in bar charts. It was not appropriate to analyse the data using SPSS, since the number of respondents was less than 30 (Field 2009). Thus, the analysis was conducted using Microsoft Office Excel.

3.9.4 Interview and Post-intervention Questionnaire

The interview and post-intervention questionnaire data were both used to investigate the students' attitudes towards and perceptions of the infusion lessons. The interview data to be analysed were collected from two groups, while the questionnaire data were obtained from the responses of 37 students (a response rate of 78.72%).

Content analysis, which is 'a set of procedures to make valid inferences from text' (Weber 2004: 117), was used in this research. This study used directed content analysis, the aim of which is to 'validate or extend conceptually a theoretical framework or theory' (Hsieh and Shannon 2005: 1281). Directed content analysis usually begins with deductive coding (Mayring 2000). Existing studies provide predictions about the variables of interest, and help to focus the interview and questionnaire questions and generate the initial themes from the data. This can help the researcher to read the transcription of the data, and the coding can begin with these initial themes.

Researchers who use a deductive coding method may argue that the inductive method is less objective, since they develop the themes before collecting the data. However, the inductive method is more open-minded, and all information and ideas that emerge from the data are valued; thus this method is also known as open coding (Sarantakos 2005). Therefore, in this study, an inductive coding method was used to generate sub-themes after the researcher's initial reading of the data (Epstein and Martin 2004).

The data were coded by the researcher, and the results were checked by teacher A. Since the students were interviewed and answered the questionnaire in Chinese, the interview data were first transcribed in Chinese, and analysed in Chinese along with the questionnaire data. Finally, the results were translated into English by the researcher, and the translation was checked by teacher A.

In the preceding sections the methods and processes of data collection and analysis have been described. In the paragraphs below, issues of reliability and validity, and thus the possibility of generalising from the results of this study, will be examined. This is followed by a brief discussion of how participants' rights and well-being were considered in the process of data collection for this research.

3.10 Reliability and Validity

Although a case study design can have considerable value in social research, a systematic evaluation of its reliability and validity is needed. In a case study, four criteria are commonly adopted to assess the rigour of the study; these are internal

validity, construct validity, external validity and reliability (Yin 2009; Riege 2003; Denzin and Lincoln 1994). According to Cohen et al. (2007) and Lopez et al. (1990) and reliability is the necessary precondition of validity. Therefore, it is more useful to examine reliability first.

3.10.1 Reliability

Reliability concerns the likelihood of similar results being obtained if the study was repeated (Payne and Payne 2004). It refers to whether or not similar results will be obtained if the data collection procedures and data analysis process are repeated with the same participants. The aim of ensuring reliability is to reduce researcher bias and enhance validity (Yin 2003).

The design of the data collection instruments can influence the reliability of a study. Establishing the internal consistency of multiple items can help to ensure reliability; this refers to whether 'each respondent's answers to each question are aggregated to form an overall score' (Bryman 2012: 170), which means that all items in one test or questionnaire should be indicators of the target phenomenon, and that all these indicators should be related to one another. The internal reliability of the CCTDI and CCTST has been tested in previous studies and satisfactory results obtained (see section 3.8.1). The self-evaluation questionnaire was adapted from Dawes at al. (2000), but it has not been widely used in other studies. Its internal consistency has thus not been established. The findings from the self-evaluation questionnaire therefore need to be carefully considered. As mentioned earlier, this study used the Chinese versions of the CCTDI and CCTST. The self-evaluation questionnaire was also translated into

Chinese and presented along with an English version. It is hoped that this increased the reliability of the data by providing a clear and comprehensive explanation to the respondents (McDonough and McDonough 1997).

In the data collection process in the present study, the students were required to complete the writing tasks independently in class, so that data of a high level of reliability could be collected from their written texts. At the same time, it allowed the students to decide whether or not to submit their works, since some students may have had a sloppy attitude towards completing writing tasks they had been compelled to perform. This strategy was also applied to the all data collection procedures to enhance the reliability of the data, and at the same time deal with ethical issues (see section 3.11).

The interview data were collected on the same day of the last infusion lesson to elicit the students' actual attitudes while their memories were still fresh. However, the reliability of these data may have been impaired by the questioning skills of the inexperienced interviewer (researcher) and the scheduling of the interviews. This was the first time the researcher had acted as an interviewer, and her questioning skills may not have been good enough to stimulate active responses, or to create an interactive environment for the group interviews. As mentioned in section 3.8.4, this may influence the quality of interview data. Moreover, as Kumar (2004) and Silverman (2006) propose, the contribution of interviewees can also influence the quality of data. In this study, the students were interviewed in the week before their final examinations, and they were preoccupied with their studies. Although they had volunteered to be

interviewed, they provided short answers, and thus the quality of the interview data might also have been influenced by their relatively poor contribution.

The self-completion questionnaire was sent to the students by email after their final examination, with one week allowed for them to return it. This was done in order to obtain more information about the students' attitudes. However, it was sent three weeks after the last infusion lesson when the winter vacation had already begun. When reading the responses, it was thus necessary to take into account the fact that some information may have been missing since some of the students may have forgotten it, and also that some of the students may have completed the questionnaire in a sloppy manner.

When analysing written data, employing more than one rater or coder can enhance internal reliability (Bryman 2012; Mays and Pop 1995). In this study, the coding of clauses, error-free clauses and T-units was completed by two coders, and the inter-rater reliability was above 90% (see section 3.9.2), which is a high level of reliability. The reliability of the scores for the students' writing proficiency may have been reduced by the fact that only one rater was employed. However, it was hoped that the careful selection of an experienced and qualified rater and the use of standardised criteria enhanced the reliability of the results (see section 3.9.3). The interview and self-completion questionnaire data were coded by only one rater - the researcher, and the themes were also developed by her. Research bias may have impaired the objectivity of the results (Fine et al. 2009). Nevertheless, the results were crosschecked by teacher A, with the aim of minimising the influence of any bias.

The tool used to analyse the use of critical thinking in the students' writing was developed by the present researcher based on the rubrics for analysing elements of critical thinking in writing proposed by Stapleton (2000) and Paul and Elder (2007). It was expected that the reliability of the results would be improved by the use of two raters, as discussed above. The inter-rater consistency was 89%.

3.10.2 Validity

Validity refers to the correctness of results (Payne and Payne 2004). Validity concerns not the data, but the conclusion drawn from them (Creswell and Miller 2000). In assessing the validity of a case study, the following three types need to be considered.

Internal Validity

Internal validity refers to establishing 'the causal relationships between intervention and outcome' (Lee et al. 2010: 684); in other words, demonstrating that it is the intervention which has led to the final outcome. The use of multiple sources of data can increase the internal validity of a study (Lee et al. 2010; Yin 2009). The internal validity of the present study was enhanced by the use of data triangulation; this makes it possible to confirm, cross-validate or corroborate the results obtained from a single case study (Creswell 2004). For example, the students' critical thinking was assessed directly through the CCTST and CCTDI, and their written texts and their self-evaluations of the group discussions would reveal whether or not and how they used critical thinking in actual practice. Cross-validation could then be accomplished by

examining whether or not the changes suggested by the results of the CCTST and CCTDI could also be seen in their writing and group discussions.

Construct Validity

Construct validity addresses whether or not the 'full content of a definition is represented in a measure' (Neuman 2012: 123). In other words, it concerns whether or not a study has investigated what it claims to have investigated. This refers to the extent of reliability of the data collection instruments, which was discussed above in section 3.10.1. It should be pointed out that this study was conducted by a single researcher, and so researcher bias may have influenced the data analysis and interpretation. It was hoped that using mixed methods, as suggest by Gibbert et al. (2008), would enhance the construct validity of the study. It allowed the researcher to investigate the phenomenon from different angles, and thus minimise researcher bias.

External Validity

External validity refers to the generalisation of the results of a study, and addresses 'how consistent findings are in similar contexts' (Lee et al. 2010: 684). It decides the scope of possible generalisation of a study's results (Yin 2009). External validity can therefore be enhanced by carefully selecting suitable samples. This study used purposive sampling, with the aim of selecting a sample that was representative of the target population. The results of this study may be useful for high school ESL teachers, especially for teachers in Asian countries which share a similar culture and educational situation. Moreover, Antonius (2002) claimed that when considering the possibility of generalising statistical results, it is useful to determine whether the sample followed a

normal distribution pattern, since if it does, the sample mean is more likely to represent the population mean (Bryman 2012). This study thus employed a Normality Test to examine the data obtained from the CCTDI and CCTST by using SPSS. The results are presented in Tables 3.5 and 3.6 below.

Table 3.5 Tests of Normality of CCTDI

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-CCTDI- IC	.065	47	.200[*]	.969	47	**.248**
Post-CCTDI- IC	.075	47	.200[*]	.961	47	**.123**
Pre-CCTDI-TTC	.085	42	.200[*]	.993	42	**.995**
Post-CCTDI-TTC	.113	42	.200[*]	.965	42	**.220**

(Note: IC=infusion class, n=47; TTC= traditional teaching class, n=42)

Table 3.6 Tests of Normality of CCTST

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pre-CCTDI- IC	.121	47	.082	.968	47	**.221**
Post-CCTDI- IC	.122	47	.076	.962	47	**.128**
Pre-CCTDI-TTC	.134	42	.054	.970	42	**.318**
Post-CCTDI- TTC	.093	42	.200[*]	.984	42	**.829**

(Note: IC=infusion class, n=47; TTC= traditional teaching class, n=42)

Since the sample size was less than 2000, the Shapiro-Wilk statistical test was used to assess normality. As shown in Table 3.4, the p-values of both classes in pre- and post-intervention tests were higher than 0.05 ($p=0.248$, 0.123, 0.995 and 0.220). Similarly, as shown in Table 3.4, the p-values were also higher than 0.05 ($p=0.221$, 0.128, 0.318 and 0.829). Therefore, the results of both the CCTDI and CCTST followed a normal distribution pattern.

Berg (2007) points out that no matter whether the result of a single case study is correct or incorrect, it should be considered carefully, since social scientists seldom accept the findings of a single study. Therefore, it requires corroboration by further studies.

3.11 Ethical Issues

Neuman reminds social researchers that when conducting their research, two sets of values need to be balanced. These are 'the pursuit of knowledge' and 'the rights of research participants' (Neuman 2012: 53). To conduct research professionally, the researcher needs to design and choose techniques properly, and also to take into account the ethical implications of research activities. These issues are mainly concerned with avoiding harm to participants and obtaining informed consent (Bryman 2008; Diener and Crandall 1978).

When conducting research, any harm to participants should be avoided (Neuman 2012). Taking part in research may harm participants physically, or cause harm to their

development, or place them in a highly stressful situation (Bryman 2001). In fact, physical harm is rare in educational research (Neuman 2012). This study avoided harm to participants' development by carefully designing the infusion lessons using their textbook and following the English syllabus and curriculum. Moreover, at the beginning of the study, high levels of stress were avoided by providing enough time for the participants to complete the tests, and they were told they could withdraw from the study whenever they wanted. Participants were also informed that the data would remain anonymous.

To respect the rights of the school, permission was first obtained from the headmaster of the school and the tutor of the class (teacher A, who was also the English teacher who taught the infusion lessons). Next, the purpose of the study and the data collection procedures were explained to the participants and oral consent obtained from the students. The tutor then explained this to the students' parents at the monthly parent-teacher meeting, and the approval for the students' participation was also gained from them. Informed consent forms (see appendix A) were signed by the students the next day.

3.12 Summary

This chapter has shown that the researcher in this study assumed the ontological, epistemological and axiological position of pragmatism to conduct an evaluative exploratory case study, and that a mixed-methods approach was adopted to enhance the validity and reliability of the results. The selection of participants (two classes of students from the same Chinese high school) was described. The methods of collecting

data from the CCTDI, CCTST, students' written texts, self-evaluation questionnaires, semi-structured group interviews and a self-completion questionnaire have also been discussed in this chapter. The collected data were analysed using a variety of measures and in different ways to allow for the triangulation of the findings. Finally, issues of validity, reliability and ethical issues relevant to this study were examined. In the following chapter, the findings will be examined in detail.

Chapter Four –Findings

4.1 Introduction

In the previous chapter the data collection tools and methods of data analysis used in this study were evaluated. In this chapter the findings of the study are presented according to the research questions, which refer to the impact of infusion lessons on the critical thinking and writing of Chinese high school students and on their attitudes towards and perceptions of these infusion lessons.

As discussed in chapter 3, in this study the quantitative and qualitative data were combined to allow for cross-validation. As shown in Table 3.4 (see chapter 3, section 3.9), the changes in students' critical thinking were assessed mainly by the CCTDI, CCTST and an examination of their written texts, while any changes in the students' writing performance were determined by an examination of their written texts alone. At the same time, the changes in thinking and writing could also be corroborated by data collected from the interviews, self-evaluation questionnaires (SEQ) and post-intervention questionnaires (PIQ), which were mainly used to reveal their attitudes towards and perceptions of infusion lessons.

It is worth pointing out here that the sample number for some of the data collection instruments was reduced, as mentioned in chapter three (see sections 3.9.2 and 3.9.4). There were three reasons for this reduction. Firstly, for ethical reasons, the researcher

did not force the students to complete or submit their writing. As found in previous studies (see section 1.4), high school students have demonstrated negative attitudes toward English writing, so some of the students might have been unwilling to write in English or to share their writing when it was not required. In the analysis of writing, therefore, in order to minimise the influence of individual differences, only data obtained from those students who submitted both pre- and post-intervention written texts were used (see section 3.9.2 in chapter three). The second reason was related to the timing of the data collection. The post-intervention questionnaire was collected at the beginning of the winter vacation, which was two weeks after the last infusion lesson, owing to the final examination. The students might have been tired and wanting to have a good rest, and thus less interested in completing the questionnaire. The other reason is related to the limitations of sending the questionnaire by email. As indicated in chapter three, one limitation of this self-completion questionnaire sent by email is the low response rate (see section 3.8.5). However, since the students were taking their final examinations in the week following the last infusion lessons, the questionnaire was sent by email in the first week of the winter vacation to allow them to prepare for the exam. The reduction in the number of the sample may have influenced the results of this study in some ways: for example, the thinking and writing performance and the attitudes and perceptions of the students who were missed out could not be revealed.

4.2 Effects on Critical Thinking

This section presents the results pertaining to the effects of the infusion lessons on critical thinking, including the students' perceptions of the effects on their thinking, effects on critical thinking dispositions and effects on critical thinking performance.

4.2.1 Students' Perceptions of the Effects on Thinking

The data obtained from the interviews and post-intervention questionnaires (PIQ), indicated that the students held positive attitudes towards the impact of the infusion lessons on their thinking, in terms of an increased motivation to engage in thinking, the establishment of an appropriate attitude towards critical thinking, and an improvement in their thinking abilities.

The interview and post-intervention questionnaire data revealed an increased motivation to engage in thinking, in other words, an increased disposition toward critical thinking (see chapter 2, section 2.2.1). This was reported by two students (out of ten) in the interviews (see Interview1 below), and supported by 27.73% students (11 out of 37) in responses to the questionnaire. These students became more active in engaging in thinking, and thus they took advantage of more opportunities and spent more time on thinking (see PIQ1 and PIQ2: PIQ1=first example cited from post-intervention questionnaire data, Q6=response to question 3, S6=Student 6). This was confirmed by data obtained from their self-evaluations of group performance, which revealed an increased active involvement in group discussion during the intervention (see section 4.2.2).

(Interview 1): 'I am more active to engaging in thinking'.

(PIQ1-Q6-S6): 'I think about the question asked by teacher in class, even though the teacher did not ask me to answer it.'

(PIQ2-Q6-S17): 'I think I know how to think now. Sometimes it takes longer, but I can think of some useful things.

The students also showed that they had established an appropriate attitude toward critical thinking, in that they now realised that judgements should be based on sound reasoning (see chapter 2, section 2.2.1). In the post-intervention questionnaires, 16.22% students (6 out of 37) acknowledged their inclination to evaluate the ideas of others based on their explanations and reasoning, and 29.73% (11 out of 37) reported that they provided reasons to support their own ideas in order to convince others. For example, S4 had begun to make judgements regarding others' ideas based on their further explanations, rather than accepting them straight away (see PIQ3). S10 had recognised the need to support his own ideas by reasons (see PIQ4). Evidence of this can also be found in their writing, in which they tended to use the critical thinking marker 'I agree' to indicate their evaluation, and they were able to give a wider variety of reasons to strengthen their ideas (see section 4.2.3).

> (PIQ3—Q6-S4): 'I expect others to explain their ideas to me, providing some reasons, not just provide the point. Then I make my personal decision. Maybe he is right and maybe not.'

> (PIQ4—Q6-S10) 'I learned one thing, that we need reasons when we propose our ideas, or nobody will believe you.'

The majority of students believed that their thinking ability had increased. This was reported by six students (out of ten) in the interviews (see interview 2 below), and 23 (out of 37, 62.16%) respondents to the post-intervention questionnaire (see PIQ5 below). The students perceived that thinking was less difficult for them, and that they were more able to clarify and explain their ideas.

> (Interview 2): 'My thinking has been improved. I found that thinking about the questions and topics was easier than before.'

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(PIQ5-Q6-S36): 'It is less difficult for me to think of different ideas, and I can clarify them by explaining why I said that, or why this is important or helpful.'

Specifically, a few students perceived that they could think from different perspectives. This was reported by two students (out of 10) in the interviews (see Interview 3), and confirmed by 16.22% of the students (six out of 37) in their post-intervention questionnaire responses. For example, S31 stated in the questionnaire that being able to think from different perspectives was the greatest benefit of the infusion lessons (see PIQ6). This can be attributed to the Six Thinking Hats task, which was voted the most helpful thinking task by the students because it developed their ability to think from different perspectives (see section 4.4.3).

(Interview 3): '(I know) how to think from different perspectives.'

(PIQ6-Q6-S31): 'The greatest benefit (of infusion lessons) is now I can think from different perspectives, just like (what we did in) The Six Thinking Hats'.

Some students perceived their increased ability in reasoning, as two students (out of 10) mentioned in the interviews (see interview 4 below), and eight students (out of 37, 21.62%) in their responses to the post-intervention questionnaire (see PIQ7 below). They were more able to explain their ideas by providing supports.

(Interview 4): 'I think I am better in providing reasons. I can explain my ideas, and I think it is important'.

(PIQ7-Q6-S33): 'My improvement in thinking is I know how to strength my ideas, and I think my performance is better and better'.

4.2.2 Effect on Critical Thinking Dispositions

Data obtained from the self-evaluation questionnaire, students' written texts and the CCTDI revealed that the students' disposition to think critically had improved after the teaching intervention. The students' self-evaluation questionnaires were collected during the intervention in weeks one, four, seven and ten. The data were used to investigate their involvement in the thinking tasks, which according to Halpern (1998) can reveal critical thinking dispositions. The students' writing was collected from the infusion class in both the pre- and post-intervention stages. These data could also be used to determine any change in the students' disposition to think critically by calculating the frequency of use of critical thinking in their essays. The CCTDI was collected from both the infusion and the traditional teaching class in pre- and post-intervention stages; the results were analysed to determine whether or not there were significant improvements in critical thinking dispositions in each class, and whether or not there were significant differences between the improvements of the students in the two classes.

Overall, the results revealed a gradual increase in the students' active involvement in the thinking tasks, an increased frequency in their use of critical thinking in writing, and increased scores in the CCTDI, suggesting that infusion lessons can help to increase the students' disposition to think critically. A comparison between the results of the improvements in CCTDI scores of the infusion class and the traditional teaching class revealed a greater improvement in the former than in the latter, suggesting that

infusion lesson can also accelerate the development of students' critical thinking disposition.

The self-evaluation questionnaire data are presented first to reveal the students' involvement in thinking tasks during the intervention; this is followed by a comparison between the frequency of use of critical thinking in their writing in the pre- and post-intervention written texts. The results of the CCTST are then examined to show the improvements in critical thinking disposition in the infusion class and the traditional teaching class, and the difference between these improvements.

Self-evaluation of the Involvement in Thinking Tasks

During the intervention, the students reported a gradual increase in their disposition to think critically. Figure 4.1 presents the results of the students' self-evaluation of their involvement in the thinking tasks in weeks one, four, seven and ten. Generally, the students became more and more satisfied with their performance between week one and week ten, in terms of talking in their groups, and asking and answering questions. Their responses to talking in groups (see SEQ1) and answering questions (see SEQ3) changed from being slightly dissatisfied to slightly satisfied. This suggests that the students became progressively more active in engaging in the thinking tasks, and consciously involved themselves in the tasks, indicating a gradual increase in their disposition to think critically. Four findings are of particular interest, and these are discussed below.

Figure 4.1 Self-evaluation of Individual Involvement in Group Discussion

(1=very unsatisfied, 2= unsatisfied, 3=slightly unsatisfied, 4=slightly satisfied, 5=satisfied, 6=very satisfied)
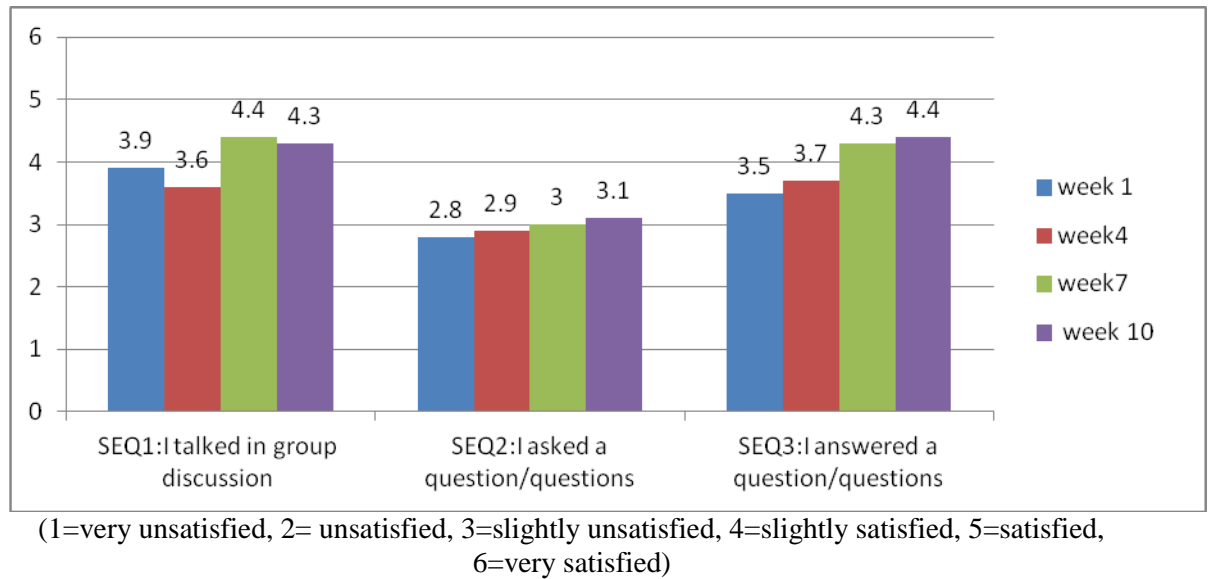
Firstly, the change in responses to SEQ1 'I talked in the group' was uneven. Slight drops can be found in weeks four and ten. This may be attributed to the thinking tasks themselves. The task in weeks four and ten (Fact or Opinion, see chapter 2, section 2.5.3 and appendix C) was considered to be the most challenging one by the students, according to their responses to the post-intervention questionnaire and in the interviews (for details see section 4.4.3).

Secondly, although there were slight drops in the response ratings for SEQ1 during the intervention, the students' satisfaction with their related performance showed an upward trend. This result indicates that the students were persistent in engaging in the thinking tasks, even though they were challenging for them, and thus reflected their increased dispositions toward critical thinking.

Further, although sustained growth can be found in the responses to 'I asked (a) question/questions' from weeks one to ten, the changes were small and by the last

lesson the students still felt dissatisfied (see SEQ2 in Figure 4.1). One possible reason for this may be their lack of awareness of asking questions, since questioning skills were not included in the lesson instructions.

Although the students were not good at asking questions, it was surprising to find that they were inclined to answer the questions (see SEQ3 in Figure 4.1). An upward trend was found in the students' responses to SEQ3, which suggests that their inclination to interact with others increased over the course of the intervention.

The Frequency of Use of Critical Thinking in Writing

As mentioned in chapter 2 (section 2.2.1), critical thinkers are those who make an active choice to think in this way, and thus calculating the frequency of use of critical thinking by the students in the current study could reveal their dispositions to think critically. The analysis of the students' writing supports the findings from the self-evaluation questionnaires presented above, revealing that they used critical thinking to elaborate on their ideas more frequently after the intervention, indicating an increased disposition towards critical thinking.

Figure 4.2 below shows the frequency of use of critical thinking in the pre- and post-intervention writing tasks. The students used critical thinking for four main purposes: proposing points and reasons, clarifying and strengthening their reasons, and drawing conclusions. The total number of points and reasons proposed increased similarly by 4 (25 in pre-intervention and 29 in post-intervention texts) and 6 (31 in pre-intervention and 37 in post-intervention texts) respectively. This implies that the students always

remembered to provide reasons to support their points. The frequency of their use of critical thinking to clarify their reasons had increased by 19 in the post-intervention written texts, and the average frequency had increased by nearly one per text. This indicates that the students were more likely to use reasoning skills in their writing. The total number of conclusions drawn in their post-intervention written texts remained roughly the same as that in their pre-intervention texts (with a total number of 25 in the former and 24 in latter). Although the frequency of use of critical thinking for different purposes differs, these findings indicate increased dispositions to use critical thinking on the part of the students, and at the same time, also imply that they were more capable of using critical thinking. A discussion of how the students used and demonstrated their critical thinking in their writing is presented in section 4.2.3.

Figure 4.2 Frequency of Use of Critical Thinking in Writing
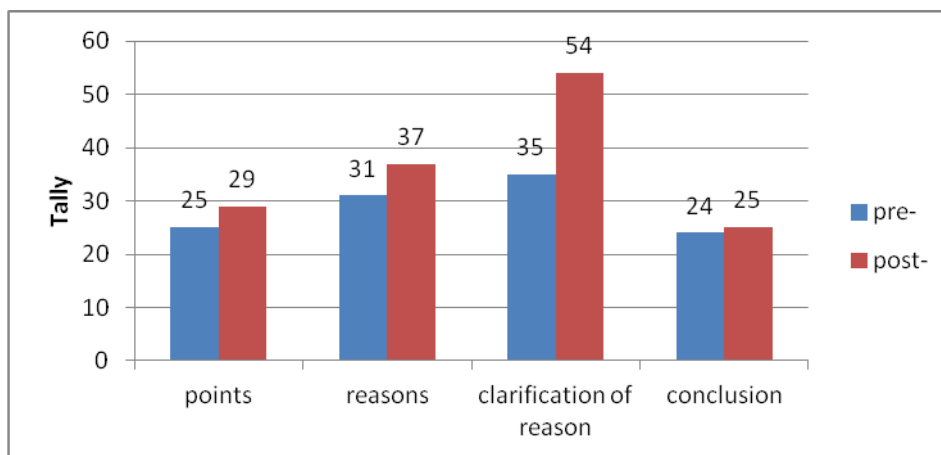
Disposition measured by CCTDI

The results of the Paired Samples T-test showed that the disposition to think critically of students in the infusion class had increased significantly (see Table 4.1) in terms of 'truth-seeking' (M=3.34, t (46) =4.23, p<0.01) and the overall CCTDI score (M=10.47,

t (46) =3.48, p=0.01). No significant improvements were found in the comparative class (see Table 4.2), and a statistically significant (t (41) =-2.55, p<0.02) decline in 'analyticity' was found among the students in this class. These results reveal that the critical thinking dispositions of students in the experimental class had improved after the teaching intervention, while the students in the comparative class remained generally the same, with a slight decrease being found in 'analyticity'.

Table 4.1 Comparison of Pre- and Post-CCTDI of Infusion Class

CCTDI	Infusion Class						
	Pre-test	Post-test	M (gain)	SD	t	df	P
Truth-seeking	35.75	39.09	**3.34**	**5.08**	**4.23**	**46**	**0.00**
Open-mindedness	40.98	42.28	1.30	6.33	1.41	46	0.17
Analyticity	35.06	34.70	-0.36	5.32	-0.47	46	0.64
Systematicity	35.47	38.11	2.64	5.64	3.23	46	0.22
Self-confidence	25.14	26.57	1.43	5.88	1.67	46	0.10
Inquisitiveness	29.23	30.55	1.32	4.76	1.90	46	0.06
Maturity	37.75	38.55	0.81	6.97	0.80	46	0.43
Total	239.38	249.85	**10.47**	**20.77**	**3.48**	**46**	**0.01**

(Note: infusion class, n=47)

Table 4.2 Comparison of Pre- and Post-CCTDI of Traditional Teaching Class

CCTDI	Comparative Class						
	Pre-test	Post-test	M (gain)	SD	t	df	P
Truth-seeking	38.33	38.74	0.41	7.60	0.40	41	0.22
Open-mindedness	41.14	42.41	1.26	9.70	0.85	41	0.55
Analyticity	36.62	34.33	**-2.29**	**5.81**	**-2.55**	**41**	**0.02**
Systematicity	37.21	37.41	1.62	5.20	1.86	41	0.91
Self-confidence	23.26	24.67	1.40	5.39	1.69	41	0.10
Inquisitiveness	30.17	31.43	1.21	6.11	1.34	41	0.19
Maturity	37.74	37.57	-0.17	8.40	-0.13	41	0.90
Total	243.05	246.55	3.50	30.27	0.75	41	0.60

(Note: traditional teaching class, n=42)

Two findings are worthy of note here. Firstly, the students in both two classes obtained the highest mean score for 'open-mindedness', and the lowest score for 'self-confidence', and the mean scores of these two sub-scales for both two classes remained roughly the same in pre- and post-tests. On the one hand, the students were already extremely open-minded before the intervention (see the CCTDI scoring system in chapter 3, section 3.8.1), and thus their responses to 'open-mindedness' did not show a significant change. On the other hand, the low score for 'self-confidence' revealed that they lacked confidence in their reasoning skills (for a description of the scales see appendix D). With regard to the traditional teaching class, the fact that they remained unconfident about their critical thinking may be attributed to their poor understanding and skills. With the infusion class, the possible reason is the fact that they had established an appropriate attitude towards sound critical thinking (see section 4.2.1), and thus they had higher expectations of their reasoning powers. Evidence can also be found in their writing that they tended to support their ideas in more logical and powerful ways (see section 4.2.3).

At the same time, from the results shown in Tables 4.1 and 4.2, it can be seen that the changes in the infusion class showed consistent increases in all sub-scales, while the changes in the sub-scales of the traditional teaching class were uneven For the latter, the mean scores for 'truth-seeking', 'open-mindedness', 'systematicity 'and 'inquisitiveness' increased, while the scores for 'analyticity' and 'maturity' decreased. This implies that the infusion lessons made a positive contribution to the development of critical thinking dispositions for students in the infusion class.

An Independent Sample T-test was then used to compare the pre-and post-test results of the infusion class with those of the traditional teaching class. The results displayed in Table 4.3 show that a significant difference was found for 'truth-seeking' (infusion class M=3.34, SD=5.41; traditional teaching class M=0.41, SD=7.74, t (87) =2.01, p<0.05). This indicates that improvement in students' critical thinking disposition can be accelerated by their taking infusion lessons. Although the difference was only significant for 'truth-seeking', the results presented in Table 4.3 still reveal that the students in the experimental class had generally improved more in the post-test CCTDI, and suggest that the teaching intervention had accelerated the development of the students' critical thinking disposition. This result could also be taken to imply that an even more significant improvement would be found in the infusion class after a longer intervention.

Table 4.3 Comparison of Gain in CCTDI in Infusion and Traditional Teaching Classes

CCTDI	Difference in gain					
	IC	TTC	M (difference)	t	df	P
Truth-seeking	3.34	0.41	**2.94**	2.01	87	**0.04**
Open-mindedness	1.30	1.26	0.04	0.02	87	0.98
Analyticity	-0.36	-2.29	1.92	1.63	87	0.11
Systematicity	2.64	1.62	1.02	0.85	87	0.40
Self-confidence	1.43	1.40	0.02	0.02	87	0.97
Inquisitiveness	1.32	1.21	0.06	0.05	87	0.96
Maturity	0.81	-0.17	0.96	0.60	87	0.55
Total	10.47	3.50	6.97	1.28	87	0.21

(Note: IC=infusion class, n=47; TTC= traditional teaching class, n=42)

4.2.3 Effect on Critical Thinking Performance

Similarly, data obtained from the self-evaluation questionnaire, the students' written texts and the CCTST revealed that the students' critical thinking performance had improved after the teaching intervention. The students' self-evaluation questionnaires were collected during the intervention in weeks one, four, seven and ten. The data were

used to investigate their performance in using critical thinking to complete the thinking tasks. The students' writing was collected from the infusion class in both pre- and post-intervention stages. These data could be used to demonstrate how the students used critical thinking to articulate their ideas. The CCTST was collected from both infusion and traditional teaching classes in both pre- and post-intervention stages, and the results were examined in order to determine whether or not there were significant improvements in critical thinking skills in each class, and whether or not there were significant differences between the improvements of the two classes.

Overall, the results revealed that the students' performance in using critical thinking in the thinking tasks, in their English writing and in the CCTST had improved, suggesting that infusion lessons can help to improve students' performance in using critical thinking. A comparison between the results of the improvements in CCTST scores of the infusion class and the traditional teaching class revealed a more thorough and greater improvement in the former than in the latter, suggesting that infusion lessons can help to accelerate the development of students' critical thinking.

Self-evaluation of the Use of Critical Thinking in Group Discussion

In infusion lessons, the students used critical thinking to propose their opinions and give reasons to complete the thinking tasks. The students' perception of their performance was that it became better and better over the course of the intervention (see Figure 4.3). Their responses to SEQ4 and SEQ5 changed from being slightly unsatisfied in week one to slightly satisfied in week ten, and these changes were in the form of steady growth throughout the intervention. These findings suggest that the students took

advantage of opportunities to use critical thinking, and that they perceived that their critical thinking performance improved through consistent practice.

Figure 4.3 Self-evaluation of Use of Critical Thinking in Group Discussion
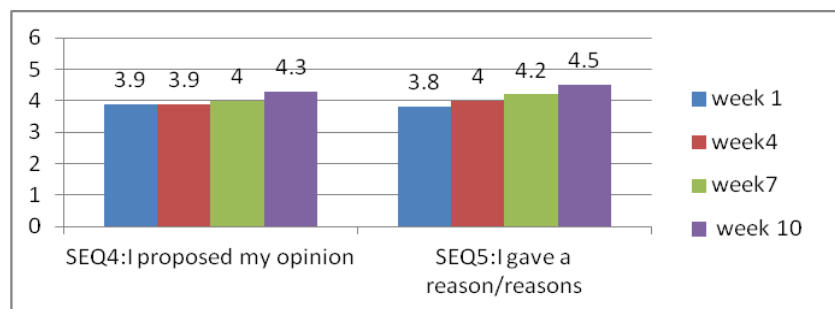
(1=very unsatisfied, 2= unsatisfied, 3=slightly unsatisfied, 4=slightly satisfied, 5=satisfied, 6=very satisfied)

The Use of Critical Thinking in Writing

As presented in section 4.2.2, in their writing, the students used critical thinking for four purposes: proposing points and reasons, clarifying ideas and drawing conclusions. The frequency of use of critical thinking for each purpose was presented above (see Figure 4.2 in section 4.2.2), and suggests an increased disposition to use critical thinking. In addition to the increased frequency, the students' written texts demonstrated their increased ability to use critical thinking. At the same time, their use of critical thinking helped them to express their own meanings in the target language, encouraging them to try to reconstruct linguistic forms and knowledge.

Although the total number of points proposed in the post-intervention written texts only increased by four (see Figure 4.2 in section 4.2.2), the students displayed their ability to use the skill of evaluation to select points from a wider variety of ideas. According to

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Paul and Elder (2006), proposing a point implies the process of selection and evaluation of relevant ideas in mind before starting writing. In other words, a point is the result of evaluating and judging relevant and possible ideas. However, without explicit explanation, it is difficult to find out whether or not students have thought of more than one idea, which is the precondition of subsequent evaluation. In the post-intervention written texts, the students made their evaluations explicit by listing several ideas, followed by a statement of the result of evaluating these ideas, which was not found in the pre-intervention written texts. As shown in Example 1 below, eight students (out of 21, 38.10%) began their writing with: 'I have learned many thinking (things) in high school, for example…. I think that the most important thing I have learned is …' (Please note that in order to display students' actual performance, in this study in the examples cited from the original written texts the grammatical mistakes have been retained; however, corrections are provided in parentheses). This finding can be linked to the students' perception that they could think of more useful and interesting ideas in writing (for details see section 4.3.1), and implies that they were using more skilful and effective critical thinking skills to evaluate these ideas and make decisions.

(Example 1): 'I have learned a lot of things since I entered into high school, for example, the knowledge, communicative (communicative → communication) skills, and how to get along with others. I think the most important thing I have learned is (being) brave.' (S14-post-intervention)

In the above example, it can also be seen that S14 combined the words 'communicative' and 'skills' to express the meaning of 'communication skills'. Although he failed to create the right expression, this finding indicates his understanding of the meaning of these two words and the linguistic knowledge of using

an adjective to describe a noun. He used these linguistic forms and knowledge to create his own meaning, which according to Vygotsky (1978, see chapter 2, section 2.3), is imitation of the target language and often occurs during the process of internalisation. This was not a unique case in the post-intervention written texts; rather, a few students made similar attempts (see section 4.3.4). This suggests that the use of critical thinking encouraged the students to reconstruct linguistic forms and knowledge, which may subsequently contribute to the internalisation of the target language.

Although the frequency of providing reasons in the post-intervention written texts was only six more than in the pre-intervention, the students had dedicated themselves to clarifying and strengthening these reasons in different and more powerful ways (see Figure 4.2 in section 4.2.2 and Figure 4.4 below), indicating an improvement in critical thinking, especially reasoning. As mentioned in chapter 3 (section 3.9.2), five methods of clarification could be related to critical thinking, of which providing examples and using personal experience could be found in both pre- and post-intervention written texts. Surprisingly, the other three methods: citing famous sayings, giving philosophical explanations and precisely defining words, were only found in post-intervention written texts. Students could clarify their ideas in a wider variety of ways, indicating that they became more critical and creative, and supporting the students' perception that their writing was more focused on explaining and clarifying ideas (see section 4.3.1).

Figure 4.4 Frequency of Using Different Methods of Clarification

(n=21)
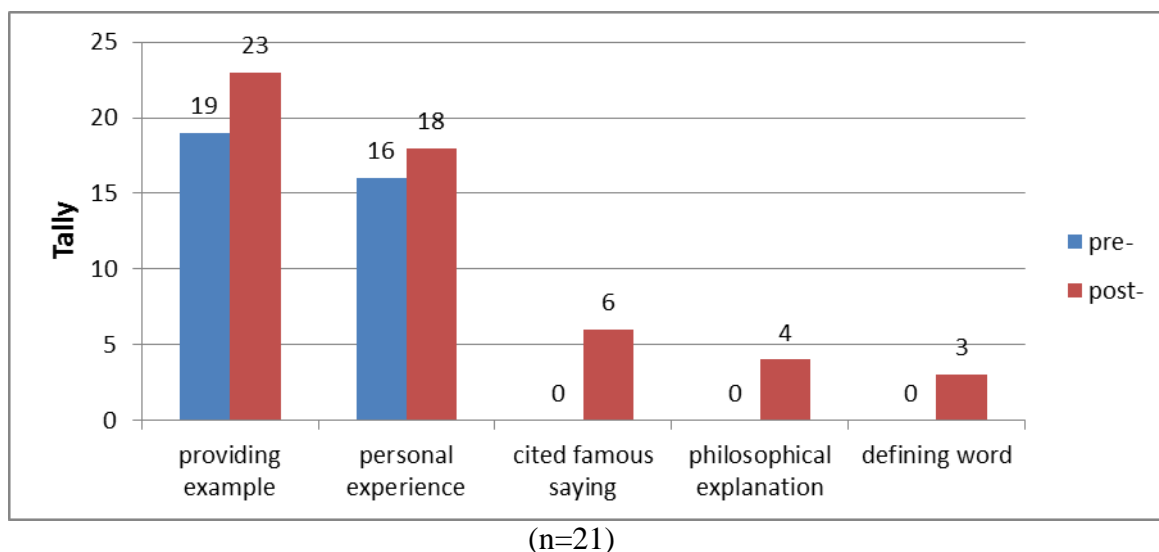
When comparing how the students used each method to clarify their ideas, it was found that they became more skilful in thinking of relevant and useful examples, more able to think from different perspectives and to think of more logical and powerful supporting reasons, indicating their increased ability in critical thinking, especially in reasoning. A detailed discussion is presented below.

'Providing an example' was the most popular method used to clarify an idea. Although the frequency of use of this method had increased by only 4 in the post-intervention written texts (see Figure 4.4 above), nevertheless, it was found that the nine students provided more than one example to support one reason in their post-intervention written texts, compared to four in the pre-intervention written texts, which is an indication of their stronger disposition to think critically and their greater reasoning skill. S13 is an example of this. In his pre-intervention written text, S13 provided one example to explain why teaching was an interesting job (see Example 2 below), while in the post-intervention text he used three examples to explain why a true friend can be

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trusted (see Example 3 below). Another good example is S17, who listed seven occasions on which he needed to be brave to support why it was important in high school life (see Example 4 below).

> (Example 2): 'Teaching is an interesting job. Teacher can make friends with different students after class.'(S21-pre-intervention)

> (Example 3): 'A true friend can always be trusted. If you tell her a secret, she will not tell others. If you are sad, she is always by your side. If you lost your confident, she will encourage you.' (S16-post-intervention)

> (Example 4):'I know I should learn to (be) brave, when I did not get along well with my friends, when I did not pass the test, when I was criticised by teachers, when I felt upset, when I found how difficulty (difficulty → how difficult it is) to learn math (math → maths), when the first time (came) to hold (a) class meeting, when (it was) the first time to give a speech'. (S17-Post-intervention)

Based on the examples presented above, it is also worth noting that the students tended to use sentences which contained dependent clauses to express these examples. When they were more skilful and efficient at thinking of relevant examples (since both pre- and post- writing tasks had to be completed within 30 minutes), they needed more sentences to express these examples, and thus created more sentences with complex syntactic structures (for further discussion see section 4.3.3), though grammatical mistakes were caused as a result (see Example 4; for further discussion see section 4.3.4).

Providing personal experience was the second most popular way of clarifying ideas, but the frequency of use of this method increased by only two from pre- to post-intervention written texts (see Figure 4.4 above). However, in the pre-intervention stage,

the students had only mentioned their own experience (see Example 5 below), while in their post-intervention written texts they used the experiences of others to support their ideas (see Examples 6 and 7 below). This can be attributed to the fact that by the post-intervention stage the students had developed the ability to think from different perspectives, as they reported in the post-intervention questionnaire (see section 4.2.1).

(Example 5): 'When I was a child, I was shy. My teacher was very nice to me. She taught me a lot.' (S3-pre-intervention)

(Example 6): 'My father has a lot of friends. They are very kind to me and always send me gifts in the festival. He told me that he made friends by heart (by heart → from the heart), so he has many friends.' (S16-post-intervention)

(Example 7): 'My friend wants to go abroad to study, so she learns English very hard. When you have a goal, you will make your effort to achieve it.' (S11-post-intervention)

'Citing famous sayings' was found to be used only in post-intervention written texts(see Figure 4.4 above). Six students (out of 21, 28.58%) cited proverbs and quotations from well-known people. Although Atkinson (1999) argued that the fact that ESL writers tend to cite such sayings reveals that they prefer to use memorisation as their learning strategy, in the current study, the fact that the students were able to use different and appropriate ways to strengthen their ideas still demonstrated their correct understanding of the meanings of these sayings, and their ability to select relevant and useful ones. Three students cited 'no pain, no gain', and one student cited 'Where there is a will, there is a way', which were successful in supporting their ideas, as shown in Examples 8 and 9. One student cited a quotation from Helen Keller (Example 10),

(Example 8): 'I understand what 'no pain, no gain' means now.' (S19-post-intervention)

(Example 9): 'I believe (that) there is a will, there is a way.' (S20-post-intervention)

(Example 10): Helen Keller said: 'Toleration (Toleration →Tolerance) is the greatest gift of the mind.' (S10-post-intervention)

Although in Example10, S10 thus makes a grammatical mistake by using the wrong form of 'tolerance', he shows his understanding that a noun is needed, and that a noun can end in '-tion'. Although he does not use the right form, he demonstrates his attempt to create an imitation of the target language.

'Philosophical explanations' were also only found in post-intervention written texts, and were used by four students (see Figure 4.4 above). Obviously, the use of philosophical explanation reflects the use of critical thinking and demonstrates a greater ability in critical thinking, as shown in Examples 11 and 12 below. These explanations attempted to identify the philosophical relationship between two phenomena, indicating a deep understanding of these phenomena and a complex thinking process. Again, Examples 11 and 12 below also suggest that using critical thinking encourages the use of more complex sentence structures, in order to express more complex ideas.

(Example 11): 'I found (that) the winners of competition are not always (those) who are clever, but the most diligent ones.' (S5-post-intervention)

(Example 12): 'Those who win at last (at last ➝ in the end) are (those) who believe (in) themselves.' (S14-post-intervention)

Three students attempted to offer precise definitions of words, and this method was not found in pre-intervention texts either (see Examples 13-15). 'Defining words', according to Stapleton (2001), is an important element of using critical thinking. Defining words requires a correct understanding of the meanings of a word and the ability to create these meanings in language. It is highly demanding from a cognitive and linguistic point of view, and thus more challenging for L2 writers. This suggests that creating tasks that are highly demanding cognitively may promote the use of expressions that are demanding from a linguistic point of view.

> (Example 13): 'Persistence means that fact (fact → act) of continuing to try to do something despite difficulty.' (S13-post-intervention)

> (Example 14): 'I thinking bravery means (to) try, do (do → to) not give up, (and) cheer up yourself (up).' (S16-post-intervention)

> (Example 15): '(A) friend is someone who can see the truth in (in → of) you; (A) friend is someone who can tell you nothing is impossible when you are sad.' (S21-post-intervention)

In addition to the improvements in reasoning skills illustrated above, in their post-intervention written texts, the students were found to make their judgements about an idea they presented in the text, although the frequency of drawing conclusions stayed roughly the same (increasing by only one, see Figure 4.2 in section 4.2.2). In their pre-intervention written texts, the students drew conclusions about the discussion in a paragraph or about the whole composition. In their post-intervention written texts, two students made their judgements about an idea they mentioned in the text by using the critical thinking markers 'I agree' (Stapleton 2001, see Example 16 below) and 'I think she was right' (see Example 17). These two students were thereby demonstrating and

emphasising their judgements of the reasons they had given to substantiate the points they had made, indicating an improvement in critical thinking. This may have been influenced by the task - Fact or Opinion: as one student mentioned in his response to the post-intervention questionnaire, influenced by the Fact or Opinion task, he had begun to think about the questions 'is it reasonable' and 'is it true' (for further discussion and evidence see section 4.4.3). Hence, they tended to evaluate ideas and demonstrate their judgements.

(Example 16): 'Quote one (one) people say: 'no pain, no gain'. I agree with that.' (S4-post-intervention)

(Example 17): 'I was poor in physics when I am (am →was) in junior middle school. My teacher encouraged me (that) I should persist in learning and doing more exercises, and I would improve. I think (that) she is (is → was) right'. (S13-post-intervention)

Their use of the above three new methods to clarify their ideas also suggests the students' inclination to be creative. One typical example is S13. He might have wanted to quote a saying, but found that he could not remember any. Since the students were not allowed to seek help from other people or materials, he created one himself (see Example 18 below). This may be more challenging than idiomatic formulations (Kitzinger 2000), and demonstrates that the students were using critical thinking to seek different and better ways of achieving their goals, and were thus becoming creative.

(Example 18):'Now, my motto is 'keep on doing everything that we want (to do), and we will succeed'. (S13-post-intervention)

In addition, this also reflects the students' imitations of the target language, so Example 18 illustrates the student's learning of the means to create a proverb-like expression. This, as mentioned above, occurs in the effective process of internalisation.

Critical Thinking Performance in Cognitive Test (CCTST)

The results of the Paired Samples T-tests suggested that the critical thinking ability of both the infusion and the traditional teaching classes had improved after the students' learning during the term as a whole. However, the improvements in the infusion class were found in the overall category and in all the critical thinking skills dimensions ($p<0.01$, see Table 4.4), while in the traditional teaching class, no significant improvement was found in 'evaluation', and a significantly negative change was found for 'inference' ($t(41) = -2.35$, $p <0.05$, see Table 4.5). These results suggest that explicit instruction in thinking can contribute to a more thorough and steady development of critical thinking skills.

Table 4.4 Comparison of Pre- and Post-CCTST of Infusion Class

CCTST	Infusion Class						
	Pre-test	Post-test	M (Gain)	SD	t	df	P
Analysis	3.72	4.32	0.60	0.65	6.30	46	**0.00**
Evaluation	5.28	5.96	0.68	1.48	3.16	46	**0.00**
Inference	4.06	4.55	0.49	0.78	4.32	46	**0.00**
Overall	13.06	14.83	1.77	1.54	7.89	46	**0.00**

(Note: infusion class, n=47)

Table 4.5 Comparison of Pre- and Post-CCTST of Traditional Teaching Class

CCTST	Traditional Teaching Class						
	Pre-test	Post-test	M(Gain)	SD	t	df	P
Analysis	3.21	3.69	0.48	0.71	4.37	41	**0.00**
Evaluation	5.21	5.57	0.36	1.78	1.30	41	0.20
Inference	4.5	4.38	0.12	0.33	-2.35	41	**0.02**
Overall	12.93	13.64	0.71	2.08	2.23	41	**0.03**

(Note: traditional teaching class, n=42)

A comparison of the difference in gains in the two classes was conducted by using an Independent Sample T-test. The results show that the improvement in the infusion class was significantly greater than that in the traditional teaching class in terms of 'inference' and overall scores. This indicates that the development of students' critical thinking ability can be accelerated by their taking infusion lessons.

Table 4.6 Comparison of Gains in CCTST in Infusion and Traditional Teaching Classes

CCTST	IC	TTC	M (difference)	t	df	P
Analysis	0.60	0.48	0.12	0.83	87	0.41
Evaluation	0.68	0.36	0.32	0.94	87	0.35
inference	0.49	0.12	0.61	4.71	87	**0.00**
Overall	1.77	0.71	1.05	2.74	87	**0.01**

(Note: IC=infusion class, n=47; TTC= traditional teaching class, n=42)

4.2.4 Summary

The effects on critical thinking were noted from four perspectives: students' perceptions, students' performance in group discussions during the intervention, use of critical thinking in writing, and the results of the cognitive tests (CCTDI and CCTST).

Overall, the results suggested that the students' critical thinking dispositions and performance had improved after the intervention, and the students were able to recognise these changes. Meanwhile, in their written texts, it was also found that their increased critical thinking dispositions and ability encouraged the students to reconstruct the target language to create their own meanings.

Specifically, the results of the analysis of interview and post-intervention questionnaire data revealed the students' awareness of their development of critical thinking in terms of increased dispositions and abilities. They reported their increased motivation to use critical thinking, and emphasised an appropriate critical thinking attitude that ideas should not be accepted without supportive reasons and explanations. The students also believed that they were more capable in critical thinking, especially in thinking from different perspectives and reasoning.

The results of the students' self-evaluations during the intervention revealed that they became progressively more willing to engage in the thinking tasks and to use critical thinking to complete these tasks from week one to week ten. These findings indicate that the students engaged in and persisted at the thinking tasks during the intervention, and at the same time, took advantage of opportunities to use and practise critical thinking.

The results of a comparison between the use of critical thinking in the pre- and post-intervention written tasks showed that they used critical thinking more frequently, indicating an increased disposition to think critically and a willingness to use critical thinking in their writing tasks when needed. This also implies that critical thinking dispositions encourage students to apply critical thinking to the situation and context where it is needed.

The comparison of the students' use of critical thinking in their pre- and post-intervention written texts confirmed the findings that the students' disposition and

ability to use critical thinking skills had improved. They used critical thinking skills to select points from more interesting and a wider range of ideas, and also showed their improved ability in reasoning and explaining ideas, in terms of being able to strengthen their ideas in a wider variety of ways, think from different perspectives, think of more relevant and useful examples, and to clarify ideas in more logical and powerful ways (citing famous sayings, giving philosophical explanations and precisely defining words). Moreover, the students were found to make judgements of the reasons they had given to strengthen their ideas, indicating their improved ability to think critically. Additionally, they had become more creative, which was demonstrated by the fact that they were able to clarify their reasons in different ways. These findings suggest that the students' critical thinking abilities had improved and that critical thinking was useful for and able to contribute to their normal writing practices.

The increased dispositions and ability in using critical thinking in writing at the same time encouraged the students to use the target language to create meaning. Findings obtained from their writing revealed that this facilitated the use and reconstruction of linguistic forms and knowledge to create more complex sentence structures and more imitations of the target language. Although more grammatical mistakes were made as a result (see section 4.3.4), these findings are encouraging, in that they indicate the effective process of internalisation.

The results of the California tests also support the above findings, and suggest that infusion lessons can help and accelerate the development of critical thinking. The results of the CCTDI revealed a significant improvement in 'truth-seeking' and overall scores in the infusion class, while the score for 'analyticity' of the traditional teaching

class had decreased significantly. The improvement in 'truth-seeking' of students in the infusion class was significantly greater than that of students in the traditional teaching class. A comparison of the pre- and post-intervention mean scores of the CCTST in each class suggested a statistically significant improvement in both classes. However, the improvement in the infusion class was found in all dimensions, and was significantly greater than that in the traditional teaching class.

In summary, all the above results imply that the mutual reinforcement of critical thinking skills and dispositions enhanced the transfer of critical thinking and cognitive developments. The students' demonstrated an increased disposition to think critically and better performance in using critical thinking in class during the intervention. The subsequent comparison between pre- and post-intervention written texts revealed that the students had begun to use critical thinking more frequently and that they were more capable and skilful in doing so. This means that students who had a positive disposition tended to take more opportunities to use and practise critical thinking, and thus created more opportunities to apply thinking learned in class to other situations and tasks and enhanced their cognitive development through consistent practice.

4.3 Impact on Writing

Based on the discussion in section 4.2, it can be seen that the infusion lessons had a positive impact on the students' thinking. Since these infusion lessons focused on both the development of thinking and the learning of language, it is also valuable to investigate their impact on the students' writing. This section first explores the students' perceptions of the effects on their writing, based on data obtained from the

interviews and post-intervention questionnaires. Then the effects on overall proficiency, syntactic complexity, accuracy and fluency of writing are presented. The analysis of writing was based on the written texts of the 21 students in the infusion class who handed them in both pre- and post-intervention.

4.3.1 Students' Perception of Effect on Writing

In their interviews and responses to the post-interview questionnaire, the students acknowledged a change in their writing in terms of including more interesting ideas, more explanations and clarification of ideas and more use of unfamiliar words and complex sentence structures.

Almost half of the respondents (17 out of 37, 45.95%) in the post-intervention questionnaire perceived that their writing included more interesting ideas. Five students attributed this to an increase in thinking ability (see PIQ8), in that they were able to think of more ideas. At the same time, they were also motivated to express these ideas, as stated by S35 (see PIQ9 below), and it was reported by seven students (out of 37, 18.92%) in their responses to the post-intervention questionnaire that they were now writing down what they really wanted to say. As S7 stated, he was used to writing down what he could express in English, but now he was trying to write down the ideas he wanted to present (see PIQ10 below). This indicates that the infusion lessons enhanced the students' thinking ability and motivated them to demonstrate it, and thus encouraged the students to use the target language to create meanings, which is crucial for effective language learning (see chapter 2, section 2.3; for further discussion see chapter 5, section 5.3). As with their perceptions of the effects on their thinking

described in section 4.2.2, two students attributed this to the helpfulness of the Six Thinking Hats task (see PIQ11), which guided them to think from different perspectives. This suggests that the thinking techniques practised in the thinking tasks in class also contributed to the students' individual writing after class.

> (PIQ8- Q7-S33): 'I know how to think now, so I can think of more interesting and different ideas.'

> (PIQ9-Q7-S35): 'I think I can think of more ideas, and I want to write them down.'

> (PIQ10-Q7-S9): 'My writing seemed to be richer in content. I was writing what I could write in English, but now, I try to write down what I want to write.'

> (PIQ11-Q7-S27): 'I learned from the Six Thinking Hats that we could think from different perspectives. I can think of some useful things for writing about.'

In addition to including more ideas, the students also mentioned that they were more focused on explaining these ideas. In the interviews, one student mentioned that he did not start the writing immediately, rather, he thought about the topic for a while (see Interview 5 below). This was echoed by seven (out of 37, 18.92%) respondents to the questionnaire who explained that they spent more time thinking about how to explain their ideas before starting to write (see PIQ12 below). When the findings regarding the students' perceptions of their appropriate critical thinking attitudes (see section 4.2.1) are triangulated with the evidence presented in section 4.2.3 that students used critical thinking to clarify and strengthen their ideas in writing more frequently, it can be inferred that the students' modes of thinking influenced the way in which they wrote.

When the students understood that critical thinking should be based on sound reasoning, they tended to concentrate more on clarifying and strengthening their ideas in writing.

(Interview 5): 'I spent more time in thinking about the topic.'

(PIQ12-Q7-S37): 'I spent more time on thinking about how to explain my ideas. (I thought about the questions) what I am trying to say, why I say this.'

Another impact perceived by the students refers to the use of vocabulary and sentence structures. In the interviews, one student said that he tended to use some words and independent clauses which he was hesitant about using before (see Interview 6 below). This was echoed by 9 respondents (out of 37, 24.32%) in the questionnaire who said they tended to use expressions they were not familiar with to express their ideas after the teaching intervention, even though they were not sure whether these were used appropriately or correctly (see PIQ13 below). This confirms the finding presented in section 4.2.3 that the improvement in their disposition and ability to think critically encouraged the students to use the target language to create meanings; it also suggests that they were able to recognise the changes in their learning process.

(Interview 6): 'Now I try to use them (unfamiliar words and independent clauses)'

(PIQ13-Q7-S26): 'I tried to use better words and complex structures.'

Two of the students who took part in the interviews considered the use of sophisticated words and complex sentence structures as indicators of a piece of

good writing (see Interviews 7 and 8 below). This means that the one of students' purpose in using these forms could be to improve the quality of their writing, and thus their writing performance. This implies that the infusion lessons could increase the students' motivation to improve their learning, as was also mentioned by the students in their responses to the post-intervention questionnaire (see section 4.4.2).

> (Interview 7): '(A good piece of good writing should) use many independent clauses.'

> (Interview 8): '(A good piece of good writing should) use sophisticated words.'

4.3.2 Effects on Overall Writing Proficiency

This study adopted the criteria used in the NCEE (see chapter 3, section 3.9.2 and appendix G) to measure the students' writing proficiency. The results are shown in Figure 4.5, and reveal a general increase in overall writing proficiency in the post-intervention written texts of 1.96 points over that found in the pre-intervention texts (with an average score of 12.52 in the pre-intervention and 14.48 in the post-intervention).

Figure 4.5 Overall Writing Proficiency
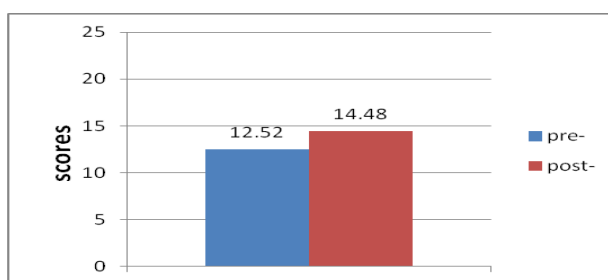
(Note: Full marks = 25, n=21)

The results of individual students are presented in Figures 4.6 and 4.7 below, from the lowest score (S1) to the highest score (S21) in the pre-intervention writing task. 15 students out of 21 (71.42%) showed an improvement in the post-intervention writing task. Three students (S6, S12, and S20) obtained the same score, and the scores of S15, S18 and S21 fell slightly in the post-intervention stage.

Figure 4.6: Individual Writing Proficiency (1)
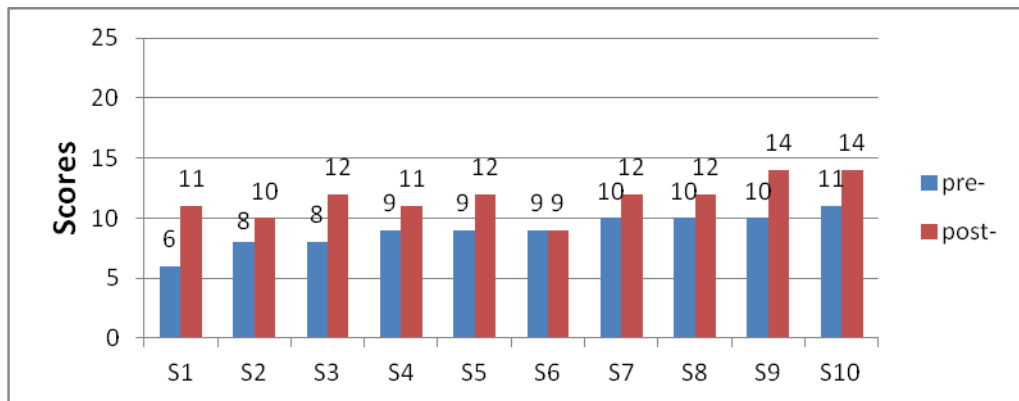
(Note: Full marks = 25)

Figure 4.7: Individual Writing Proficiency (2)
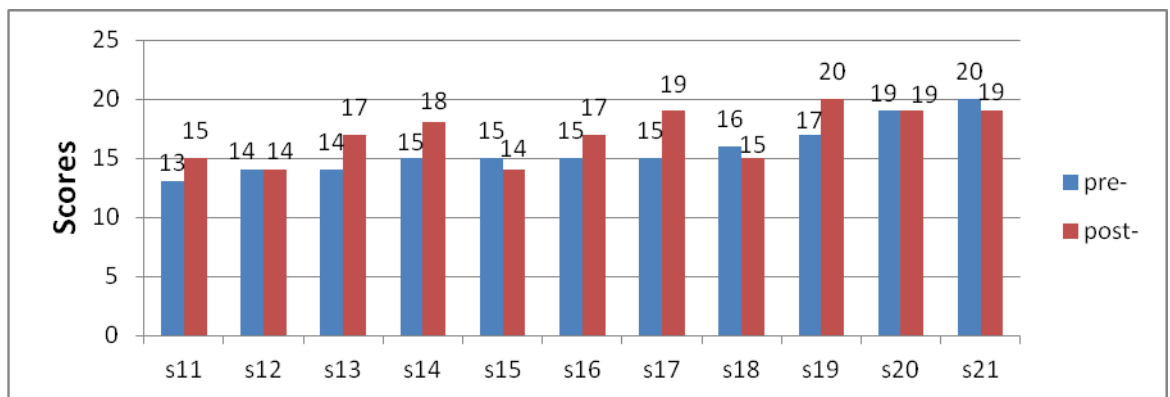
(Note: Full marks = 25)

Possible reasons for the declining or equal scores could be the increase in grammatical mistakes in the post-test writing and the influence of individual differences. For example, the percentage of error-free clauses in S18's post-intervention written text fell by 7% (72% in the pre-intervention written text and 65% in the post-intervention text). Therefore, in the interviews, S21 suggested that the teacher should provide timely feedback, enabling them to know whether or not the unfamiliar forms they were using in their writing were appropriate, and if they were not, how to correct them. (It should be noted here that the extracts taken from the interview data and used here as examples are not usually associated with any one particular student, since they were interviewed in a group. However, the quotation below (from Interview 9) is an exception, and it can be confirmed that this comment was made by S21, because she engaged in further discussion about the teacher's feedback with the researcher and the teacher afterwards.)

> (Interview 9-S21): 'I hope the teacher can mark our composition and return to us as soon as possible, in order to enable us to know if the use of some words and the structure of sentences are correct or not, otherwise the feedback will be less valuable for us since we may forget what we have written, and thus may not be interested in the feedback.'

On the other hand, individual factors also influenced their progress: for example, attitudes toward the learning of writing, the effort they made and familiarity with the topic. Firstly, compared to other language skills, writing is the least favourite among students. In the interviews, six students (out of ten, 60%) reported that speaking was their favourite language skill and two students (out of ten, 20%) voted for reading and listening respectively, while no student claimed to like writing best.

Moreover, the students seldom made additional efforts to improve their writing. Seven out of 10 students (70%) who took part in the interviews said that they did not make additional efforts to improve their writing outside of class. Three students explained that they had no extra time to do this, and one student complained that he had tried, but that it was not helpful (see Interview 10 and Interview 11 below). This supports the findings of Lin (2007) and Lin (2008) that Chinese high school students tend to hold negative attitudes toward the learning and improvement of English writing, since writing seems to be difficult to improve and thus less effort is made to do so (see chapter 1, section 1.4).

(Interview 10): '(Whether or not you have done additional practice to improve your writing?) No. I have no time to'.

(Interview 11): 'I have tried, but it is seemed useless. '

Additionally, familiarity with the topic also influenced the students' writing performance. This was mentioned in both interviews (see Interview 12 below) and in the responses to the post-intervention questionnaire (see PIQ14 below). These findings suggest that the impact of the infusion lessons may differ from student to student owing to individual differences.

(Interview 12): 'It is very difficult to think of useful or interesting ideas for topics'.

(PIQ14-Q8-S12): It really depends on the topic. I can think of many ideas for some topics, but for some others, I have none.

An unexpected finding is that the infusion lessons may be more helpful for low achievers (overall writing score is lower than 60%, in this case, 15) in writing. A decrease in the scores for overall writing quality only occurred among those students who gained 15 marks out of 25 or above in the pre-test writing, and the quality of their writing in the post-intervention stage had increased by an average of 1.29 points (see Figure 4.6; seven students (S14- S21) obtained 9 points in total), whereas the scores of those students who had got less than 15 in the pre-intervention written tasks had increased by 2.46 points on average (see Figures 4.5; 13 students (S1-S13) obtained 32 points in total), which is almost twice the former. This implies that the infusion lessons had a greater impact on those students who were regarded as possessing a relatively lower level of writing proficiency. One possible reason for this is that low achieving students were hesitant about expressing their ideas in English, since they were worried about making grammatical mistakes. The infusion lessons increased their motivation to use critical thinking and express ideas, and thus they took advantage of more opportunities to use the target language to create meanings. Consequently, they benefited from practising thinking skills and the target language. S9 may be seen as an example of this. As mentioned in section 4.3.1 above, he reported that he now tended to write down all of his ideas, whereas before the intervention he only wrote about those ideas he was able to express in English (see PIQ10 in section 4.3.1), and his overall writing score had increased by 4 points after the intervention (see Figure 4.6 above). Further investigation is needed to check this finding or discover why the lower achieving students derived more benefit from the infusion lessons.

4.3.3 Effects on Complexity

This section presents the findings relating to changes in syntactic complexity in order to reveal whether or not the students generally used more complex syntactic structures in their writing after the intervention.

The complexity of writing was assessed in terms of mean clause length and the number of clauses per T-unit, and the results are displayed in Figures 4.8 and 4.9 respectively. In Figure 4.8 below, it can be seen that the mean length of clause in the pre-intervention texts was 6.67, while in the post-intervention written texts it was 7.11, which means it remained roughly the same. This suggests that the students did not use more non-clausal expressions in their writing. The results relating to the average number of clauses per T-unit are shown in Figure 4.9 below, and reveal that there was only a 0.21 increase in the post-intervention written texts compared with the pre-intervention texts (an average number of 1.49 in the former and 1.28 in the latter). This increase seems not remarkable. These should not be considered as a discouraging result; rather, the students committed themselves to use these complex sentence structures only when they were needed.

Figure 4.8 Grammatical Complexity (1)   **Figure 4.9 Grammatical Complexity (2)**
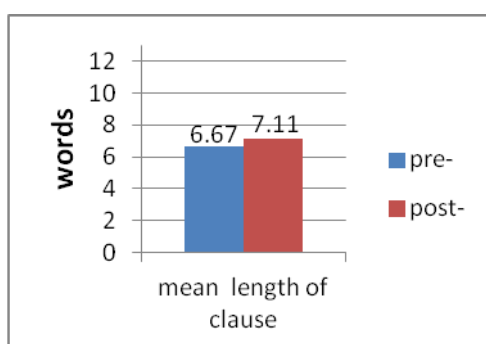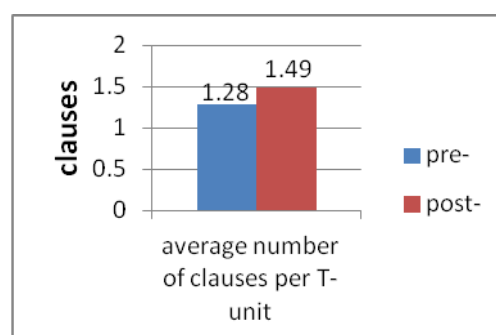
One the one hand, when comparing the total number of T-units and clauses used in the pre- and post-intervention texts, it can be seen that in the latter the students created only two more T-units than in the former, while the number of clauses increased by 69 (see Figure 4.10 below). In other words, on average, the students' post-intervention texts consisted of the same number of T-units, but contained 3 more clauses per text (see Figure 4.11 below). These results indicate that the students did not create more dependent clauses in every T-unit; rather, they used more complex syntactic structures in some T-units.

On the other hand, these findings, triangulated with the students' perception that dependent clauses were indicators of a piece of good writing (see section 4.3.1), and their actions in using dependent clauses to explain their more logical and reasonable ideas (see Example 7-15 in section 4.3.2), imply that the students inserted dependent clauses only in places where they were really needed, although they were motivated to use more complex sentence structures.

Figure 4.10 Total Number of T-units and Clauses
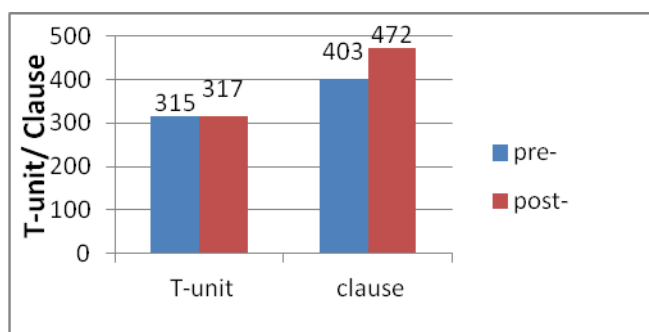
Figure 4.11 Average Number of T-units and Clauses
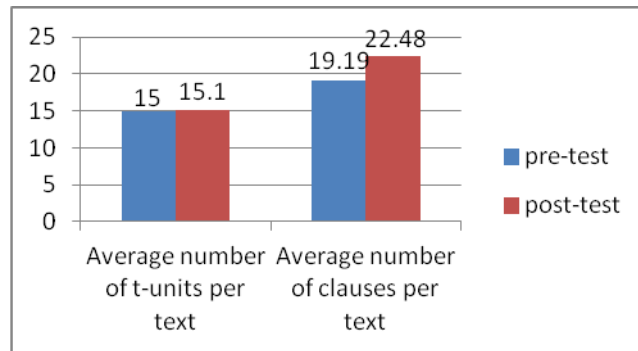
4.3.4 Effects on Accuracy

The accuracy of writing was measured in terms of the percentage of error-free T-units. As shown in Figure 4.12 below, this decreased by 3.89%: from 65.08% in the pre-intervention written texts to 61.19% in the post-intervention texts. This can be attributed to the students' production of more grammatically complex sentences (see section 4.3.3), and more unfamiliar expressions, as the students themselves reported (see section 4.3.1). Examples are given below:

Figure 4.12 Accuracy of Writing
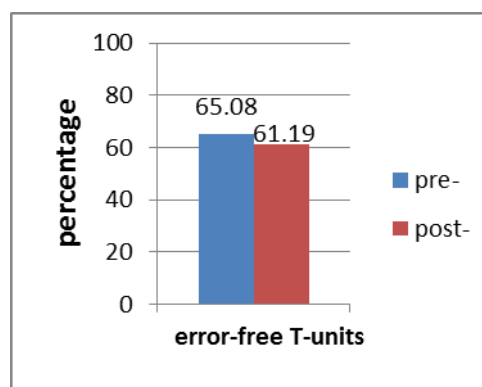
(Example 19): '(A) Team cooperates (cooperation), I think it is the most important thing I have learned in high school.' (S1-post-intervention)

(Example 20): 'I learned many useful things, such as the (the) knowledge of the (of the → from) books, the (the) personal relations (personal relations→interpersonal relationships) and so on.' (S6-post-intervention)

(Example 21): 'For example, when I organised an activity, I made a plan about what should we do (what should we do →what we should do) and how to do it well.' (S8-post- intervention)

Two types of mistake attracted the attention of the researcher, and these were an unexpected finding of this study. The first of these was where students demonstrated a correct understanding of the meaning and spelling of a word, but used an inappropriate form. In Example 19, S1 wanted to use 'team cooperation', but he probably did not know the correct expression, or only knew the form of the verb 'cooperate'. This is also similar to the case of S10 discussed earlier (see Example 10 in section 4.2.3), who intended to use the word 'tolerance', but used 'toleration' instead. This was an unexpected finding, so the researcher calculated the frequency of this type of mistake in the pre- and post-intervention texts. The results revealed that the frequency in the latter was 22, which was more than twice the former (9). This finding indicates that the infusion lessons encouraged the students to use different forms of words in the target language, and also suggests that they were more willing to take risks in making grammatical mistakes.

The second type was where students demonstrated an understanding of the meaning and spelling of two words, but their combination of these two words failed to express their intended meaning. In Example 20, S6 intended to combine the words 'personal' and 'relation' to form the expression 'interpersonal relationships'. Example 1 in section

4.2.3 contains a similar mistake, where the student used 'communicative skills' to express the intended meaning 'communication skills'. Similar mistakes were found in a few post-intervention texts; for example, 'responsibility of the society' (social responsibility), 'communicating skills', and 'small talking' (small talk). The frequency of this type of mistake was thus calculated, and it was found that the frequency in the post-intervention written texts was 11, which was almost three times that in the pre-intervention (4). This finding suggests that the infusion lessons encouraged the students to reconstruct linguistic forms to compose intended meanings, once again indicating their increased willingness to take risks.

The mistake in Example 21 is related to the order of words in a dependent clause as a form of question (what should we do →what we should do). The mistake in Example 4 (see section 4.2.3) is also of this type. The student intended to express the meaning that he had learned to be brave when he found out how difficult it is to learn maths, but he failed to create a correct dependent clause.

These findings indicate that being able to think of different ideas can facilitate the production of a wider variety of words and expressions, which are crucial for L2 learning (see chapter two, section 2.3). Although more mistakes are caused, they are encouraging evidence of effective learning, and may contribute to the subsequent internalisation of these words and grammatical knowledge.

4.3.5 Effects on Fluency of Writing

The fluency of writing was measured in terms of the average number of words per text produced within the 30 minutes. As shown in Figure 4.13, the students produced longer texts in the post-intervention, with an increase of 32 words per text (see Figure 4.13 below). On the one hand, the students stated that they could think of more ideas to write about (see section 4.3.1), and thus they produced longer texts. On the other hand, they also appeared to be able to use more complex syntactic structures in their writing when they needed to, and were able to create more clauses within the same span of time (see section 4.3.3). The triangulation of the above findings implies that both thinking and grammatical proficiency can influence the fluency of writing. The infusion lessons helped the students to improve their critical thinking disposition and ability, and encouraged them to use the target language to express their ideas. The students thus had more opportunities to use the target language to create meanings, and subsequently internalised these linguistic forms and grammatical knowledge. Consequently, their writing fluency improved.

Figure 4.13 Average Numbers of Words
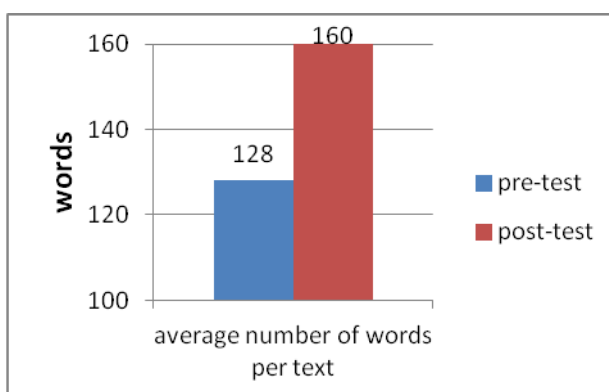
4.3.6 Summary

The effects on the students' writing were revealed by examining the data collected from the infusion class through the interviews and post-intervention questionnaires after the intervention, as well from their written texts in both pre- and post-intervention stages.

Overall, the results suggest that the students' L2 writing had improved after the intervention, and the students were also able to perceive these changes. At the same time, based on the students' explanations and their use of critical thinking in their writing (see sections 4.2.2. and 4.2.3), these changes can be linked to the changes in their thinking.

Specifically, the students' perceptions of the effects on their writing were that it included more ideas, that they paid more attention to clarifying these ideas, and that they attempted to use more sophisticated words and complex sentence structures to express their ideas. They attributed the above to their increased ability in thinking, motivation to express all their ideas, and understanding of the need to explain and support these ideas.

The data obtained from their pre- and post-intervention written texts revealed that the students' overall writing proficiency had improved after the intervention, especially for low achievers. The students were found to create more clauses in some T-units. Combined with the finding presented in section 4.2.3 that the students tended to use complex sentence structures to present their more logical and powerful ideas, this indicates that the students used these when they perceived they were needed, and that

critical thinking encouraged the production of complex sentence structures. The students thus made more grammatical mistakes, owing both to this tendency and to their use of unfamiliar forms. Moreover, the students were able to produce longer texts within the same span of time, indicating an increase in fluency.

An unexpected finding emerging from their grammatical mistakes is that the students tended to use different words and reconstructed linguistic form to express their own meanings. They showed their understanding of the meaning and spelling of the words, but they either used incorrect forms or their combination of two words failed to express the intended meaning. The frequency of these types of mistake in the post-intervention texts was more than twice that in the pre-intervention. This is encouraging evidence of imitation of the target language, which is an effective process of internalisation.

Triangulating these findings with the findings of the increased frequency of using critical thinking in writing (see section 4.2.2), the students' improved ability in using critical thinking to propose points and reasons, clarify reasons and draw conclusions (see section 4.2.3), it can be inferred that increased dispositions towards and ability in critical thinking motivated the students to apply and demonstrate critical thinking in their writing, and thus they tended to use unfamiliar forms of the language to express their intended meanings and dedicated more effort to explaining and clarifying their ideas. Moreover, these findings suggest that modes of thinking can influence the content of the writing, and thus the use of language. Therefore, developing critical thinking can encourage students to create meanings in the target language, which ultimately contributes to the improvement of overall proficiency in writing.

4.4 Attitudes towards and Perceptions of Infusion Lessons

Having examined the impact of the infusion lessons on students' thinking and writing, it is worth exploring the students' attitudes and perceptions concerning the lessons, based on data collected from the self-evaluation questionnaires, the interviews and the post-intervention questionnaires of the infusion class. This section first presents the students' general attitudes towards and perceptions of the infusion lessons, followed by their perceptions of effects on their English learning, and their perceptions of the thinking tasks and group discussions. Finally, this section presents the students' suggestions about and expectations of future lessons.

4.4.1 Attitudes towards and Perceptions of Infusion Lessons

The students' attitudes and perceptions were determined mainly by using data from the interviews and post-intervention questionnaires. Overall, the students' positive attitudes related to the enjoyable and helpful nature of the lessons, while any negative attitudes were caused by their worries about performance in examinations and difficulties encountered.

It is worth noting here that the majority of the students who took part in this study reported that they had not had individual English writing lessons before. This was mentioned by six students (out of 10, 60%) in the interviews and confirmed by 24 respondents (out of 37, 64.86%) to the post-intervention questionnaire. At the same

time, those students who considered previous lessons as writing lessons reported negative attitudes toward them. In interview, four (out of 10) students reported that they had had writing lessons before, but three of them perceived that those lessons were focused on writing down other aspects of the target language, for example, reading and grammar, instead of on writing itself. This was confirmed by 10 students (out of 13 who considered they had had writing lessons before the intervention) in their responses to the post-intervention questionnaire. This may explain why the other students perceived that they had not had writing lessons before. This supports the finding of previous studies that writing is still a neglected part of language teaching (see section 1.4).

Enjoyment

It is interesting that four students used the word 'boring' to describe their experience of previous writing lessons in the post-intervention questionnaire (see PIQ15 below). Therefore, many students expressed positive attitudes towards the infusion lessons because they found them enjoyable.

(PIQ15-Q1-S27): 'They were a little bit boring I think.'

In the interviews, six (out of 10, 60%) students said that they enjoyed the lessons (see Interview 13 below), and this was confirmed by almost 60% (22 out of 37, 59.46%) of the respondents in the post-intervention questionnaire. They liked the enjoyable atmosphere created in the lessons (see PIQ16 below), which can be attributed to the tasks (see Interview 14 below; for further discussion see section 4.4.3) and group discussions (see PIQ17 below; for further discussion see section 4.4.4).

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(Interview 13): 'I think the writing lessons are more interesting than before. I like it.'

(PIQ16-Q4-S22): 'I like the enjoyable atmosphere in class and the activities are interesting'.

(Interview 14): 'Of course I like infusion lessons. I like the tasks.'

(PIQ17-Q4-S20): 'We felt happy when discussing in groups, because we could express our ideas freely, and not need to worry about being asked question by the teacher.'

Activeness

When they were asked about their perceptions of previous writing lessons, 9 students (out of 37, 24.32%) reported their passivity in their responses to the post-intervention questionnaire. Some students felt sleepy in class, and just listened to the teachers.

(PIQ18-Q1-S23): 'I found that some students felt sleepy in the class.'

(PIQ19-Q1-S30): 'I don't like them (previous writing lessons). We were just sitting in the classroom and listening to the teachers'.

The active nature of the infusion lessons was therefore valued by six students (out of 10, 60%) who took part in the interviews, and this view was supported by nearly 60% of the students (22 out of 37, 57.89%) in their responses to the post-intervention questionnaire. They explained that the infusion lessons obliged them to be active in class, and the students interacted with each other (see PIQ20 and PIQ21 below).

(PIQ20-Q4-S1): 'I like infusion lessons, because we become more active in the classes. We were thinking in the class'.

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(PIQ21-Q4-S4): 'I like the activated atmosphere in class. The class is more interactive now'.

Worries

Although most of the students demonstrated positive attitudes towards the infusion lessons, some students mentioned worries. This negative feedback mainly relates to the pressures of examinations. Thus, although they found the infusion lessons active and enjoyable, they were still worrying about their exams. This was mentioned by one student in the interviews and by five (out of 37, 13.51%) students in the responses to the post-intervention questionnaire. They wanted very much to gain high scores in the examinations, especially in the NCEE (see PIQ22 below). Therefore, the students reminded the teachers of the need to teach them more knowledge of grammar and vocabulary (see Interview 15).

(PIQ22-Q10-S36): 'We will move on to the third stage of high school. We will attend the national college entrance examination. We need to improve our scores.'

(Interview 15): 'The activity is interesting, we had fun. However, we still need to think about the exam. The teacher should teach more grammar and vocabulary, which we can use in writing.'

Difficulties

The students encountered some difficulties in the infusion lessons related to the types of task, unfamiliarity with topics, inadequate amount of time for thinking and discussion, and becoming stuck because of language difficulties.

In the interviews, one student mentioned that some of the tasks in the classes were difficult, so that he could not think of useful information or ideas to share (see Interview 16 below). This was confirmed by the respondents to the post-intervention questionnaire, who attributed this to the Fact or Opinion task (see section 4.4.3).

> (Interview 16): 'Some activities were fine, some were difficult, and I could not think of something to say.'

As stated earlier, the students mentioned the influence of familiarity with the topic on their writing performance (see Interview 12 and PIQ14 in section 4.3.2). Two other students also recognised a similar influence on their group discussions in class. As S23 reported in his responses to the post-intervention questionnaire (see PIQ23 below), he was aware of the difficulty of thinking of ideas for unfamiliar topics. This suggests that the students' thinking can be restricted by some topics in the textbook.

> (PIQ23-Q4-S23): 'When I got a topic which I was not familiar with or I was not interested in, it was difficult for me to think of useful ideas.'

At the same time, four students (out of 37) also complained that there was not enough time for discussion (see PIQ24 and PIQ25) (based on post-intervention questionnaire data). This is not a discouraging finding, since it reveals the students' positive disposition to think and discuss things with their peers in class, implying that they may perform better and benefit more if they have more time.

> (PIQ24-Q6-S9): 'Sometime I need more time to think, and we need more time to discuss.'

(PIQ25-Q6-S27): 'I thought of some new ideas, but I had no time to share with my group.'

The students also realised that their poor language proficiency restricted them when attempting to express their ideas in class. This was mentioned by two students in the interview, and supported by seven students (out of 37, 18.92%) in their responses to the post-intervention questionnaire. They explained that sometimes they thought of interesting ideas, but were unable to express these ideas in English (see PIQ26 and PIQ27 below). However, this should not be seen as discouraging either. Rather, it indicates that the students were aware of their limitations and learning needs, and as they reported, it motivated them to learn more (for further discussion see section 4.4.2).

(PIQ26-Q8-S24): 'I can remind some words when I needed them, but I can spell out in dictation.'

(PIQ27-Q8-S31): 'For some ideas, I need to use some words and expressions, which were more sophisticated to explain. I did not familiar with them, so sometime I could not express my ideas in English.'

4.4.2 Perceptions of the Effects on English Learning

According to data obtained from the interviews and post-intervention questionnaires, the students' perceptions of the effects of the infusion lessons on their English learning were mainly related to motivation and awareness of effective ways of learning.

The students' motivation to learn English had increased. In the post-intervention questionnaire, five students (out of 37, 13.51%) stated that they were now more interested in learning English (see PIQ28 below). Seven (out of 37, 18.92%) students mentioned that they were more motivated to learn, because they wanted to express their ideas and had noticed their limitations in using the target language (see PIQ29 and PIQ30 below). Three students perceived that what they had learned was useful, and thus they were more willing to learn more (see PIQ31 below). All these findings suggest that infusion lessons create opportunities for and encourage students to express their ideas in the target language. Students can then apply what they have learned in real practice and also become aware of what they can or cannot express in English; this guides them in what to learn and motivates them to learn more.

(PIQ28-Q8-S37): 'I am more interesting in English, so I want to improve it.'

(PIQ29-Q8-S31): 'I thought I had learned something, but I realised I had not when I attempted to use it. Now, I use it whenever I can to examine whether or not I have learned something, and then I become more confident to use it next time.'

(PIQ30-Q8-S2): 'I want to express my ideas, so I need to improve my English'.

(PIQ31-Q8-S34): 'Now I realise that what we learned was useful. We have opportunities to use it, so I have become more motivated (to learn English).'

The students also showed their understanding of effective ways of learning in their responses to the post-intervention questionnaire. Although this was only reported by a limited number of students (six out of 37, 16.22%), this is an encouraging finding, indicating the effectiveness of metacognition in learning, which can give rise to self-

regulated learners and contribute to the subsequent internalisation of knowledge (see chapter 2, section 2.3). In the example shown in PIQ33 below, the student perceived that the successful learning of a word means being able to use it, and thus it could not be achieved by simple memorisation, but through practising. S23's explanation can be connected to the process of internalisation (see PIQ34 below). The student recognised that her knowledge was no longer stored at surface level only; rather, it had been transformed into internal knowledge through practice and use in the infusion lessons. S20 admitted that his learning in previous lessons had been passive, but the infusion lessons encouraged the use of what had been learned in class, and contributed to the establishment of his knowledge system (see PIQ35 below).

> (PIQ33-Q8-S31) 'We learned a word, not by memorising it, but by using it. The knowledge was not just stored in our mind. We only learned a word when we can use it, not just recognise it in reading. The purpose of learning English is to be able to use it in daily life.'

> (PIQ34-Q8-S23): 'Infusion lessons encourage us to use unfamiliar words. This valuable knowledge no longer remained on the surface of our mind only, but was 'engrave' (刻) in our 'inner plate' (底板).'

> (PIQ35-Q8-S20): 'Previously, the learning in class was passive. I listened, but I probably forgot it soon after. However, thinking tasks promoted us to use what we have just learned, and thus this knowledge can be processed in our mind and subsequently form the system of knowledge.'

This finding confirms the students' perception of the increased frequency of their use of unfamiliar words and complex sentence structures, and may be associated with the findings of the decreased accuracy and increased complexity of their post-intervention written texts, suggesting that the appearance of more mistakes was not accidental, but that they were well aware that they were making them. Therefore, those mistakes should

be considered as evidence of the process of internalisation. The appearance of these mistakes does, however, as proposed by S21 in the interviews (see Interview 9, section 4.3.2), give rise to the need for teachers' feedback to help them to correct their mistakes and modify their linguistic knowledge, in order to achieve successful internalisation.

4.4.3 Perceptions of Thinking Tasks

Three types of task were used in the infusion lessons: Odd One Out, Fact or Opinion, and Six Thinking Hats (see chapter 2, section 2.5.3). In the interviews and post-intervention questionnaire (Q3), all the students reported that they preferred the lessons with tasks. Specifically, they voted Six Thinking Hats as their favourite because it is useful and practical, while the most challenging and interesting tasks were Fact or Opinion and Odd One Out respectively.

Four students (out of 10, 40%) in the interviews voted Six Thinking Hats their favourite task, and this was supported by 16 (out of 37, 43.24%) respondents to the post-intervention questionnaire; they explained that it is practical and helpful. In the interviews, one student said that Six Thinking Hats was the most practical task (see Interview 17), and another student proposed that this task guided them to think from different perspectives (see Interview 18 below). Similarly, in their responses to the questionnaire, the students explained that it provided clear instructions for them to think from different perspectives, so that they could easily recall and follow them even in individual tasks (see PIQ36 below). As mentioned in section 4.3.1, the students also reported that this instruction was helpful in their individual writing (see PIQ11 in section 4.3.1). This finding implies the importance of explicit instruction which guides students in what type of thinking to use, how to use it and how to perform it.

(Interview 17): 'It (Six Thinking Hats) is the most practical task. I like it.'

(Interview 18): 'Six Thinking Hats taught us different perspectives we could thinking from, and it is very useful for writing. (Will you use it in the following study? Sure.)'

(PIQ36-Q5- S29): 'The instruction is very clear. It tells us which perspectives we can think from. It is easy for us to recall and follow in class and out of class. '

Fact or Opinion was the favourite task for four interviewees (out of 10, 40%), and this view was echoed by nine respondents (out of 37, 24.32%) in the post-intervention questionnaire, but it was also considered to be the most challenging task (see Interview 19 and PIQ37 below). However, the students still reported a variety of effects brought about by this task, and their investment of more intensive cognitive work (see Interview 19 and PIQ37 below). Fact or Opinion developed their habit of evaluating the information received, rather than accepting it immediately (see PIQ38 below). S13 stated that his writing also benefited from the task, which reminded him to provide reasons (see PIQ39 below). Interestingly, three students mentioned that Fact or Opinion stimulated their motivation to learn more relevant knowledge and collect additional information not in the textbook (see PIQ40 below). These findings suggest that the challenging task was more demanding cognitively, requiring more knowledge and cognitive work, and thus students could gain more benefit from it.

(Interview 19): '(Other interviewee: I like Fact or Opinion) Me too, but it is the most challenging one'

(PIQ37-Q5- S3): 'I like Fact or Opinion. It is the most difficult one. It required us to think harder, and used our knowledge to make judgement. It is helpful to improving our thinking.'

(PIQ38-Q5-S27): '(I like) Fact or Opinion. It sounded like a philosophical question when the teacher asked us 'is this a fact or just an opinion?' It tells us not to accept everything you receive, but to evaluate it and make a judgement by yourself, based on your knowledge and your experience.

(PIQ39-Q5-S13) 'The tasks pushed us to think harder. We practised our thinking skills. Now, I won't forget to explain my ideas by providing reasons, as we did in Fact or Opinion.'

(PIQ40-Q5-S14): '(I like) Fact or Opinion. Sometimes it needs some information and knowledge exclusively from our textbook. For example, Mark Twain, he is introduced in an article in the textbook, but if you know more about him, then you can provide more different ideas. This can enhance our confidence and stimulate us to learn more and collect additional information not in our textbook.'

Odd One Out was considered to be interesting by two interviewees (out of 10, 20%), and this view was supported by 12 respondents (out of 37, 32.43%) in the post-intervention questionnaire. The students explained in response to the questionnaire that they became more creative and felt excited when they thought of different answers (see PIQ41 and PIQ42). In the interviews, one student mentioned that it was easy for her to think of different ideas, which suggests that Odd One Out was less challenging for them (see Interview 18). However, this was deemed to be a positive aspect for S23 (see PIQ43); in his response to the questionnaire, he stated that he became more confident when he found he was able to propose an idea different from those put forward by other students. This suggests that the thinking tasks should be able to attract students' interest, and that the manageable nature of the tasks enhances students' confidence.

(PIQ41-Q5-S33): 'The answer can be creative, so it develops our creative spirit.'

(PIQ42-Q5-S23): 'I like Odd One Out, because when I proposed a different opinion, I felt excited.'

(Interview 18): 'It is easy to think of many different ideas, no difficulties.'

(PIQ43-Q5-S23): 'It is interesting and I was proud and became more confident when I could propose different ideas.'

These findings suggest that the thinking tasks can also contribute to students' thinking and learning, and different types of task may have different influences. At the same time, the majority of students preferred the helpful and challenging tasks to the interesting one. It is therefore important for the teacher to select appropriate and useful tasks.

4.4.4 Attitudes towards and Perceptions of Group Discussion

According to the self-evaluation questionnaire collected during the intervention, and the interview and questionnaire data collected after the intervention, the students generally held positive attitudes towards the group discussions. They enjoyed them and became more and more satisfied with their group performance and their own contributions throughout the intervention. They perceived that group discussion was helpful for thinking and English learning.

The students' feelings about group discussion were revealed by their responses to questions 16-18 in the self-evaluation questionnaire. The results are shown in Figure 4.14 below, and suggest that the students found engaging in these discussions more and more enjoyable and less and less difficult. The students began to enjoy the discussions after week four (see SEQ16 in Figure 4.14 below), and this positive attitude steadily increased throughout the rest of the intervention. At the same time, they found it less and less difficult to join in or talk in group discussions (see SEQ17 and SEQ18, Figure 4.14 below), and the decrease in their response ratings to SEQ17 and SEQ18 suggests that they perceived that they were more and more capable of participating in group discussions. A slight increase in week four can be found in their responses to these questions. This may be attributed to the difficulty of the task. During the intervention, Fact or Opinion was first used in week four (see appendix C), and it was considered as the most challenging by the students (see section 4.4.3). This finding is in line with the finding of a slight decrease in week four in their self-evaluations of their performances in 'I talked in the group' (see SEQ1 in Figure 4.1, section 4.2.2) in the same questionnaire, and suggests that the students needed time to involve themselves in a new type of task.

Figure 4.14 Students' Feelings about Group Discussion
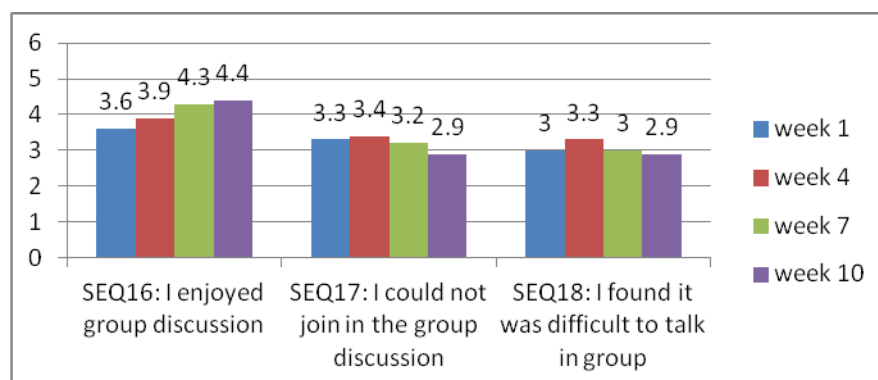
(1=strongly disagree, 2=disagree, 3=slightly disagree, 4=slightly agree, 5=agree, 6=strongly agree)

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The students' evaluations of group performance in the infusion lessons were revealed by questions 8 to 12 in the same questionnaire, and the results are shown in Figure 4.15 below. It is evident that the students perceived that their group performance became better and better, and also more and more interactive at the same time. An increase in satisfaction can be found in the responses to SEQ8-SEQ10. The results for SEQ8 indicate that the students perceived that their group members were able to think of more and more different ideas throughout the teaching intervention. Their responses to SEQ9 and SEQ10 suggest that they believed their performances in making group decisions became better and better, and they became progressively happier about talking things over to deal with different opinions. The students were slightly dissatisfied with the statement in SEQ11: 'we talk about everyone's ideas', during the intervention, and their ratings for this question remained nearly the same throughout the term. This may be because of the insufficient amount of time available for group discussion, with the students proposing that they needed more time for discussion (see section 4.4.1). Their responses to SEQ12 remained roughly the same from week one to week ten, because when one member of the group was expressing his/her ideas, the other members were always listening. These findings suggest that group discussion allowed the students to come into contact with different ideas and learn how to deal with them, and also created an environment in which each member's ideas were valued and respected.

Figure 4.15 Self-Evaluation of Group Performance
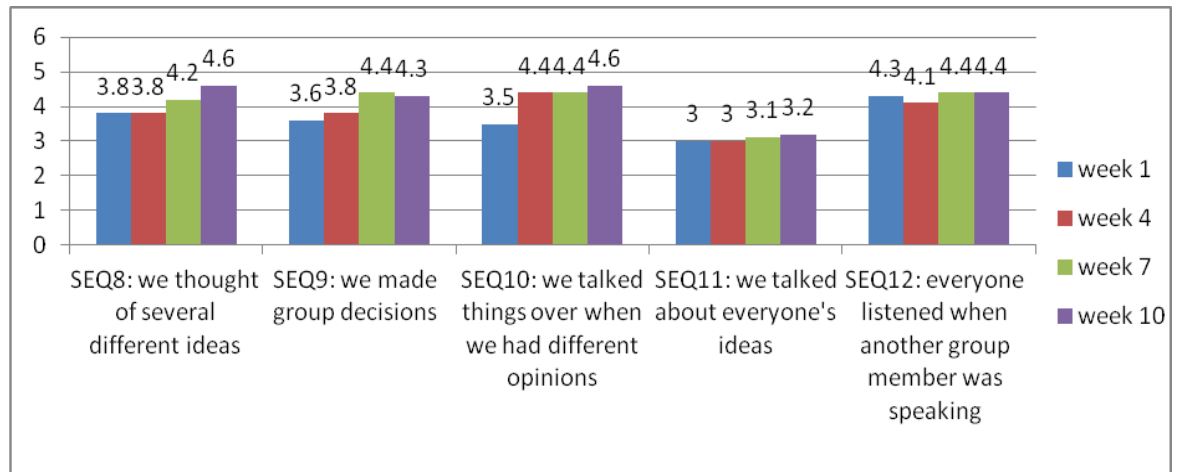
(1=very dissatisfied, 2= dissatisfied, 3=slightly dissatisfied, 4=slightly satisfied, 5=satisfied, 6=very unsatisfied)

The self-evaluation questionnaire also investigated the students' perceptions of their personal contributions, which helped to reveal whether they were willing to make personal contributions to the discussions. As shown in Figure 4.16 below, the results suggest that their individual contributions also increased throughout the intervention. These results are similar to the findings of their self-evaluations of involvement (see section 4.2.2) and group performance (as discussed above), which suggested that the students were able to think of more and more ideas over the course of the intervention (see SEQ6 in Figure 4.16 below and SEQ8 in Figure 4.15 above) and that they were willing to share them with each other (see SEQ7 in Figure 4.16 below and SEQ1 in Figure 4.1 in section 4.2.2). At same time, the students became more and more willing to interact with each other through answering questions (see SEQ3 in Figure 4.1 in section 4.2.2), talking things over to make group decisions (see SEQ9 and 10 in Figure 4.15 above), and providing feedback (see SEQ7 in Figure 4.16 below). These results imply that the infusion lessons encouraged the students to make contributions to the group, and thus facilitated collaborative learning.

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Figure 4.16 Self-evaluation of Personal Contribution to Group Discussion
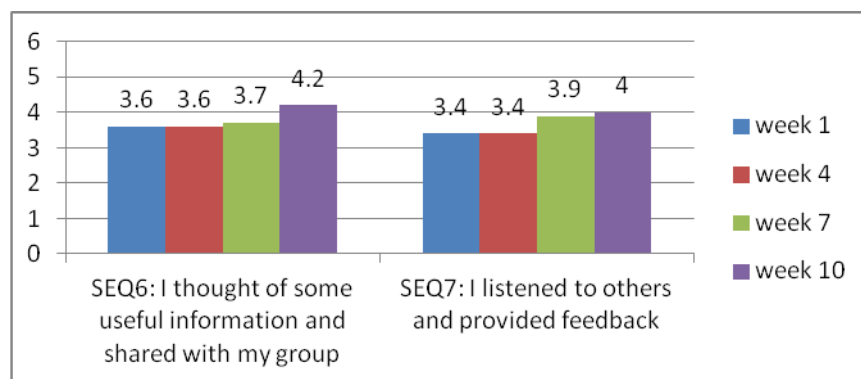
(1=very dissatisfied, 2= dissatisfied, 3=slightly dissatisfied, 4=slightly satisfied, 5=satisfied, 6=very unsatisfied)

In the same questionnaire, the students also perceived that the effects on their thinking increased over time. An examination of their responses from weeks one to ten reveals a linear increase in the results for SEQ 13 and SEQ14 (see Figure 4.17 below), which suggests that group discussion can provoke students' thinking and stimulate them to think of new ideas, and the more they engage in group discussion, the more benefit they gain from it. However, the students' responses to SEQ15 remained approximately the same from week one to week ten, and they slightly disagreed that group discussion helped them to change their minds. The reason may be that the students tended to develop their own ideas, rather than copying or simply agreeing with what others said. Evidence for this can be found in the post-intervention questionnaire data. Four students emphasised the fact that they wrote about their own ideas when writing at home (see PIQ44 below and PIQ47 in the next page).

(PIQ44-Q7-S15) 'It was unavoidable for me to think of what we have discussed in class (when I start to write at home), but I developed my own ideas.'

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Figure 4.17: Effects of Group Discussion on Thinking
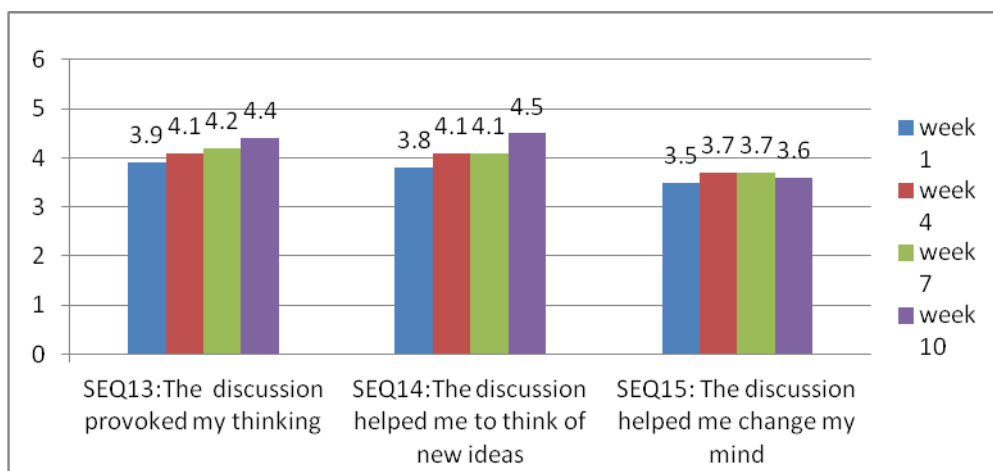
(1=strongly disagree, 2=disagree, 3= slightly disagree, 4=slightly agree, 5=agree, 6= strongly agree)

In addition to the benefits in provoking their thinking and helping them to think of new ideas, eight students proposed that group discussion helped them to think about the topic and develop their ideas. They reflected on their thinking modes and processes, and this reminded them how to think and which perspectives they could think from (see PIQ45-47 below). This finding implies that the process of writing encouraged the students to reflect on the thinking they had engaged in before, and thus contributed to the improvement of their thinking. At the same time, in turn, the practice of thinking in class also guided the students in how to think in their individual practices after class.

(PIQ45-Q9-S10): 'I recalled how we thought and what we have discussed. It was helpful.'

(PIQ46-Q9-S29): When I began to write, I usually reviewed which perspectives we had thought from in class.

(PIQ47-Q9-S7): 'I recalled what we had discussed in class, and then developed my own ideas. For example, in the lesson about movies (see Lesson eight in appendix C), I wrote about a movie different from the

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one we discussed in class. However, I reviewed our group discussion to help me think about the ways I could think and write.'

In the post-intervention questionnaire, group discussions were valued by 11 (out of 37, 29.73%) respondents for giving them the opportunity to use their thinking skills, knowledge and the target language to produce and express their own ideas, and thus they recognised the usefulness of what they had learned (see PIQ48 and PIQ49 below). The students tended to value knowledge which was useful, and this may explain why their critical thinking disposition and motivation to learn English had increased (see sections 4.2.2 and 4.4.2).

> (PIQ48-Q9-S23): 'Group discussion is a good time for us to use thinking skills and practise English. It required us to use what we had learned in class to complete the task.'

> (PIQ49-Q9-S2): 'When I used the thinking skills and English in discussion, I realised how useful they were. I think we all want to learn useful things.'

Moreover, they proposed that they liked the environment of group discussion, because they found collaborating with their peers less stressful. This was mentioned by 8 (out of 37, 21.62%) students in the post-intervention questionnaire. The reasons were that they did not need to worry about being asked questions by the teacher (see PIQ17 in section 4.4.1) or making mistakes in front of all their classmates (see PIQ50 below). Another reason was that their discussion kept their attention focused on the topic and ideas (see PIQ51 and PIQ52 below). With regard to the finding from the self-evaluation questionnaires, discussed above, that the students were more willing to talk,

share ideas, answer questions and provide feedback, it can be seen that the atmosphere in the group discussions reduced the students' worries and sense of pressure, and thus enhanced the interaction, communication and collaboration which is crucial for effective learning to take place (see chapter 2, section 2.3).

> (PIQ50-Q9-S34): 'I like it, because I was always worrying about making mistakes in front of the whole classes. Discussing in group, I felt less nervous'.

> (PIQ51-Q9-S36): 'In group discussion, I can talk freely. We discuss about the topic and exchange ideas. We completed the tasks together. This made me felt fewer pressures.'

> (PIQ52-Q9-S31): 'We complete the task in group. Our discussion focused on the ideas. I mean our opinions and understanding of topics. Our ideas were seemed valuable.'

4.4.5 Suggestions for Future Lessons

The students provided various suggestions for future lessons, mainly relating to teaching content and material, time for group discussion, types of task, expectation of being understood, as well as willingness to continue infusion lessons.

As mentioned in section 4.4.1, the students referred to the pressure of examinations and their desire to obtain high scores in the examinations (see PIQ22). They therefore offered suggestions about the teaching content, which they expected to be able to use directly in their writing and which would help them to improve the scores in the examinations. Two interviewees asked for 'formulaic sentences' or 'universal sentences' (see Interviews 19 and 20 below), which they could use directly in their writing. Four respondents supported this idea in their responses to the post-intervention

questionnaire (see PIQ53 below). This reveals that the students were still worried about their language in writing, and believed that memorisation was a helpful learning strategy. As mentioned in section 4.4.1, one interviewee still believed that the focus on vocabulary and grammar was more helpful (see Interview 15), and this belief was also reported by two respondents in the post-intervention questionnaire. Moreover, since they tended to use famous sayings to support their ideas in their writing (see section 4.2.3), they wanted to learn more (see Interview 21 below). To some extent, these suggestions reflect the students' desire to improve their performance, revealing their positive attitudes towards learning.

> (Interview 19): 'The lessons were interesting, but we need more 'formulaic sentences'. (Interviewer: formulaic sentences?) Yes, those we can use in writing directly.'

> (Interview 20): 'I want to learn some 'universal sentences'.'

> (PIQ53-Q10-S33): 'I think if teacher can introduce some model sentences to use, it will be better. We can use them in the examinations.'

> (Interview 21) 'I expect the teacher to introduce some famous sayings to us, so that I can use them in writing'.

Additionally, the students wanted the teacher to use a wider variety of sources of teaching material. One interviewee explained that using some material that did not appear in the textbook made the lessons more interesting (see Interview 22 below). This suggestion was supported by six respondents (out of 37, 16.22%) in the post-intervention questionnaire. They believed that the knowledge they got from the textbook was not enough for students who would soon be starting their academic learning and social life at university (see PIQ54 below), and thus they not only

expected to learn knowledge from books, but also other things which would be helpful

for their future social life and which could broaden their horizons (see PIQ55 below).

This finding suggests that the students had become more active and positive in learning,

and thus they had begun to think about development in the future.

> (Interview 22): 'I hope the teacher can use some material not in the textbook. That will be more interesting.'

> (PIQ54-Q10-S21): 'Teacher can find some more useful and interesting material from other books to teach us. We will enter into university soon. We need to learn more. They knowledge in the textbook is not enough. The study in university requires a lot of knowledge and skills, which we cannot learn from the textbook.'

> (PIQ55-Q10-S35): We are not only expecting to learn the knowledge in the book. We also want to learn how to get along with other, since we will get into the society in further. The teacher can invite others, for example, Miss Lin (the present researcher) to share her learning and living experience in England, so that we can broaden our horizons.

It is interesting that the students offered numerous suggestions about the types of task

that could be used in future lessons. In interview, one student suggested that they could

dub foreign films in class (see Interview 23 below). In the post-intervention

questionnaire, five students (out of 37, 13.51%) proposed that debate was useful for

developing thinking, and other students recommended role playing and enacting

dramas in classroom activities, and they thought these activities could help them to

learn and practise English (see PIQ56 and 57 below). This finding reflects the students'

positive attitude towards thinking tasks. Interestingly, S24 also expressed a willingness

to engage in the design of classroom activities (see PIQ58).

> (Interview 23): 'I like to watch and dub English movies.'

(PIQ56-Q10-S13): 'Role-play is an interesting activity. We can try in the future'.

(PIQ57-Q10-S19): 'When learning from movies and literature, we can enact them. This is interesting and helpful for learning. We can learn knowledge and practise our English, why not do that?'

(PIQ58-Q10-S24): 'I want to take part in the design of thinking tasks'.

Three students (out of 37, 8.11%) hoped that the teacher would talk to them after class and listen to their opinions and feelings. This implies that the students were active thinkers in everyday life. They thought about the teachers' teaching, their learning and their further studies. Thus, they expected their voices to be heard and to be understood.

(PIQ59-Q10-S18): The teacher can communicate with us after class more frequently to listen to our ideas and feelings.

(PIQ60-Q10-S22): The teacher should not only pay attention to the quality of teaching, but also our perceptions and ideas.

It was surprising to find from their responses to the post-intervention questionnaire that four students (out of 37) wished the infusion lessons could continue, since they were not asked the question whether or not they would like to continue taking the lessons. Therefore, although this was reported by only a limited number of students, the result is still encouraging. As presented in PIQ61 below, the student wished to continue because the lessons were helpful.

(PIQ61-Q10-S34): 'Infusion lesson were interesting and helpful. I have learned a lot. I wish these lessons can continue.'

4.4.6. Summary

The students' attitudes towards and perceptions of the infusion lessons were revealed by the self-evaluation questionnaire data collected during the intervention, and from the interview and post-intervention questionnaire data collected after the intervention, from the infusion class.

Overall, the majority of the students held positive attitudes towards the infusion lessons. In both the interviews and the post-intervention questionnaire, more than 60% of the students perceived the lessons to be enjoyable and active, although some students also referred to their worries about their performance in the exams. Although this was only mentioned by one interviewee and five respondents in the post-intervention questionnaire, it still implies that the students were under pressure from the exams. In the lessons themselves, the students encountered some difficulties relating to the insufficient amount of time available to think and discuss, unfamiliarity with the topics and being restricted by their low English proficiency. The influence of low English proficiency was reported by nearly 20% of the respondents to the post-intervention questionnaire.

In addition to the effects on thinking and writing presented in sections 4.2.1 and 4.3.1, the students were also aware that the infusion lessons had increased their motivation to learn and improve their English. They reported their increased interest in learning English, awareness of their limitations and recognition of the usefulness of the knowledge, which motivated them to learn more and improve their ability. At the same

time, they showed their understanding of effective processes of learning. They believed that successful learning should result in the ability to use the knowledge and linguistic forms they have acquired, and thus they recognised that effective language learning could be achieved through practising.

All the students liked the thinking tasks in class, and they reported different benefits of different tasks. The Six Thinking Hats task was the most popular because of its helpful and practical nature. Fact or Opinion was considered as the most challenging task, but at the same time, the students mentioned that this challenge required more cognitive work, and thus brought about various benefits and motivated them to learn more. Odd One Out was voted to be the most interesting task. It encouraged the students to be creative and enhanced their confidence, while one student pointed out that it was less challenging.

The students also liked the group discussions as the way to complete the thinking tasks. They enjoyed the discussions and did not find it difficult to talk or join in from the beginning to the end of the infusion lessons. They perceived that their group performances became more and more satisfactory from week one to week ten, suggesting an improvement in their ability to deal with different ideas and to work in groups. They also considered that the discussions provoked their thinking and helped them to think of more ideas. They claimed that group discussion gave them opportunities to apply their knowledge, which enabled them to see the usefulness of what they had learned. They felt fewer pressures in group discussions. The reasons for this were that they did not need to worry about being asked questions by the teacher or making mistakes in front of the whole class, and the focus of the discussion was on the

topic and everyone's ideas. When they were writing at home, they recalled the process of group discussion to guide them in how to think and develop their ideas, which suggests that writing can help students to reflect on their thinking.

Owing to their positive attitudes towards the lessons, the students provided a number of useful suggestions for further lessons. They suggested that further lessons should introduce more formulaic sentences and famous sayings which could be used in writing. They also hoped that they could learn things that would help them have a successful social and academic life in college, and thus suggested that the teacher use a wider range of sources of materials. The students were interested in the thinking tasks in class, and suggested many different types that could be used in further lessons, including dubbing foreign films, debate, role playing and enacting dramas. At the same time as having these positive attitudes, the students were also willing to continue these lessons.

The above findings suggest that the infusion lessons were popular with the majority of the students and that they were able to adapt to the lessons. The students perceived that they could benefit from the lessons, and thus they became more active and positive in learning.

In the next chapter, all the findings are combined for a discussion, in terms of the context created in the infusion lessons, the students' performance outcomes and attitudes towards the infusion lessons, mutual reinforcement of critical thinking skills and dispositions, and thinking and language learning.

Chapter Five-Discussion

5.1 Introduction

In the previous chapter the results of the current study were presented and illustrated. Overall, the results of this study indicated that the infusion lessons helped the students to develop critical thinking dispositions and improved their performance in thinking critically (research question one, see chapter 3, section 3.2; for evidence see chapter 4, section 4.2). The teaching of critical thinking contributed to an improvement in their overall writing proficiency, grammatical complexity and fluency. Although in the present study it was found that the accuracy of their writing decreased slightly, this indicates the effectiveness of the students' internalisation of linguistic forms of the target language (research question two, see chapter 3, section 3; see chapter 4, section 4.3). Moreover, the infusion lessons were perceived to be enjoyable and helpful for the majority of students, indicating their positive attitudes and adaption to this new teaching method (research question three, see chapter 3, section 3; chapter 4, section 4.4). These findings point to the effectiveness and applicability of infusion lessons in Chinese high school English classes, indicating the possibility and value of teaching critical thinking in Asian L2 classrooms and at high school level.

In this chapter the research questions are answered by discussing the findings in the light of the relevant literature and previous research. Firstly, the context created by the critical thinking tasks is described, in order to portray how the characteristics of the subject class were taken advantage of in order to teach critical thinking in the infusion

lessons. The discussion then moves to demonstrating how the infusion lessons succeeded in achieving the mutual reinforcement between the students' critical thinking and their learning of English, followed by a description of the effects of the infusion lessons on the students' thinking, English writing and attitudes and perceptions. Finally, the implications of the study are presented.

5.2 Contexts for Critical Thinking

As mentioned earlier in this thesis (see chapter 2, section 2.2.2), many scholars have cast doubt on whether critical thinking can be taught in Asian countries and claim that the cultures of these countries do not encourage critical thinking. The results of this study, by contrast, indicate that the thinking tasks created a positive and appropriate context for enhancing critical thinking, where intensive cognitive work was demanded, and different ideas and opinions were tolerated, respected and appreciated. The students could express their ideas, discuss the topics with their peers, and learn how to deal with different ideas through making group decisions. At the same time, interaction and collaborative learning were encouraged, and the influence of teacher authority was reduced.

In this section it is demonstrated how the design of the thinking tasks in the present study helped to create the context for the infusion lessons, and how the students' critical thinking performance was enhanced as a result.

5.2.1 Design of Thinking Tasks

The majority of the students who took part in this study perceived that the thinking tasks were cognitively demanding and helpful for their thinking and learning (see chapter 4, section 4.4.3). This result is in line with Lin and Mackay's (2004) finding that thinking tasks can engender productive cognitive work. The design of the thinking tasks contributes to this. In the present study three types of thinking task were selected, and these were performed in small groups during the intervention. The teacher provided modelling before the students completed the tasks collaboratively, and group decisions were required.

The results of this study suggest that thinking tasks in infusion lessons should be cognitively challenging, and at the same time, compatible with students' cognitive and linguistic levels. Unfamiliar topics should be carefully considered, since familiarity with the topic can influence students' cognitive performance. Nevertheless, they should not be completely avoided when they are important, and especially when it is necessary for the students to learn about them. Moreover, students' thinking performance and development can benefit from explicit instruction and modelling. Completing thinking tasks in groups eliminates the potential influence of teacher authority, and encourages interaction and collaboration.

The thinking tasks should be designed to be cognitively challenging, but at the same time interesting and manageable. In this study, the students perceived that the most challenging thinking task - Fact or Opinion - pushed them to think harder (see chapter 4, section 4.4.3). The cognitive challenge promotes more complex thinking processes and

intensive cognitive work. However, the thinking task should also be able to attract students' interest and it should be ensured that the tasks are manageable for the students, as suggested by Kumaravadivelu (1993). The findings of this study were that enjoyment was valued by 60% of the interviewees and respondents to the post-intervention questionnaire as being the reason for their positive attitude towards the infusion lessons. The students were happy to take part in enjoyable tasks, and thus in the design of the task the cognitive level of students should be considered, and the amount of interest inherent in the task should not be ignored.

When designing the tasks, the students' familiarity with the topics needs to be taken into account. The students in this study mentioned that unfamiliarity with the topic restricted their performance (see PIQ23 in chapter 4, section 4.4.1). This means that even if students are willing to engage in thinking tasks, their thinking can be hampered by a deficiency of relevant information and knowledge. This finding supports that of previous studies that students' performance in thinking tasks can be influenced by the familiarity of the topics (O'Hara and Sternberg 2001; Stapleton 2001). However, unfamiliar topics should not be completely avoided. The fact that a topic is unfamiliar does not mean it is not worth learning about. Alternatively, it may be something students need to learn about, but they have not yet done so. The topics in the textbooks used by the students in this study are selected by the Chinese Ministry of Education, and are considered to be relevant and helpful for their studies and everyday life. Since this is the case, the teacher needs to encourage students to devote more efforts to achieving learning goals.

Explicit instructions and modelling are important to enhance students' performance (Abrami et al. 2008). In this study, the Six Thinking Hats task was the favourite thinking task of more than 40% of the interviewees and respondents to the post-intervention questionnaire (see chapter 4, section 4.4.3). The students clarified the reasons for this as being that it was practical and helpful, because it provided clear instructions which they could easily follow individually, and they reported that they would use this instruction to guide their thinking in further study. The students also mentioned that they recalled the process and the ways of thinking they used in class when they engaged in individual writing at home. These findings suggest that students need explicit instructions and the teacher's modelling to show and guide them in how to use these skills to complete the tasks; they can then easily follow these methods and engage in similar thinking processes subsequently. This finding supports that of Kirkwood (2000) that in infusion lessons, teachers need to provide explicit instructions and modelling of thinking processes; however, it conflicts with the finding of Carl's study (1996), which revealed that students had an indifferent attitude towards the Six Thinking Hats task - neither positive nor negative. A possible reason for this is that the participants in Carl's study were college students and they used L1 in class. This task would have been more cognitively and linguistically demanding for the participants in the present study, since they were high school students and the language used in class was L2. This again implies that the cognitive challenge of a task can stimulate students to think, and is thus more helpful for them.

In this study, group discussion was used to allow students to interact and complete the task with their peers, with the role of the teacher being minimised. Students were assigned to discussion groups according to their seating arrangement in class, which

allowed them to interact with several peers they were familiar with. In this study, the students reported that they felt happy and less pressured when completing the task with their peers, that they could talk freely and did not need to worry about being asked questions by teachers or about making mistakes in front of the whole class (see chapter 4, section 4.4.4). This finding is in line with that of Chen and Tjosvold's (2002) study. As many scholars have pointed out, Chinese culture encourages respect for the teacher's authority (Lau 2013; Mason 2008; Tu 2001; Bush and Haiyan 2000), and some studies have found that this culture influenced students' critical thinking performance in class (Tan 2007), since thinking critically may be seen to risk challenging the authorities (Heyman 2008). Discussing in groups can thus eliminate the pressure on students caused by facing the teacher and the rest of the class.

In summary, the above discussion has demonstrated the importance of the design of thinking tasks in infusion lessons which aim to encourage critical thinking and create a supportive environment. In the next section, the discussion focuses on how students' critical thinking performance and development can be enhanced in this context.

5.2.2 Thinking Tasks as a Context for Enhancing Critical Thinking

The findings of the present study are in line with those of many previous studies (for example, Qing et al. 2010; Dewey and Bento 2009; Adey et al. 2002; Kirkwood 2000) in revealing a positive impact of collaborative thinking tasks on enhancing critical thinking. Thinking tasks provide students with opportunities to practise their thinking skills and to become aware of their thinking ability, and they involve an intensive

cognitive process which requires intellectual effort on the part of the students. At the same time, the culture created by such tasks is interactive and collaborative. Thus, students can learn from each other and be inspired, and at same time, learn to deal with different opinions and make group decisions.

The fact that thinking tasks give students opportunities to practise thinking skills was acknowledged by nearly 30% of the students in their responses to the post-intervention questionnaire (see chapter 4, section 4.4.4). This is important for developing critical thinking. Students should discover how to think critically and which is the best way to do so in their actual practice, and they can only become more capable critical thinkers through practising (see chapter 2, section 2.2.2). This accords with Facione's (2000) suggestion that the teaching of critical thinking should expand the opportunities for students to practise relevant skills. The results of this study suggest that consistent practice is helpful in cultivating the disposition and ability to think critically (for further discussion see section 5.4.1).

Furthermore, manageable thinking tasks enhance students' engagement and confidence in their subsequent learning. In this study, the students reported their increased satisfaction with their performance during the intervention, and they also became more and more active in using critical thinking in the class (see chapter 4, sections 4.2.2 and 4.2.3). Moreover, one student stated that Odd One Out was too easy and not sufficiently challenging, but the perception of another student was just the reverse: he claimed that he felt proud of being able to think of many different ideas and this increased his confidence (see PIQ43 in chapter 4, section 4.4.3). This finding confirms that of many studies in both L1 and L2 classrooms that when students become aware of

their abilities in using critical thinking, in other words, what they can do and achieve, they become more confident in applying them in subsequent tasks (for example, Aizikovitsh-Udi and Amit 2011; Yang 2008; Rao 2007; Trickey and Topping 2004; Dyfed County Council 1994).

The challenging nature of the thinking tasks necessitated more cognitive effort, which contributed positively to the cognitive development of the students. In the present study, the students reported that they encountered difficulties in thinking of ideas for some tasks, especially for Fact or Opinion (see chapter 4, sections 4.4.1 and 4.4.3). The students' thinking performance was hampered, and this could have affected their motivation both to think and to learn (Nicholls 1984). However, once students dedicate themselves to making an effort and to intensive cognitive work in order to complete the task, they will become more motivated and capable critical thinkers (Halpern 1998); this phenomenon has been reported by other researchers, such as Yang et al. (2008), and also occurred in this study. Two interviewees (out of ten) and nearly 30% of the respondents to the post-intervention questionnaire reported an increased motivation to engage in critical thinking (see chapter 4, section 4.2.1).

The form of group discussion could stimulate the students' thinking. In this study, students reported two simultaneous effects on their thinking performance: the group discussion provoked their thinking and they were able to think of more and more different ideas (see chapter 4, section 4.4.4); this was also found in Gokhale's (1995) study. The group discussions involved the expression of the students' own ideas, and exchanging and discussing these ideas with their peers. The thinking tasks thus resulted in meaningful communication. This communication focuses on the topic and produces

a variety of ideas, which stem from the diversity of knowledge and understanding of the topic of the different members of the group. Students can thus gain inspiration and stimulation from each other.

Collaborative group discussion not only exposes students to an environment of different ideas, but also encourages them to deal with different opinions with an open-minded attitude. As Chen and Tjosvold (2002) found, collaborative learning in groups encourages a supportive, rather than a competitive or independent climate. Different ideas are desired and respected, and a foundation for discussing opposing ideas openly and for being tolerant of different ideas is established. In this study, the students perceived that they become more capable of thinking of different ideas, but also that they made group decisions through talking things over when they had different opinions, and thus the group performance also become more and more satisfactory (see chapter 4, section 4.4.4). The students also reported shared their ideas with other group members, answered their questions and provided feedback, and they claimed that their performances became more and more satisfactory throughout the intervention (see chapter 4, section 4.4.4). These findings are in accordance with those of studies in both L1 (Miri et al. 2007; Campbell 2002) and L2 (Shahini and Riazi 2010) classrooms. They can also be seen to add to the literature, in that although some scholars cast doubt on whether it is appropriate to teach critical thinking in Asian countries where harmony is valued, in the classroom, expressing different ideas does not necessarily lead to imposing these ideas on others or hurting other people's feelings. Rather, the students in this study reported they became happier and happier about sharing their ideas, and felt proud when they proposed different opinions (see PIQ42 and PIQ43 in chapter 4, section 4.4.3).

It is therefore apparent that the context created by thinking tasks can contribute positively to enhancing critical thinking. In the next section, the effects of the infusion lessons on cognitive and writing performance and attitudes are discussed.

5.3 Mutual Reinforcement of Critical Thinking and Language Learning

Infusion lessons target both thinking skills and the learning of a school subject, allowing the development of thinking and the learning of the subject to support each other. Overall, in the current study the teaching of critical thinking and L2 were mutually reinforced in three ways. Firstly, as discussed in the previous section, in the infusion lessons the thinking tasks took advantage of the classroom time for the school subject to create a supportive context for critical thinking, and this in turn created a context for using the target language as a communication tool. Moreover, integrating critical thinking into the subject class allowed the students to recognise the usefulness of thinking skills for their learning, and thus increased their motivation to use and improve their thinking, which in turn produced active and positive language learners. In addition, writing is at once the practice and application of relevant thinking processes, and something which is influenced by them. The writing therefore encouraged the students to think about their thinking, and in turn, effective thinking contributed positively to their writing.

Context for Critical Thinking and the Use of L2 to Create Meaning

As discussed in section 5.2, the thinking tasks created a context in which critical thinking was enhanced, and at the same time, it was also a context where the target language played a role as a communication tool. In the infusion class, the target language was not only the subject to be learned, but also the tool for communication. The students needed to use the target language to express ideas, discuss topics and talk over different opinions to reach agreement. They also needed to listen to other group members when they were speaking, and to provide feedback. In this regard, the aim of the latest English curriculum for Chinese high schools that English should be used as a communication tool (Ministry of Education 2003) can be achieved by infusion lessons.

Students' language learning can benefit from this in three ways. Firstly, expressing critical and creative ideas encouraged students to use different linguistic forms of the target language to create different meanings. This accords with Lantolf and Pavlenko's (1995) claim that the acquisition of a language goes far beyond simply mastering linguistic forms; rather, it encompasses ways of creating meaning. Chomsky (1966) pointed out that learning a language was learning the 'finite means' of producing the 'infinite possibilities of expressions'. In other words, although it is impossible for students to learn all the possibilities of expressions in the target language, effective language teaching should be able to stimulate them to produce a wide variety of expressions. Only in this way can students can improve their ability and increase their control over the target language. This is in fact what occurred in this study: the students became able to think of more and more different ideas by using critical thinking, and thus they produced a wider variety of expressions in their writing, although more

grammatical mistakes were found as a result (see chapter 4, section 4.3.4; for further discussion see section 5.4.2).

Further, the creation of different meanings enables students to recognise what they can or cannot express in English, and thus to notice their limitations and learning needs. In this study, the students explained that they did not realise that they were not able to use some words and expressions until they tried to use them (see chapter 4, section 4.3.1), and thus they wanted the teacher to introduce more expressions for them to use (see chapter 4, section 4.4.5). This is in line with Gibson's (2012) finding that students understood the insufficiency of their target language after critical thinking was integrated into a L2 college classroom; they then knew what they needed to learn and improve in their subsequent study.

Additionally, this resulted in more comprehensive input and output, which is important in the process of L2 learning. As Vygotsky (1987) argued, imitation is an effective mechanism in L2 learning. Lantolf (2006) clarifies this, pointing out that imitation is not simply repetition, but that it is a means of noticing the expressions used by others and reforming them in such a way as to convey one's own meanings. Therefore, discussion in groups encourages students to produce more imitations of the target language through noticing the linguistic forms and rules employed in the expressions of others, and subsequently reproducing and reconstructing them to express their own meanings.

Active Thinkers and Active Learners

As McGuinness (2006) found, infusion lessons give rise to expectations of a high quality of thinking and learning, with students being activated and motivated to think and learn for themselves, thus creating active thinkers and learners.

In this research, it was found that integrating critical thinking with language learning enables students to recognise the usefulness of thinking skills, and thus increases their motivation to learn about and improve their thinking. McGuinness (2006) found that teaching thinking skills along with a school subject enabled students to feel that their thinking was meaningful and that these skills were useful. Previous studies have also found that students become more active and confident in thinking critically (Virjo at al. 2001; Sternbery and Ghana 1996; Williams 1993), and that students believe that their performance in thinking tasks demonstrates their ability (Willis 1996). In this study, the students reported that they could use the thinking skills and knowledge learned in the lessons to complete the tasks, and thus they recognised that these thinking skills were useful. This can motivate students to learn and improve their thinking skills; as one student stated, they were all willing to learn useful things. This means that if students see thinking skills as helpful for them to solve problems in their learning, they will be more likely to learn and use them. This is in fact what occurred in this study: the students became more and more actively involved in the thinking tasks, and used critical thinking skills more frequently in the group discussions and in their writing (for further discussion see section 5.4.1).

In turn, the teaching of critical thinking also gave rise to active learners, which increased the students' motivation and established positive attitudes towards learning

English. Simister (2005) makes a distinction between active passive learners and active positive learners. The former refers to those who are determined and driven to take an active part in their learning, but who are actually simply spoon-fed with other people's ideas with the sole aim of passing exams. By contrast, the latter are those who discover the truth by themselves, provide reasons to explain their ideas, judge the information received, and assimilate the knowledge into their consciousness. As also suggested by Simister (2004), a classroom in which there is an over-emphasis on the regurgitation of facts and the repetition of accepted ideas may produce 'active passive learners', while the teaching of critical thinking can inspire students and activate their enthusiasm in learning. In the teaching of critical thinking, the ideas conveyed by the language and the reasons behind the students' choices of the opinions they propose and the ideas they write about are valued. In this way, the students' disposition to take risks was increased, an appropriate attitude towards memorisation as a learning strategy was developed, enthusiasm in learning was produced, and metacognition in learning was facilitated, all of which contributed positively to their learning.

The results of this study revealed that the students became more willing to take risks in their studies. As discussed above, the effective learning of a language means that learners should be able to use its forms to create their own meanings. However, worries about making grammatical mistakes may inhibit students in reconstructing forms and creating their own meanings. This was reported by the students in the present study who were used to avoiding using expressions they were not familiar with to avoid making grammatical mistakes. As McPeck (1990) points out, if students are aware that the 'right' answers can bring them high marks, they will try to produce them. Infusion lessons, by contrast, encourage students to express their own ideas and respect different

opinions. Thus, as found in this study, students are encouraged to take risks and they start to try using more unfamiliar linguistic forms. The students in the current study overcame the psychological barrier, moving from 'writing down what they could' to 'writing down what they wanted', and from 'being hesitant about using some expressions and complex syntactic structures' to 'using them even though still not sure whether they were correct or appropriate' (see chapter 4, section 4.3.1; for further discussion see section 5.4.2). This supports the finding of Shahini and Riazi's (2011) study conducted in a college L2 class that developing critical thinking can motivate students to take risks, and is also in accord with the ideas of Casanave (2010), who recognised the formulaic style of L2 writing and thus proposed that education needs to encourage students to take risks.

The results of this study also suggest that with positive attitudes towards learning and dispositions to think critically, it can be expected that L2 students will use the memorisation learning strategy appropriately. On the one hand, the students in the present study reported that they wanted to learn more proverbs and formulaic expressions. On the other hand, they tended to use proverbs to support their points in writing, and one student actually created a proverb-like expression of his own (see chapter 4, section 4.2.3). From the combination of these findings it may be inferred that the desire to learn proverbs might have emerged from the students' increased disposition to think critically. Furthermore, in this study, a student created a proverb-type expression to support his ideas in his post-intervention written text (see chapter 4, section 4.2.3). This means that memorisation of these expressions does not always result in simply copying the forms, which corresponds with Atkinson's (1999) negative attitude towards the use of memorisation by ESL writers. On the contrary, the learning

of these proverbs can help them to notice the features of the expressions, and create imitations by using the target language, which as suggested by Lantolf (2006), will contribute to the process of internalisation (see discussion above, and chapter 2, section 2.3).

In this study, the students revealed their increased enthusiasm for their learning. In their responses to the post-intervention questionnaire, they expressed the desire for a wider variety of knowledge with the aim of preparing themselves for academic learning and social life at college (see chapter 4, section 4.4.5). This means that infusion lessons can to some extent support the educational goal of Chinese high school English teaching that the English course should support students' lifelong learning and personal development (Ministry of Education 2003; Wang and Lam 2009).

The results of this study also revealed that the students were motivated to find better and more effective ways to learn; in other words, evidence of metacognition in English learning. In their responses to the post-intervention questionnaire, the students demonstrated the fact that their understanding of effective learning was very close to the idea of internalisation. One student perceived that the successful learning of a word meant the ability to use it, rather than simply being able to recognise it when reading (see chapter 4, section 4.4.2). Another student explained that the lessons encouraged them to use sophisticated words, which helped them to 'engrave' the linguistic knowledge and forms, which was simply stored on the surface of their mind, onto their 'inner plate' (see the same section). This finding is encouraging and supports the findings of previous studies on the effects of teaching critical thinking in L1 and L2 classrooms (Kirkwood 2000; Gibson 2012). It demonstrates the students' awareness of

and ability to use knowledge to direct and improve their learning, although the number of respondents who reported this was admittedly limited, and further investigation is needed to confirm this result.

Thinking and Writing

The results of this study suggest that writing was a cognitive process in which students could practise and apply critical thinking, and thus in turn, critical thinking influenced the content of their writing. On the one hand, the students reported that their writing included more ideas and was more focused on explaining and strengthening these ideas. This indicates that the students were more willing to use critical thinking in their writing, and suggests that writing was a useful practice for them to use to apply critical thinking. On the other hand, the students reported that they tended to evaluate the ideas they received and that their reasoning ability had increased. Therefore, they demonstrated the process of evaluating ideas, and provided different types of and more powerful resources to support their ideas in their post-intervention texts. This means that in addition to facilitating the creation of meaning in the target language, as discussed above, critical thinking can also foster more critical and creative ideas in writing. This is in line with the claim of other researchers (Surd-Büchele 2011; Lei 2008; see chapter 2, section 2.4.1), and confirms the findings of Rao's (2007) and Gibson's (2012) studies that teaching critical thinking in an L2 writing class facilitates the production of more critical ideas in writing, which also influences the use of language (for further discussion see section 5.4.2).

In this study, it was also found that writing could foster reflection on thinking. The students reported that they spent more time thinking about how to explain and clarify their ideas, and they also recalled the ways of thinking and the ideas discussed in class to help them develop their ideas. These findings reveal that the students tended to think about their thinking, and sought better ways to think, which supports the idea of many scholars who regard writing as a process of metacognition (Hacker et al. 2009; Larkin 2009; Lei 2008), and concurs with Paul and Elder (2007) that substantive writing requires the writers to reflect on their own thinking process. Although Kirkwood's study (2000) provided evidence of students' use of metacognition skills after taking infusion lessons, the students in his study mainly used these skills to monitor, check and self-test their learning of the school subject, and no evidence was found of any inclination or action taken on their part to think about their thinking. The reflective nature of writing may be one of the reasons why the students who took part in the current study tended to reflect on their thinking. Another reason may be the difference in age, since the students in Kirkwood's study were aged between 14 and 16 years, while the students in this study were from 16 to 18 years old.

In turn, their improved thinking ability contributed positively to the students' writing. As discussed in detail below (see section 5.4.2), the increase in critical thinking dispositions and ability brought about an increase in overall writing proficiency, grammatical complexity and fluency. Although accuracy slightly decreased, this is evidence of the process of internalisation.

5.4 Performance Outcomes

Having discussed the supportive context created by the infusion lessons for critical thinking and the mutual support between critical thinking and language learning encouraged by the infusion lessons, this section discusses the students' performance outcomes, including their cognitive and writing development, attitudes and perceptions, in order to give the reader an overall understanding of the effect of the infusion lessons in this study.

5.4.1 Cognitive Performance

Overall, the results of this study reveal that infusion lessons could help the students to develop their critical thinking dispositions and ability, and accelerate this development. Their increased dispositions towards critical thinking were reflected in their more active involvement and persistence in the thinking tasks, appropriate critical thinking attitudes, increased frequency of using critical thinking in writing, and increased scores in the CCTDI. Their increased ability was revealed by their critical thinking performance in the thinking tasks, in their writing and in the CCTST. The acceleration of the development of critical thinking was revealed by the greater improvements in the infusion class than in the traditional teaching class. It was also found that their performance in reasoning and creative thinking was enhanced, and also their inclination to reflect on their thinking. The infusion lessons allowed critical thinking dispositions and performance to develop hand in hand, which may explain the acceleration, and which enhanced the transfer and longevity of the effects.

As discussed in section 5.3, the teaching of critical thinking in a subject class gives rise to active thinkers, who take more advantage of opportunities to use and practise critical thinking. The results of the present study revealed that the students became more and more actively involved in the thinking tasks throughout the intervention (see chapter 4, Figure 4.1 and section 4.2.2). At the same time, the students reported increased satisfaction with their performance in using critical thinking to propose ideas and reasons (see chapter 4, Figure 4.3 and section 4.2.3). This finding supports the findings of previous studies in both L1 (Burke and Williams 2008) and L2 classrooms (Rao 2007) that the teaching of critical thinking motivates students to take part in thinking tasks and that their performance in critical thinking is therefore enhanced. As Facione (2000) claimed, students are best at learning what they are willing to learn, and thus this finding also implies a positive relationship between an increased disposition to think critically and an improvement in critical thinking performance. When students' disposition to think critically increases, they tend to be more willing to become involved in thinking tasks. They then have more opportunities to use critical thinking and demonstrate a more satisfactory performance.

The infusion lessons developed the students' awareness of evaluating the ideas of themselves and others. This attitude is important since it results in appropriate critical thinking behaviour and contributes positively to the thinking process. In this study, students realised that they should explain their ideas and provide supporting reasons. They also expected others to clarify the reasons behind their judgements (see chapter 4, section 4.2.1). This helped to cultivate the students' critical thinking attitudes, which refers to evaluation and making judgements based on sound reasoning (see chapter 2, section 2.2.1). 16.22% of the respondents reported their disposition to evaluate the

ideas of others, and nearly 30% of the students said they provided supporting reasons when expressing their own ideas (see chapter 4, section 4.2.1). Similar results were obtained in Campbell's (2002) and Yang et al.'s (2008) studies conducted in L1 classrooms, namely, that the teaching of critical thinking can develop critical thinkers who discover the world by themselves, rather than accepting everything without question.

The infusion lessons encouraged the students to apply their critical thinking, which as other researchers claim, revealed their positive dispositions towards critical thinking (see chapter 2, section 2.2.1). In this study the students used critical thinking more frequently to elaborate their ideas in writing after the intervention (see chapter 4, Figure 4.2 and section 4.2.2); this finding is in line with that of Godfrey (2001) in an L1 classroom, that the teaching of thinking skills can increase the frequency of use of relevant types of cognition.

The results of this study suggest that the development of a critical thinking disposition can be enhanced and accelerated through the teaching of critical thinking. The results of this study indicate that the infusion class had improved significantly in 'truth-seeking' and in their overall scores of CCTDI, while the traditional teaching class showed no significant improvement, but a significant decrease in 'analyticity' (see chapter 4, Tables 4.1 and 4.2, section 4.2.2). Moreover, the improvement in 'truth-seeking' in the infusion class was significantly greater than that in the traditional teaching class. These findings indicate that infusion lessons can help to improve students' overall dispositions and 'truth-seeking', and at the same time, accelerate the development of 'truth-seeking'. These results are in line with that of Miri et al.'s (2007)

study that the students' mean scores in 'truth-seeking' and their overall CCTDI scores had improved after teaching critical thinking, and that the improvements were significantly greater than in the non-intervention class. However, the results are not consistent with Zhou et al.'s (2010) and Miri et al.'s (2007) findings, in that in the current study no significant increase was found in the students' 'self-confidence' in thinking critically.

The inconsistency of the above results does not mean that the infusion approach is not effective, however. Rather, in this study, the low level of confidence in their reasoning capabilities of the students in the infusion class can be attributed to their disposition to evaluate their own reasoning. As proposed by McGuinness (2006), infusion lessons set expectations of a high quality of thinking. The students therefore had higher expectations of their reasoning skills, which are at the heart of critical thinking (see chapter 2, section 2.2.1), and thus a low estimation of their existing levels and performance. In Zhou et al.'s (2010) and Miri et al.'s (2007) studies, instruction on critical thinking was implicit, and metacognition was not promoted. The students did not build appropriate attitudes toward critical thinking, and at the same time, were not aware of the need to evaluate their own ideas and ways of thinking. Therefore, they did not derive the same amount of benefit as the students in this study or those who took part in Dewey and Bento's (2009) and Kirkwood's (2001) studies did.

Results of this study reveal that the students' performance in using critical thinking in their writing also improved (see chapter 4, section 4.2.3). This result supports the findings of Higgins et al. (2005) and Burke and Williams (2008), who taught thinking skills in an L1 classroom; their findings suggest that teaching thinking skills can

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improve students' cognitive performance. The findings are also evidence of the students' use of critical thinking in their normal writing tasks, indicating that the infusion lessons were practical and helpful for the students' learning of their school subjects (in this case, the English language). The students were also aware of the effects on their writing (see chapter 4, section 4.3.1). This result contradicts the claim of some scholars (Atkinson 1997; Fox 1994) who are hesitant about introducing critical thinking into Asian L2 classrooms, yet support the need to teach and the benefit of teaching critical thinking along with school subjects in school curriculums (Assaf 2009; McGregor 2007; McGuinness 2006) and in Asian L2 classes (Wen et al. 2009; Wen 2008; Stapleton 2002, 2001; Davidson 1998).

A noteworthy improvement was found in the reasoning performance of the students who took part in this research. They used a wider variety of ideas and more powerful ways to strengthen these ideas (see chapter 4, section 4.2.3). This finding corroborates those of most studies on the teaching of critical thinking: in L1 classrooms in primary schools (Campell 2002; William 1993), in high schools (Lizarraga et al. 2001), in colleges (Yang et al. 2008) and in L2 classrooms in college (Rao 2007), revealing students' improvement in reasoning skills. This corresponds with the view of many scholars that reasoning is at the core of critical thinking (Sternbery et al. 2007; Cotterell 2005; Sigel 1998), and therefore the ability to reason is the key to being able to think critically; thus programmes on teaching critical thinking can result in the improvement of reasoning skills.

The students also showed their inclination to be creative. Scholars have pointed out that critical thinkers tend to be creative and that creative thinking is of great value for

critical thinkers (Simpson and Courtney 2002; Brookfield 1987). In the current study it was found that the students tended to think of different ideas from each other, and that they used three new and stronger ways of clarifying their ideas in the post-intervention written tasks (see chapter 4, Figure 4.4 and section 4.2.3). In their responses to the post-intervention questionnaire, the students mentioned that they were excited and proud of being able to think of different ideas. This finding is consistent with the results of Lizarraga et al. (2010) in a high school L1 class and Rao (2007) in a college L2 writing class, suggesting that an increase in creativity can be another benefit of teaching critical thinking.

The students also reported on their actions in thinking about the thinking processes they had engaged in in class before they started their individual writing tasks at home. They had learned these ways of thinking and perspectives from which to think from the group discussions, and they recalled the ways of thinking and the perspectives they had thought from, along with the ideas raised in group discussions, in order to develop better ideas in their writing (see chapter 4, PIQ43-45, section 4.4.4). Consequently, 16.22% of the respondents to the post-intervention questionnaire reported that their thinking had improved because they could think from different perspectives (see chapter 4, section 4.2.1). This finding suggests that infusion lessons can encourage students to find different and better ways in which to think, as was found in Dewey and Bento's (2009) and Kirkwood's (2000) studies, and also implied their inclination to reflect on their thinking. As discussed in section 5.3, this can be attributed to their active and positive attitudes towards critical thinking and the influence of writing, which created the opportunities for and encouraged the students to reflect on their own thinking.

The results of this study also suggest that the students' critical thinking ability, as measured by the CCTST, can be consistently and thoroughly improved and accelerated after taking infusion lessons. In this study, the infusion class demonstrated significant improvements in all sub-scales and overall scores, while in the traditional teaching class, improvements were found in 'analysis', 'inference' and overall CCTST scores (see chapter 4, Table 4.9 and section 4.2.2.2). This indicates that infusion lessons can assist students' development in all dimensions of critical thinking skills; this result is in line with the findings of Aizikovitsh and Amit (2010), and it also supports Ali and Daud's (2003) finding that the teaching of thinking can improve students' performance in cognitive tests. Although both the classes who took part in the current research improved, the results of the Independent Sample T-test showed that the improvements of students in the infusion class were significantly greater than those in the traditional teaching class in 'inference' and overall scores (see chapter 4, Table 4.6, section 4.2.3). This finding supports the results of Dewey and Bento (2009) that infusion lessons can accelerate students' cognitive development.

The traditional teaching class also had improved CCTST scores in some dimensions and in their overall scores. This finding is contrary to the notion of some scholars that critical thinking cannot be taught using traditional teaching methods (Wong 2007; McCarthy-Tucker 2000). Huff's (2000) study may also provide indirect evidence to support this. The purpose of his study was to investigate if there was any difference between the development of critical thinking in students who received face-to-face teaching as opposed to distance teaching, and in those with whom no special teaching method was employed. Both groups of students showed significant improvement in

CCTST scores, and no difference was found between the two groups. Although his study investigated university social work classes, however, the results still reflect the fact that traditional teaching is helpful in the development of critical thinking.

The present study, however, reveals that new teaching methods, such as infusion lessons, that allow the mutual reinforcement of thinking skills and dispositions, can accelerate this development and contribute to development in all dimensions. On the one hand, Facione (2000) proposed that learning always follows motivation. In the infusion lessons employed in this study, the thinking tasks activated the students' desire to use critical thinking as an effective means to solve problems and make decisions, and thus increased their positive attitudes and dispositions towards using critical thinking (Miri et al. 2007, Facione 2000). This prepared a foundation for the teaching and learning of critical thinking skills. On the other hand, the infusion lessons provided explicit instruction and modelling on how to perform critical thinking, which illustrated the kind of skills they could use, why they should use them, and how to use them. This enabled the students to perform better in the thinking tasks and to notice the usefulness of what they learned, and thus they became more willing to learn and use these skills, as discussed in sections 5.2.2 and 5.3. The students in the traditional teaching class did not receive explicit instruction on critical thinking skills, nor were they exposed to an environment in which critical thinking was encouraged, desired or respected. Their motivation to think critically was not activated, and they had fewer opportunities to practise and use critical thinking. In contrast, students in the infusion class showed greater and consistent improvements. This result supports the findings of Aizikovitsh and Amit (2010) that infusion lessons can accelerate the development of both critical thinking dispositions and skills.

Additionally, the findings of this study confirm the findings of Yang et al. (2008) and Adey and Shayer (1994) that the effects of teaching thinking can be transferred within the subject it has been taught along with. In this study, thinking skills were taught in class and practised in group discussions. The students perceived that they tended to use these skills in writing, and their ability to use these skills in writing was also found to be improved. The results show that they actively applied critical thinking, and thus were able to use these skills in different contexts and different tasks. Although transfer across subjects was not investigated in the present study, many empirical studies have proved that reasoning skills are often transferred to a wider variety of situations, social life and the study of other subjects (Miri et al. 2007; Zohar and Dori 2003; Zohar and Nemets 2002). This can be attributed to the benefit of mutual reinforcement discussed above, where their improved dispositions motivated the students to apply critical thinking in other contexts and situations to help them solve problems. The use of relevant skills enabled them to achieve their aims and complete the tasks.

Longevity of effects is an ultimate goal when teaching thinking. The interview and post-intervention questionnaire data provided evidence of the students' willingness to use the thinking skills and methods which they had learned in the infusion lessons in their future learning. For example, the students reported that the Six Thinking Hats task provided clear and practical instruction, so they would follow the instruction and use it in future study (see chapter 4, section 4.4.3). This means the students would continue to apply the thinking they had learned in the infusion lessons afterwards, take advantage of more opportunities to practise these skills, and become more capable critical thinkers. Therefore, the longevity of the effects of the infusion lessons in the present study can

be expected, as found in Yang et al. (2005) and Adey et al. (2002). Again, the reinforcement gives rise to active and positive critical thinkers, as discussed above and in section 5.3, who continually take advantage of opportunities to practise and apply critical thinking, and eventually become more confident, motivated and efficient critical thinkers. Further studies are needed to investigate how long these effects can last and how these effects influence students' thinking and learning performance and development.

To summarise the relationship between the results of the current study and those of previous research: the above findings first contradict those of Atkinson (1997), and confirm the possibility and effects of teaching critical thinking in L2 classrooms, as found in Gorjian et al.'s (2012) and Shahini and Riazi's (2011) studies. Secondly, the results are inconsistent with the claim of Ramanathan and Kaplan (1996) and Fox (1994) that critical thinking is a product of Western culture, and cannot be taught in Asian countries where the culture does not encourage it, and instead support the findings of Liaw (2007) that critical thinking can be taught in Chinese L2 classrooms. Additionally, the results are also consistent with those of Lizarraga et al.'s (2010), Giancarlo and Facione (1994) and Qing et al.'s (2010) studies, indicating that critical thinking can be taught within a high school curriculum in both L1 and L2 contexts.

Again, the reinforcement gives rise to active and positive critical thinkers, as discussed above and in section 5.3, who continually take advantage of opportunities to practise and apply critical thinking, and eventually become more confident, motivated and efficient critical thinkers. Therefore, the results of the present study suggest that infusion lessons, which encourage the mutual reinforcement of critical thinking

disposition and skills, can combine the benefits of the various programmes applied in different contexts in the above-mentioned studies, indicating the possibility and effectiveness of teaching critical thinking in a Chinese high school L2 class, and that they could also help to achieve the aim of the latest Chinese high school English curriculum by improving the critical thinking ability of Chinese high school students through integrating critical thinking into the English curriculum.

It is worth noting that although the students did not show improvements in all sub-scales of the CCTDI (this result being in line with those obtained by previous researchers, such as Aizikovitsh-Udi and Amit (2011), Qing et al. (2010), Ozturk et al. (2008) and Miri et al. (2007)), the results provided insight into the students' strengths and weakness in various dimensions of their critical thinking disposition, and into the effects of these programmes on the development of these various dimensions (Tiwari et al. 2006); this will help future researchers to develop an approach which is more capable of achieving changes in all, or other, dimensions of the critical thinking disposition.

5.4.2 The Development of Writing

The effect of the infusion lessons in terms of assisting and accelerating the students' cognitive development was discussed in section 5.3.1. The findings of this study also support the idea that infusion lessons can enhance students' performance in the school subject (in this case, the English language). Comparisons between the students' pre- and post-intervention written texts revealed that the overall writing proficiency, grammatical complexity and fluency of writing of the students had improved, while the

accuracy of their writing had decreased slightly. The data from the written texts also indicated positive associations between the changes in their thinking and their writing performance. Although their writing contained more grammatical mistakes after the intervention, these were the results of an increase in their motivation to improve their writing.

The students showed improvements in overall writing proficiency (see chapter 4, section 4.3.2). This can be attributed to the development of their thinking. The process of writing is influenced by the cognitive process to which it is connected (see chapter 2, section 2.4.1); hence, Rao (2007) claimed that good writing comes from good thinking. Kenkel and Yates (2009) pointed out that L2 writers have a common problem in making points and providing support for their arguments in writing. Xu (2009) and Lin (2007) proposed that Chinese high school students invariably demonstrate a low proficiency in writing, and that one of the main features of this is the 'poor content' of their writing (Lin 2007). The improvement in critical thinking that took place in this research enabled the students to think of more useful and interesting ideas, and to explain and clarify these ideas in different and more rational ways. This finding is consistent with the finding of Gorjian et al. (2012) and Riazi (2010) that an improvement in critical thinking ability can contribute to an improvement in overall L2 writing proficiency, although unlike the current study, their studies were conducted among college students.

An improvement was found in the grammatical complexity of the students' writing (see chapter 4, section 4.3.3). In the post-intervention writing texts, it was found that the students tended to use more dependent clauses (see chapter 4, section 4.3.3). By using

critical thinking, they gained a deeper understanding of the topics (Gibson 2012); for example, in this study, the students demonstrated their analysis of the relationship between two different phenomena and their comprehension of the meaning of words. They thus needed to use more complex syntactic structures to explain these more complex and logical ideas; for example, when providing more examples and philosophical explanations, and when precisely defining words (see chapter 4, section 4.2.3). This finding is consistent with the results of other researchers when teaching critical thinking in L1 classes (Nippold et al. 2005; Crowhust 1980; Rubin and Piche 1979), suggesting that infusing critical thinking into a L2 writing class can increase the need to use complex sentence structures through promoting a deeper understanding of the topics. In addition, although longer or more complex T-units do not necessarily mean better T-units, an increase in syntactic complexity still reveals the development of linguistic repertories that the learners can use appropriately to express themselves (Ortega 2003).

It is worth noting that the students did not use complex sentence structures in all the T-units; rather, they tended to use them only when they were needed. In the interviews, the students expressed the view that a piece of good writing should contain many independent clauses (see Interview 7 in chapter 4, section 4.3.1). This means that they perceived that the inclusion of complex sentence structures could contribute to the quality of their writing, but at the same time they admitted that they were hesitant about using them for fear of making grammatical mistakes (see chapter 4, section 4.3.1). Thus, they tended to use them only to express their more logical and creative ideas, although they did demonstrate an increased willingness to take the risk of making mistakes. These findings indicate that the use of critical thinking increased the students' need to

use these linguistic forms and knowledge, rather than simply encouraging them to take unnecessary risks and use unfamiliar expressions needlessly. In summary, the students were found to use complex sentence structures when needed, rather than with the sole intention of demonstrating their language proficiency, and thereby spoiling a good piece of writing.

The accuracy of the writing of the students who participated in the current study decreased slightly after the intervention (see chapter 4, section 4.3.4). This result contradicts the finding of Gibson (2012) that integrating critical thinking into a college L2 classroom did not appear to have any influence on the accuracy of L2 writing. The finding of the present study may be attributed to the students' willingness to apply critical thinking in the writing tasks and to express their ideas in writing. As the students reported in the post-intervention questionnaire, they were used to writing down only those ideas that they were able to express in English; now, however, they wanted to write down all the ideas they wished to include in their writing (see chapter 4, section 4.3.1). The students thus needed to use expressions with which they were not familiar or had not used before to express these new ideas. In Gibson's (2012) study, mentioned above, critical thinking was not taught as an explicit objective in the class as it was in the infusion lessons in the current research, and thus the students in his study might not have been encouraged or motivated to apply critical thinking in other contexts or in other tasks. The finding of this study suggests that the teaching of critical thinking should be able to encourage students to apply and demonstrate their thinking, in order to motivate and activate them to use the target language to express ideas, which is what happened in the infusion lessons.

The decrease in accuracy guide the researcher to note students' increased imitations of target language, which demonstrated students' reconstruction of the linguistic forms. In their post-intervention written texts, they were found to show their understanding of the meaning and spelling of some words, while they were failed to use them to express intended meanings since they did not use the correct forms or combined two words inappropriately (see chapter 4, section 4.3.4). The frequency of these types of mistake in the post-intervention written texts was more than twice that in the pre-intervention texts. This can be attributed to the students' increased willingness to take risks, and these mistakes are in fact evidence of the effective process of language acquisition (see section 5.3). Students need to reconstruct linguistic knowledge and forms to create their own meaning in order to acquire the ability to produce a variety of possible expressions.

At the same time, the modification of existing knowledge is important to achieve successful internalisation (Swain and Lapkin 1999). The appearance of these mistakes indicates that the students had initiated attempts to internalise these expressions and linguistic knowledge, which would guide them to confirm, correct and modify their existing knowledge. The increase in grammatical errors found in this study also highlights the need for and importance of teacher feedback, as also proposed by the students (see chapter 4, section 4.3.2), which allows students to see what kind of mistakes they have made and how to correct them. Only in this way will students be able subsequently to complete the internalisation process successfully.

The reasons for the decrease in accuracy and increase in grammatical complexity are linked to the fact that infusion lessons create a climate in which there is a high expectation of a good quality of learning (McGuinness 2006). Students want to

demonstrate their best performance. In the present study, the students considered that the use of sophisticated words and complex syntactic structures were two of the main indicators of a good piece of writing (see chapter 4, section 4.3.1). This finding is consistent with that of Xu's (2008) study that there appeared to be a consensus among Chinese high school students regarding what constitutes good writing. In the post-intervention questionnaire in this study, the students admitted that they had been hesitant about using such words and structures before, in order to avoid the possibility of making grammatical mistakes. However, in the same questionnaire, they reported that they had now become more willing to use them, even though they were not sure whether they were using them correctly or appropriately. This can be considered as an indication of their attempts to improve the quality of their writing, indicating their positive attitude towards and increased motivation in learning English.

At the same time, the students' increased disposition to be creative can also explain these results. As discussed in section 5.3.1, the students tended to become more and more creative, and felt excited about and proud of this. This influenced their writing. In the post-intervention written texts it was found that the students used three new ways to clarify and strengthen their ideas (see chapter 4, Figure 4.3 and section 4.2.3), and one student created a proverb of his own when he wanted to use a proverb but could not remember any (see Example 18 in the same section). This finding corresponds with the finding of Nippold et al. (2005) in a L1 writing class and Rao (2007) in a L2 writing class that the teaching of critical thinking can stimulate more creative and critical ideas in writing. The students wanted to demonstrate these ideas, and thus used more unfamiliar words and expressions, and complex sentence structures when needed.

An improvement in the fluency of the students' writing was also found in this study (see chapter 4, section 4.3.5). The students were found to produce longer texts in the post-intervention written tasks. This may be attributed to their increased ability in thinking. As found in Shahini and Riazi's (2011) study in a college L2 class, developing students' critical thinking fosters the production of expressions in the target language. Students can think of more ideas, and thus produce longer texts. In addition, writers can become 'stuck' in their thinking when they are writing (Chenoweth and Hayes 2001), and thus thinking efficiency can affect fluency in writing. The students in this study perceived that they were able to think of more ideas, and in their post-intervention written texts there was an increase in the frequency of their use of critical thinking to articulate their ideas. Since both the pre- and post-intervention written tasks were completed in 30 minutes, the students demonstrated a better and more efficient use of critical thinking, and were therefore more fluent in writing down their thoughts. Previous studies on the teaching of thinking in L2 classes have not provided empirical evidence of the effect on fluency in writing; the finding of this study that the fluency of L2 writing can be increased by improving students' thinking therefore adds to the literature in this respect.

The fluency of their writing can also be enhanced by the students' willingness to take risks, which, as proposed by Simister (2004), is an effect of teaching thinking. Students can become stuck in their writing by searching for appropriate language (Hall 1990), but at the same time, be hesitant about using unfamiliar expressions, as the respondents reported in the post-intervention questionnaires in the present study. Infusion lessons encourage students to take risks, which means that they may waste less time worrying

about making mistakes. Thus, as noticed by the students in this research, after the intervention they had the courage to use unfamiliar linguistic forms.

One unexpected finding is that students who were deemed to be low achievers (who obtained overall writing scores of less than 60% in the pre-intervention writing task) in English writing improved more in overall writing scores after the intervention than the high achievers (see chapter 4, section 4.3.2), with the scores of the former increasing by twice as much as those of the latter. As discussed in chapter 4, S9 is a good example of this phenomenon. S9 reported that he was encouraged by the infusion lessons to include more ideas in his writing, and thus took advantage of opportunities to practise thinking and create meaning in the target language (see chapter 4, section 4.3.2).

One possible reason for the above is the effect of metacognition. Researchers have found that teaching thinking skills can have an impact on students' learning awareness (Moseley et al. 2005; Lin and Mackay 2004; Moseley et al. 2004), which is particularly helpful for low achievers (Kramarski et al. 2002; Quicke and Winter 1994; Powell and Makin 1994). The post-intervention questionnaire used in the current research provided evidence of the students' awareness of the process of effective learning (see chapter 4, section 4.4.2). Although most of the students who reported their awareness of effective learning were those who had not submitted their written texts (the number of written texts and the number of post-intervention responses were different), these encouraging results need to be considered, and an investigation into the effects and progress of individuals at different levels would make an interesting subject for future research.

Another possible reason for the greater improvement of low achievers can be linked to the concept of the ZPD (see chapter 2, section 2.3). Ohta (2000) found that L2 development could benefit from collaborative learning in class. Vygotsky (1978) and, more recently, Watson (2001) believed that collaborative learning could help low achievers to improve. Zohar and Dori (2003) revealed that lower achievers made greater academic improvements by teaching higher order thinking skills. In the current study, the students completed the thinking tasks in groups (see section 5.3), so the low achieving students might have had more opportunities to learn from the expressions of others, and to reproduce them to explain their ideas. This imitation of the target language contributes positively to the process of internalisation of the target language. As a result, the low achievers showed greater improvement in overall writing proficiency.

The above results suggest that the L2 writing performance of Chinese high school students can be improved by the teaching of critical thinking, in the same way as that of L1 students (Nippold et al. 2005) and L2 college students (Shahini and Risazi 2010). It also supports the findings of studies which indicate that integrating the learning of thinking skills with that of a school subject leads to improvements in both areas,

5.4.3 Attitudes and Perceptions

When attempting to introduce new teaching methods, it is crucial to understand students' attitudes and perceptions. The intervention used in this study affected the students' attitudes towards and perceptions of infusion lessons, and at the same time, their attitudes and perceptions also affected their actions and performance, and thus to

some extent determined the effects of the intervention. As mentioned in section 5.3.2, students who had positive attitudes towards critical thinking were more willing to use and apply these skills in a wider context, and thus the possibility of extending and prolonging the effects of the intervention was enhanced.

More than 60% of the interviewees and respondents to the post-intervention questionnaires found that they were enjoying the lessons and that they were more active in class (see chapter 4, section 4.4.1). It is interesting that nearly a quarter of the respondents to the post-intervention questionnaire referred to their passivity in previous writing lessons. This means that the students liked the infusion lessons and were willing to take an active part in them. This finding supports that of the studies of Marin and Halpern (2011), Lizarraga et al. (2010) and Miri et al. (2007) that high school students can adapt to integrate critical thinking into their school curriculum; it also adds empirical evidence to the literature that L2 high school students have positive attitudes and adaptability to the teaching of critical thinking. This finding, however, conflicts with that of Carl's (1996) study in a college, which revealed students' indifferent attitudes to the instruction on thinking skills in a L1 classroom. This difference in students' attitudes implies that programmes in which thinking is taught apart from subject learning do not attract students' interest. Since Carl's programme was not linked to the learning of a subject, the students might have been less interested and less motivated to become involved in the programme.

As mentioned in section 5.2.1, the students in this study referred to the helpfulness of the thinking tasks. Three tasks were selected for the present study. The Six Thinking Hats task, which provides clear and practical instructions, was the students' favourite

task. The students perceived that they became more able to think from different perspectives and attributed this to the effect of Six Thinking Hats (see chapter 4, sections 4.2.1 and 4.4.3). Their perception of the effects of Six Thinking Hats did not, however, include the view found in Adetunji and Amaraeze's (2012) study that it was an effective technique for encouraging creativity. In this study, the students attributed this to the effect of the Odd One Out task. Although one student claimed that this task was too easy and not challenging enough, other students valued its positive impact on creativity and on enhancing their confidence. Although Fact or Opinion was voted to be the most challenging task, surprisingly, no further negative comment was found (see chapter 4, section 4.4.3). Rather, the students reported that this task developed their habit of evaluating information received, and reminded them to provide reasons to justify their own ideas.

Based on the students' attitudes towards the tasks discussed above, it can be inferred that they also had positive attitudes towards the cognitive challenges presented by the tasks. According to the findings of Abdullah et al.'s (2003) study, students believe that challenging tasks promote their thinking and that this will make them cleverer. In Liaw's study (2007), the students even asked for more challenging materials. Similar results were also obtained in this study. The students pointed out that the challenging tasks encouraged them to make more effort in their thinking and to think more intensively, and they were also motivated to search for additional information and knowledge. It was thus not surprising to find, therefore, that they suggested that the teachers use a wider range of teaching material, and suggested a variety of different types of task for future lessons, some of which were more cognitively challenging and linguistically demanding; for example, debate was recommended by 5 students.

It should also be pointed out, however, that the infusion lessons were not universally popular. In their interviews and responses to the post-intervention questionnaire, the students expressed their worries and described some difficulties they had encountered. Their worries concerned their performance in the examinations, especially the NCEE, which is considered the real aim of high school education, since the overall NCEE scores determine which university students can be enrolled in (see chapter 1, section 1.3). This result is in line with the finding of Cheng (2009) that obtaining high scores in the NCEE is the aim and motivation behind high school learning in China. The students in the present study also reported some difficulties with the infusion lessons. They explained that some of the tasks and topics inhibited their thinking performance, and they needed more time to think and discuss. They also recognised that their expressions of ideas were restricted by their poor language proficiency.

The difficulties did not always have a negative impact, however. On the one hand, as found in Shahini and Riazi's (2010) study in an L2 classroom, the students enjoyed the group discussions and were not aware of the passage of time. On the other hand, the group discussions also allowed the students to recognise the limitations in their use of the target language, thus enabling them to see what should be improved in future study, as was also found in Rao's (2007) study. As discussed earlier in section 5.2, in this study, the students became more and more actively involved in and persistent at group discussion, and they perceived they derived benefits in both thinking and learning. These findings have an implication for pedagogy, in that teachers should encourage students to be active and positive learners, who can make efforts to overcome their difficulties and ultimately gain improvements.

In addition, Nakatani (2005) has pointed out that it is unlikely that every student will gain improvement through a training programme. Kirkwood (2010) claimed that it is not possible that all students will report similar and positive attitudes towards infusion lessons. McGuinness's (2006) study also revealed that the image of the active learner in the infusion lessons did not appear in all the students. The results of the present study thus provide evidence that will help future researchers to design a teaching method that will achieve the specific changes desired.

The students offered many suggestions for further lessons, which reveal their positive attitude and interest in infusion lessons (see chapter 4, section 4.4.5). They perceived that the knowledge found in the textbook could not fulfil their needs for their future learning and social life, and thus they desired a wider variety of knowledge and material. They showed particular interest in the thinking tasks, and they recommended several different types of task; one student reported his willingness to take part in the design of thinking tasks.

Some other suggestions reveal the students' awareness of the need for linguistic input and output. On the one hand, the students expected the teacher to introduce more model expressions and proverbs which they could use directly in their writing. Although this could be evidence that memorisation was still a learning strategy valued by the students, this should not be discouraging in infusion lessons. It may contribute to the imitation of the target language, as found in the present study. On the other hand, the thinking tasks recommended by the students were linguistically demanding; for example, dubbing

English films, enacting literature and films, debate and role play. They wanted more opportunities to use and practise the target language, indicating their motivation and awareness of effective ways to learn English.

5.5 Implications of the Study

The teaching of critical thinking in an L2 classroom activates meaningful practices of different language skills simultaneously in the class. Thinking tasks require students to use the target language to create meaning and interact with their peers in order to complete the tasks. Therefore, their communication is meaningful. Students practise speaking and listening when expressing ideas and communicating with group members. They practise reading when reading the material and searching for relevant and helpful information. They practise writing when they are articulating their ideas in the written language. This creates more opportunities for the students to learn from the expressions of others, and to reconstruct the forms to create their own meanings. Students produce more imitations of the target language, which can contribute to an effective process of internalisation.

The teaching of critical thinking can give rise to positive and active learners who are enthusiastic about both their studies and their lives. They are actively involved in class and dare to take risks in their studies. They reflect on their own thinking and learning, and seek better and more effective ways to think and learn. They also prepare themselves for academic learning in college and social life in the future. This makes it possible for English teaching to contribute to the students' personal development and life-long learning.

As the students who took part in this research suggested, thinking tasks can be more diverse and linguistically demanding. This study revealed that the thinking tasks were favoured by the majority of students, and they were willing to take advantage of them to practise their language skills. This has implications for pedagogy, in that teachers can choose a wider variety of tasks, which demand a wider range of linguistic forms, resulting in effective internalisation.

Teachers' feedback is essential. As found in this study, the students were more willing to take risks in using unfamiliar expressions, and thus made more grammatical mistakes. Although these mistakes are milestones in the process of internalisation, students can only achieve successful improvement by correcting their mistakes and modifying their existing knowledge. Teachers' feedback is thus crucial in order to guide students to make the required corrections and modifications.

As mentioned by the students, they expected the teacher to listen to their voices after class. This is also something suggested by Seedhouse (1997, see chapter 1, section 1.6): that students' attitudes and perceptions are important and valuable. Students who hold positive attitudes are more willing to become involved in the lessons and to invest more effort in the work. Therefore, when designing the lessons, students' opinions and feelings should be taken into account.

5.6 Summary

In this chapter the research questions have been answered through a discussion of the contexts created by the infusion lessons for critical thinking, the effects of the infusion lessons on students' cognitive and writing performance, attitudes and perceptions, as well as the mutual reinforcement of critical thinking skills and language learning.

The results of this study suggest that integrating critical thinking with regular language instruction facilitates effective cognitive and learning development. As claimed by many scholars, teaching thinking skills along with subject content may be the most effective way of developing thinking (David and Taverner 2008; Macleod and Holdridge 2006; Hayard and Fernandez 2004; Lin and Macky 2004; Cheney 20002). In contrast, if thinking skills are taught in isolation and separate from the school curriculum, as argued by McGuiness (1999), it may be impossible to transfer them to the mainstream curriculum, and thus they are less valuable. Therefore, the results of this study support the views of Dewey and Ben (2009), Assaf (2009), Moseley et al. (2005) and Moseley et al. (2004) that the infusion approach is a helpful and effective method of integrating thinking skills into a school curriculum, and also reveal that it is an applicable and feasible method to employ in a Chinese high school L2 context. The results also contradict the view of some scholars (Atkinson 1997; Fox 1994) who are hesitant about introducing critical thinking into Asian L2 classrooms.

Teaching critical thinking in an L2 class created a context where critical thinking was enhanced, and the target language was used as a communication tool. The students hence engaged in a critical thinking process which allowed them to practise relevant

skills, and at the same time used the target language to create their own meanings, which in turn encouraged them to reconstruct linguistic knowledge and forms. The infusion lessons also produced active thinkers and learners, and promoted metacognition in both thinking and learning. Therefore, the students enjoyed and were able to adapt to the lessons, their disposition to think critically increased, and their critical thinking and writing performance improved.

In the next chapter, the research aims and main findings of this study are briefly reviewed, followed by an overview of the contributions made by the study. Finally, the limitations of the study and suggestions for further research are presented.

Chapter Six- Conclusion

6.1 Aims and Key Findings of the Study

The aim of this study was to examine the applicability of infusion lessons in Chinese high schools by investigating their effects on the development of thinking, language learning and students' attitudes and perceptions.

The results of this study suggest that the thinking tasks used in the infusion lessons helped to create a context conducive to critical thinking. They were cognitively demanding and challenging, which meant the students were required to use thinking skills (post-intervention questionnaire data, see chapter 4, section 4.4.3). The manageable nature of the tasks caused the students to become involved and enhanced their confidence (see same section). The fact that the tasks were challenging motivated the students to invest more effort in their cognitive work. Completing the tasks in groups encouraged interaction and collaboration, and this enabled the students to exchange ideas, and to be stimulated and inspired by others (self-evaluation questionnaire data, see chapter 4, section 4.4.4). The students thus learned to deal with different opinions, and made group decisions through talking over different ideas (see same section).

The students' critical thinking disposition and performance hence improved. They perceived that during the intervention they became more and more active in and persistent at performing the thinking tasks (self-evaluation questionnaire data, see

chapter 4, Figure 4.1 in section 4.2.2). At the same time, they became more and more satisfied with their performance in using critical thinking to propose ideas and provide reasons (self-evaluation questionnaire data, see Figure 4.3 in chapter 4, section 4.2.3). Their willingness to share ideas and interact with others also increased (self-evaluation questionnaire data, see chapter 4, Figure 4.16, section 4.4.4).

They also used critical thinking more frequently in their writing, at the same time demonstrating their increased ability in thinking, in particular in reasoning and creativity (see chapter 4, section 4.2.3). They dedicated themselves to clarifying and strengthening their ideas in their post-intervention writing by providing more support for these ideas and using new methods, which were more logical, reasonable and powerful, and which included citing famous sayings, philosophical explanations and precisely defining words. These findings also revealed that critical thinking skills are helpful and practical cognitive skills for L2 students.

The results of this study also suggest that infusion lessons could help students to improve and accelerate the development of their critical thinking dispositions and skills. With regard to disposition, the traditional teaching class did not show any significant improvement in the critical thinking disposition test, while a significant decrease in 'analyticity' (CCTDI) was found. The infusion class, by contrast, showed a significant improvement in overall CCTDI scores and in 'truth-seeking', their improvement in 'truth-seeking' being significantly greater than in the traditional class. With respect to thinking skills, the traditional teaching class showed increases in scores for some dimensions and in overall CCTST scores. The infusion class, on the other hand, significantly improved in all dimensions and in overall scores, and the improvements in

'inference' and in their overall scores were significantly greater than in the traditional teaching class.

Although it was evident that traditional teaching could also help the students' development of thinking skills in some way, infusion lessons could help students to improve thinking skills in all dimensions and accelerate these developments. When all the above findings are combined, it can be seen that this acceleration contributed to the cultivation of critical thinking dispositions. The students in the infusion class were more willing and more determined to engage in critical thinking. This enabled them to take more advantage of opportunities to practise these skills, and consequently they gained more benefits.

It was also found that the infusion lessons resulted in the mutual reinforcement of thinking and language learning. The context created by the thinking tasks for critical thinking became a context in which the students could use the target language to create meaning; they were motivated to reproduce the target language to express their meanings and also became aware of their learning needs and limitations. The lessons also produced active learners and thinkers, and made it possible for thinking and writing to have a positive influence on each other.

The mutual support between skills and dispositions enhances the transfer and longevity of effects. In this study, the students reported that they applied the thinking skills they had learned and practised in class and group discussions to their individual writing at home (post-intervention data, see chapter 4, section 4.4.4). They also expressed their

willingness to use these skills in their future study of English (post-intervention questionnaire and interview data, see chapter 4, sections 4.4.3 and 4.4.5). Therefore, effects transfer can be expected when students have strong dispositions to think critically, and effects can also be expected to last longer when students continually apply these skills and improve their ability.

The students' overall writing proficiency, grammatical complexity and fluency improved. Although a slight decrease was found in the accuracy of their writing, this result revealed the students' attempts to use the linguistic forms and knowledge to express their meanings, indicating their intention to internalise these forms and knowledge (students' written texts, see chapter 4, section 4.3).

An unexpected finding is that the students demonstrated their attempts to use unfamiliar linguistic forms and to reconstruct them (see chapter 4, section 4.3.3). In their writing, the frequency of two types of mistake found in the post-intervention written texts was more than twice that found in the pre-intervention texts. The first type was where they indicated their understanding of the meanings and spellings of words, but used the wrong forms (for example: using 'toleration' where 'tolerance' was needed). The second type was when the students knew the meaning and spelling of two words and intended to combine them, but where the meaning of their combination either did not express their intended meaning or was grammatically incorrect (for example, combining 'responsibility' and 'society' to form 'responsibility of society' to express the meaning of 'social responsibility'). The appearance of these mistakes demonstrated that the teaching of critical thinking encouraged the students to use

linguistic forms and knowledge to construct their own meanings, which is evidence of the effective process of internalising the target language.

Surprisingly, this study revealed that the students were able to see the changes that were occurring in their learning process, since their self-reported impacts were similar to the changes seen in their real practice, and they also became aware of the effective ways of learning English (see chapter 4, section 4.4.2). This finding also implies that infusion lessons can develop students' awareness and ability to evaluate and improve the ways in which they learn.

The students demonstrated positive attitudes towards the enjoyable and active nature of the infusion lessons (post-intervention questionnaire and interview data, chapter 4, see section 4.4.1), and they perceived the helpfulness of the lessons for their thinking, writing and language learning (post-intervention questionnaire and interview data, see chapter 4, sections 4.2.1, 4.3.1 and 4.4.2). They also liked the thinking tasks: they found the Six Thinking Hats task practical and helpful and stated they would be willing to use it in their subsequent learning; Fact or Opinion was challenging but promoted hard cognitive work, while the Odd One Out task cultivated their creativity (post-intervention questionnaire and interview data, see chapter 4, section 4.4.3). The students did express their worries about their performance in the examinations, especially in the NCEE, and they also encountered some difficulties in the lessons. Overall, however, the infusion lessons were favoured by the majority of students, and they provided many useful suggestions for the design of future lessons.

In summary, the results of this study support the effectiveness of infusion lessons in Chinese high school L2 classrooms, and thus their applicability in that context. The results also suggest that critical thinking can be taught in an Asian L2 context, and to high school students.

6.2 Contribution of the Study

The value of the present study lies in the attempt to serve the dual goals of thinking development and language learning. As mentioned in section 1.4 (chapter 1), current English teaching in China is far from beneficial for the development of students' critical thinking, and at the same time both teachers and students are unwilling to invest their time and effort in writing. Hence, the findings of the study could help high school teachers to design their teaching, in order to take advantage of classroom time to develop independent and effective thinkers and learners who can solve problems in both their learning and their everyday lives, and also better writers, who can articulate their personal views using appropriate English.

This study is one of the very first studies in which critical thinking has been taught in an Asian L2 context. Some scholars cast doubt on the applicability of teaching critical thinking in Asian contexts and in L2 classrooms, since it is not encouraged by the cultures, and students may also be restricted by their limited language proficiency (see chapter 2, section 2.2.2). The results of this study will add to the literature by suggesting that Asian L2 learners can in fact be taught and benefit from learning critical thinking. On the one hand, thinking tasks create a positive and appropriate context for enhancing critical thinking (see chapter 5, section 5.2). On the other hand,

the restriction imposed by poor language proficiency should not be deemed to be a discouraging factor. Rather, it allows students to recognise their linguistic needs and modify their existing knowledge (see chapter 5, section 5.3).

Next, this study supports the notion that critical thinking can be taught in L2 classes at high school level, and demonstrates that it was helpful in the English learning and writing of Chinese high school students (see chapter 5, sections 5.3 and 5.4.2). The students who took part in this study perceived its helpfulness and enjoyed the lessons.

Further, this study reveals that the benefits of infusion lessons found in an L1 class can also be seen in an L2 class. It suggests that the infusion approach is a useful and applicable teaching method that would help English teaching to achieve the aims of the Chinese high school curriculum, developing students' critical thinking through the teaching of English.

Moreover, the results of this study suggest that the students' dispositions to think critically should not be ignored. They motivated the students in this study to take advantage of opportunities to use and apply critical thinking and persist at challenging thinking tasks, and gradually become more active and efficient critical thinkers.

Additionally, this study adds to the literature on the use of the Chinese versions of the CCTST and CCTDI to measure Chinese students' critical thinking. It provided an insight into the current level of Chinese high school students' critical thinking. The

results generally support the view that the Chinese versions of these tests are comprehensible and suitable for high school students. The results also suggest a different administration time for the CCTDI and CCTST from that suggested by the manuals, revealing that high school students may need 5 and 10 extra minutes for these tests respectively. Moreover, the results provided data which can be used to establish a norm for the CCTST of Chinese high school students.

6.3 Limitations of the Study

The main limitation of the present study lies in the absence of writing text data collected from the traditional teaching class. As mentioned, this class did not participate in all the data collection procedures owing to the opposition of their tutor. Therefore, the results of this study concerning the effects of infusion lessons on L2 writing should be carefully considered, since no comparative group was available to prove that these effects were solely a result of the instruction. Nevertheless, infusion lessons encourage mutual support between thinking and learning, and the results of this study have provided some evidence of the influence of the use of critical thinking on students' writing. The study can therefore at the very least be said to show evidence of the potential effects on L2 writing development.

Next, this study did not include delayed tests, which can help researchers to investigate the longevity of effects. The reason for this was that the academic term ended after the last infusion lessons, and the participants would be taking part in their graduation examination (not the NCEE) the following term. The students needed to concentrate on their studies, and thus no further data collection was allowed.

Moreover, this study focused mainly on outcomes, and thus did not investigate how the students used critical thinking, how they discussed the topics, how they took over different ideas, or how they learned from and supported each other in the group discussions in the lessons, since video-recording was not permitted.

Since no norm for the CCTST for Chinese students has been established, this study could not compare the performance of the participants to those of other Chinese high school students. As mentioned in chapter 3 (section 3.8.1), the CCTST is frequently used to rank the levels of critical thinking in target populations. Therefore, norms for target groups are needed. A norm for the Chinese version of the CCTST has not been established owing to the insufficient amount of data collected from the intended target group, for example, based on province, city or school. This, however, as mentioned in section 6.1, became one of the contributions of the present study to the literature and the establishment of norms.

The lack of experience and questioning skills of the researcher in conducting interviews may have influenced the quality of the interview data. The interviewees only provided short answers and seldom interacted with each other. This study then used questionnaires to obtain more information about the students' attitudes towards and perceptions of the infusion lessons.

The last limitation may be the time span of the intervention. Although this study covered all the writing lessons during an entire academic term, as many researchers

claim, the teaching of thinking takes time to show any effect, and the longer students take infusion lessons, the more they can benefit from them (Fisher 2005; Rapps et al. 2001; Pally 1997). Adey et al.'s (2002) cognitive acceleration programme was run over one year, and subsequent investigation revealed that its effects lasted for at least three years. Therefore, greater effect can be expected from a longer intervention.

6.4 Suggestions for Future Study

Based on the discussion in chapter 5 and the limitations discussed above, areas where further research is needed are as follows.

A. Examining how long the effects of infusion lessons can last (see chapter 5, section 5.4.1);

B. Examining how the mutual reinforcement of critical thinking dispositions and skills enhances the transfer and longevity of effects (see chapter 5, section 5.4.1);

C. Examining the effects of infusion lessons on the critical thinking development of students at different initial levels of dispositions and abilities (see chapter 5, section 5.4.2);

D. Investigating the effects of infusion lessons on the progress of individual writers at different levels of L2 proficiency (see chapter 5, section 5.4.2);

E. Investigating whether or not the effects of infusion lessons can be transferred across the curriculum;

F. Investigating the process of infusion lessons, for example, students' performance in group discussions, the influence of collaborative learning in group discussions on students' thinking and language learning, etc.;

G. Understanding teachers' attitudes and perceptions;

H. More China-based study is needed to provide data to establish norms for the CCTST for different groups of Chinese students;

I. Investigating the effects of longer interventions, for example, one or two-year interventions, in order to provide more comprehensive and thorough insights into the effects of infusion lessons;

J. More China-based empirical studies are needed (Mok 2009).

With regard to the research methodology, future studies using the infusion approach should include a comparative group who participate in all data collection procedures. This would allow the researcher to examine whether the changes can be attributed to the intervention alone.

To examine the longevity of the effects of infusion lessons, a delayed test should be designed. This could provide evidence of whether or not the effects of the infusion approach last, and for how long.

As mentioned in chapter 3 (section 3.10.1) and in section 6.3 of this chapter, in this study, the interviewees seemed to become shy in the interviews. The image of the interviewees was different from that of the active learners who took part in the infusion

lessons, and the evidence of their enthusiasm was obtained from the post-intervention questionnaire. Future studies could try other types of interviews, for example, focus-group interviews and individual interviews.

Future studies could use more and different types of thinking task, as suggested by the students in this study (see chapter 4, section 4.4.5). Different types of thinking task require different thinking skills and processes, and will thus have different effects on students' thinking.

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Appendixes

Appendix A: Consent Form

Project title: Infusing critical thinking into EFL class: a case study in Chinese high school

This study will be conducted for one semester with an intervention of the infusion approach into English writing lessons. The study attempts to explore the effect of infusion lessons on the development of thinking and language learning.

I have read the statement above about the research project, and the researcher has explained the research project to me clearly. I understand that all the data will be kept confidential and my identity will be anonymous in the research report.

I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reasons. I agree to take part in the above study.

Name of participant:_____ Signed:_____ Date:_____

Name of researcher: _____ Signed:_____ Date: _____

参与研究同意书

此研究采用'注入式'教学法，将在这一学期的英语写作课上介绍批判性思维技巧，辅助结合英语的教与学。此次研究的目的是探讨注入式教学法对思维发展和英语学习的作用。

我已经阅读了以上研究的描述，调研者也清楚的介绍了这次调研的内容。我知道这次调研的数据会保密，并且我的名字会不会在调研报告中提及。

我明白我是自愿参加这次调研的，并且我可以无理由的随时退出调研。我同意参加这次调研。

参与者姓名：   签名：   日期：

调研者姓名：   签名：   日期：

Appendix B. Example of Guideline in Textbooks

| Module	Topic and Task	Grammar / Functions	Skills
1 P1	**Topic:** British and American English **Task:** Identifying a variety of English	**Grammar:** Review of verb forms (1) Present simple, present continuous, present perfect and future reference; *for* and *since* with present perfect **Function:** Giving reasons	**Reading:** Comparing texts **Listening:** Listening for main ideas **Writing:** Writing about the Chinese **Speaking:** Talking about varieties of
2 P11	**Topic:** A Job Worth Doing **Task:** Identifying important jobs for the future	**Grammar:** Review of verb forms (2) Past simple, past perfect, past continuous **Function:** Making deductions about the past	**Reading:** Reading for main ideas **Listening:** Listening for specific **Writing:** Writing a job application letter **Speaking:** Role-play a job interview
3 P21	**Topic:** Adventure in Literature and the Cinema **Task:** Doing a survey of teenage reading habits	**Grammar:** Review of verb forms (3) The *-ing* form, the *-ed* form and *to* + infinitive; link verbs **Function:** Reporting statements and suggestions	**Reading:** Understanding text organisation **Listening:** Listening for specific **Writing:** Writing a summary of a film **Speaking:** Talking about films
4 P31	**Topic:** Carnival **Task:** Describing a Chinese festival	**Grammar:** Review of the passive voice **Function:** Expressing likes, dislikes and preferences	**Reading:** Reading for main ideas **Listening:** Listening for specific **Writing:** Writing an email about a **Speaking:** Talking about food and
5 P41	**Topic:** The Great Sports Personality **Task:** Making a list of Chinese sports personalities	**Grammar:** Review of adverbial clauses **Function:** Agreeing and disagreeing: degree of certainty	**Reading:** Inferring **Listening:** Listening for main ideas **Writing:** Writing a notice **Speaking:** Talking about sport
6 P51	**Topic:** Animals in Danger **Task:** Making a survey of endangered species in China	**Grammar:** Review of attributive clauses **Function:** Expressing concern	**Reading:** Predicting **Listening:** Listening for main ideas **Writing:** Writing a description of an **Speaking:** Talking about animals in
7 P61	**Revision**		

Appendix C. Design of Tasks

Lesson One: Introduction to infusion lessons and critical thinking

Skills: explaining and reasoning

Task in class: Odd One Out

Linguistic support: I like… because, Since..., As…, camel, cactus (cacti), hedgehog, thorn, spine, spiny

Intended outcome: being able to express ideas and explain reasons
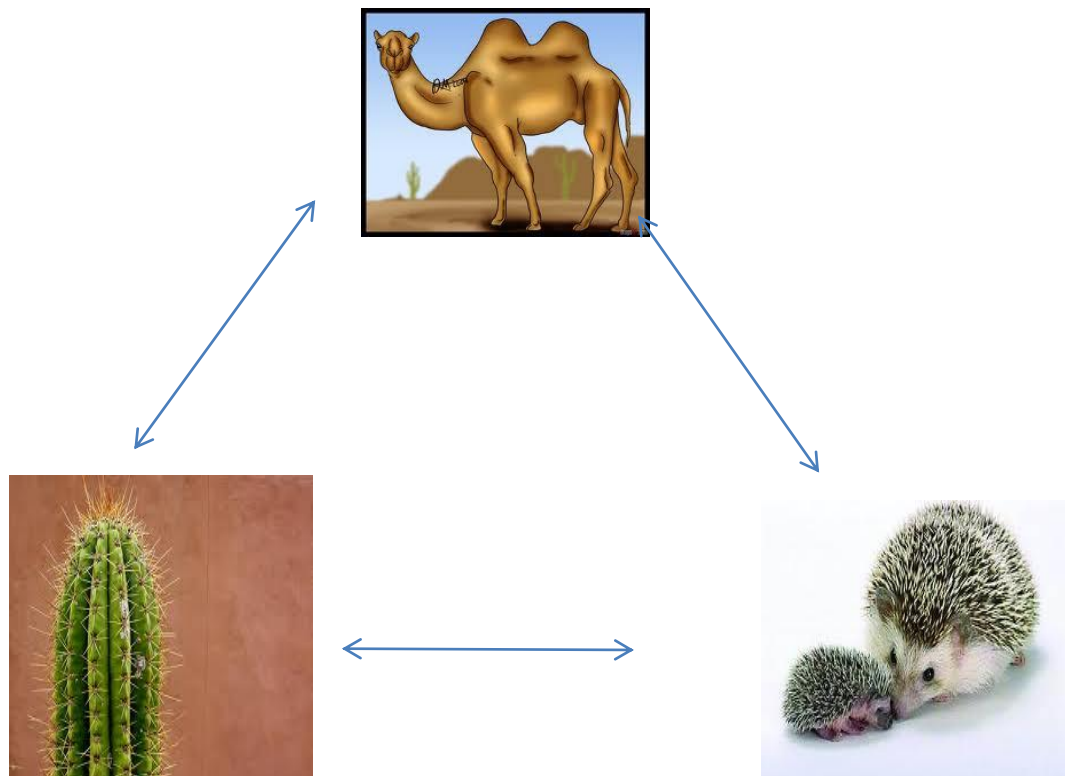
Examples:

Hedgehog is the odd one out. Both camel and cactus can be found in desert.

Camel is odd one out. Both cactus and hedgehog are spiny.

Cactus is odd one out. Both camel and hedgehog are animals. / Both the plural of 'camel' and 'hedgehog' simply adds 's'.
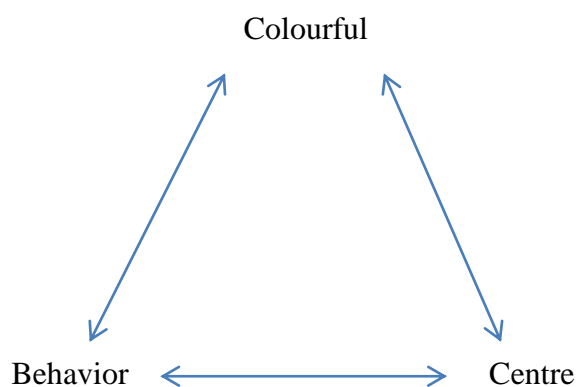
Lesson Two-British and American English

Skills: explaining and reasoning

Task: Odd One Out

Linguistic support: I like… because, Since..., As…, spelling, pronunciation, verb, noun, vowel, consonant, adjective, adverb, original

Intended outcome: being able to tell the difference between British and American English

Colourful

Behavior ⟷ Centre

Examples:

'Colourful' is the odd one out. Both 'behaviour' and 'centre' can be noun.

'Behavior' is the odd one out. The spelling of 'colourful' and 'centre' are British English.

'Centre' (['sentə(r)]) is the odd one out. Both 'colourful'(['kʌləfəl]) and 'behavior' ([bɪˈheɪvjə]) consist of three vowels.

Homework for week two (writing task):

Read the debate on the best variety of English in the textbook. In your opinion, which variety of English do you think is the best to learn? Give your reasons (in at least 120 words).

Lesson Three: A Job worth doing

Skills: analysing and synthesising, evaluating and judging

Task: Fact or Opinion

Linguistic support: accountant, administrative, agency, assistant, barber, chef, data analyst, fire fighter, electrician, miner, lorry driver, stressful, salary, badly paid, career prospect.

Intended outcome: naming of jobs, use of future tense

Identifying important jobs for the future

1. Make a list of the jobs you have learnt about in this module.
2. Write your list of the three most useful jobs for China's future.
3. Why these jobs are useful for China? Is this your opinion or fact? Give your reasons and evidence.

Homework for week three (writing task):

In your opinion, which type of job will be the most useful for China in the future? Give you reasons (in at least 120 words).

Lesson Four- Adventure in literature and the cinema

Skills: generalising and summarising, evaluating and judging

Tasks: Fact or Opinion

Linguistic support: era, biography, have connection with, set, fiction, review, create, romantic, comedy, make up, vivid, reputation.

Intended outcomes: use of past tense, being able to introduce a famous person and his works

1. Read the passage about the life of Mark Twain.
2. Group discussion: Mark Twain is known as one of America's greatest writers. Is this a fact or an opinion about the author? Explain your reasons and provide evidence.
3. Summarise all ideas of your group members, and share your group idea with the whole class.
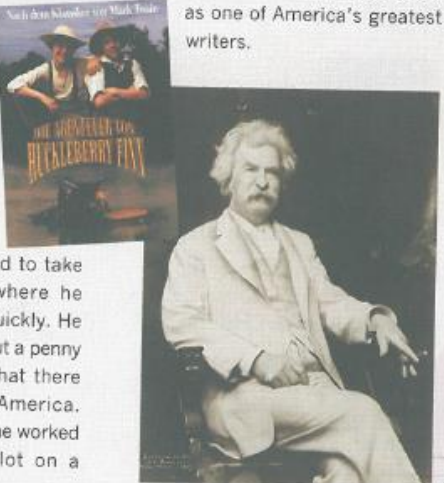
The Life of Mark Twain

Often the lives of writers resemble the lives of the characters they create. Mark Twain, who wrote *The Adventures of Huckleberry Finn* and *The Adventures of Tom Sawyer*, was no exception. To start with, the author's name, Mark Twain, is itself an invention, or "pen name". Twain's real name was Samuel Clemens. "Mark Twain", which means "watermark two", was a call used by sailors on the Mississippi to warn shipmates that they were coming into shallow water.

Like Huck, Mark Twain led an adventurous life. He left school early, and as an adolescent, determined to make his fortune in South America, set off from his home in Hannibal, Missouri, for New Orleans. He wanted to take a boat to the Amazon, where he thought he could get rich quickly. He arrived in New Orleans without a penny in his pocket only to find that there were no boats for South America. Forced to change his plans, he worked for several years as a pilot on a steamboat, taking passengers up and down the Mississippi, the great river which flows from the north of the US near the Canadian border, down to the Gulf of Mexico.

Later he became a journalist and began writing stories about life on the river. Twain's vivid and often amusing descriptions of life on the river quickly became popular, and established the reputation he still enjoys today as one of America's greatest writers.

Homework for week four (writing task):

Who is your favourite writer? Give you reasons (in at least 120 words).

Lesson Five- Carnival

Skills: generalising and summarising, reasoning and explaining

Task: Six Thinking Hats

Linguistic support: I hate …, I like …very much, I prefer …, rather, it would be better that …, Spring festive, Mid-autumn festival, Dragon Boat Festival, Double Ninth Festival, tradition, atmosphere, excitement, extravagance,

Intended outcomes: being familiar with the name of Chinese Festivals in English, being able to writing a passage to introduce a Chinese festival

Working in groups:

1. Put on your white hat (focus on the facts, figures and information available). Choose a Chinese festival. Discuss: the origins and meaning of the festival, where and when it is celebrated, what happens during the festival costumes and food.

2. Put on your Red hat (description of emotions, feelings, hunches and intuition without giving reasons). Tell the group members about your feeling to the festival, whether you like it or not. You do not need to provide any reasons.

3. Put on your Black had (identifying faults or weaknesses). Think about this question and share your idea with group members: do you think there is any a problem or issue about the celebration of this festival? For example: extravagance.

4. Put on your Yellow hat (identifying the value or advantages in something). Think about something good of this festival and share your idea with group members. For example: it provides a good opportunity for family members get together.

5. Put on your Green hat (focus on exploration of new and alternate proposals, suggestions and ideas). What is the best way people celebrate this festival? Provide your suggestions and discuss it with your group members.

6. Now put on your Blue hat (focus is on thinking about thinking). Think about the thinking and discussion you did, focusing on the questions: what did we think about just now? What were the ways we thought about the issue? What were the ideas of our group?

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7.   Sharing your group ideas with the whole classes.

Homework for week five (writing task):

Which Chinese festival is the most important one for Chinese people? Give your reasons (in at least 120 words).

Lesson Six- The great sport personality

Skills: generalising and summarising, analysing and synthesising

Task: Fact or Opinion

Linguistic support: ambition, athletics, badminton, baseball, bat, boxing, brand, gymnastics, logo, marathon, Olympics, perform, medal, gold, silver, bronze

Intended outcomes: being familiar with the names of sports in English, being able to write a passage to introduce a great sports personality.

1. Read the passage about the sporting life of Li Ning.
2. Work in group. Make a list of Chinese sports personalities.
3. Think about the stories of these personalities and vote for the three greatest.
4. Is this a fact or just an opinion that they are the three greatest Chinese sports personalities? Explain your reasons and provide evidence.

A Life in Sport

They called him the prince of gymnasts. When he retired at the age of 26, he had won 106 gold medals in major competitions across the world. They included six out of seven gold medals at the 1982 World Championship, and three at the 1984 Olympics in Los Angeles (as well as two silver and a bronze). Li Ning was the best. When sports journalists met in 1999 to make a list of the greatest sportsmen and sportswomen of the twentieth century, Li Ning's name was on it, together with footballer Pele and boxer Muhammad Ali. But even though he had won everything it was possible to win in his sport, Li Ning retired with the feeling that he had failed. He was disappointed because he had not performed well in the 1988 Seoul Olympics.

But it was this sense of failure that made him determined to succeed in his new life. A year after his retirement, Li Ning began a new career — as a businessman. But he didn't forget his sporting background. He decided to launch a new brand of sportswear, competing with global giants like Nike and Adidas. He made the unusual choice, for a Chinese person, of choosing his own name as the brand mark. The bright red logo is made up of the first two *pinyin* letters of Li Ning's name, L and N.

Li Ning's sports clothes came onto the market at just the right time. The number of young people with money to spend was on the increase — and sport had never been so popular. Li Ning's designs were attractive, and they had a major advantage over their better-known rivals — they were cheaper. A pair of Nike trainers, for example, could cost up to five times as much as a similar Li Ning product. Success for Li Ning was guaranteed, and it came quickly.

In just a few years, Li Ning won more than fifty per cent of the national market. Today a Li Ning product is purchased every ten seconds. But the clothes are not only worn on the athletics track or the football pitch. If you go into a school or university anywhere, the chances are you will see students in Li Ning tracksuits with the familiar logo. The company has also grown internationally. The Spanish and French gymnastics teams wear Li Ning clothes, while Italian designers are employed by the company to create new styles. Whenever Chinese athletes step out onto the track during the 2008 Olympics, they will be wearing Li Ning tracksuits.

But Li Ning's goal when he retired was not to make money. His dream was to open a school for gymnasts. He was able to do this in 1991. Since then, he has continued to help young people to achieve their sporting ambitions. Like Pele and Muhammad Ali before him, who have worked with the United Nations for children's rights and peace, Li Ning has discovered that the work of a great sportsman does not finish when he retires from the sport. It starts. And if you are a great sportsperson, *anything is possible,* as Li Ning's advertising slogan says.

Homework for week six (writing task):

In your opinion, who is the greatest Chinese sports personality? Give your reasons (in at least 120 words).

Lesson Seven: Animals in danger

Skills: reasoning and synthesising

Task: Fact or Opinion

Linguistic support: Siberian tiger, blue whale, African elephant, northern bald ibis, cat family, largest member, biggest animal, land animal, forest in, ocean, valley, desert, coastal areas, natural causes, hunted for, oil, ivory.

Intended outcomes: Being able to write a passage to introduce an animal in danger and explain why and how to protect it

1. These animals are considered to be in danger. Discuss in group if this is a fact or an opinion? Provide evidence why you think they are in danger or not.
2. Discuss in group that how to protect those animals you think are in danger.
3. Share your group ideas with the whole class.

Homework for week seven (writing task):

In your opinion, should we protect endangered animals species? What can we do and why? (in at least 120 words).

Lesson Eight: Movies

Skills: generalising and synthesising, explaining and reasoning

Tasks: Six Thinking Hats

Linguistic support: the story implies that…, from the movie we know that …, the main character's attitude towards … is …, after I watch this movie, I …., this movie is mainly concerned with, cartoon, comedy, historical adventure, horror, romantic, science fiction

Intended outcomes: being able to recommend a movie and explain why to recommend it

Working in groups:

1.	Put your white hat on (focus on the facts, figures and information available). Choose a movie you would like to recommend to the classmates. Discuss: the title of the movie, what type of movie it is, who the movie is about, who are the actors and actresses, the main story of the movie.

2.	Put your Red hat on (description of emotions, feelings, hunches and intuition without giving reasons). Tell the group members about your feelings about the movie, whether you like it or not. You do not need to provide any reasons.

3.	Put your Black had on (identifying faults or weaknesses). Think about this question and share your ideas with group members: do you think there is any flaw in the movie, For example, the movie is too long.

4.	Put your Yellow hat on (identifying the value or advantages in something). Think about something good about this movie and share your ideas with group members. For example: it encourages people to overcome difficulties in life.

5.	Put your Green hat on (focus on exploration of new and alternate proposals, suggestions and ideas). Provide your suggestions about the movie and discuss them with your group members.

6.	Now put your Blue hat on (focus is on thinking about thinking). Think about the thinking and discussion you did, focusing on the questions: what did we think about just now? What were the ways we thought about the issue? What were the ideas of our group?

7.	 Now recommend the movie chosen by your group to the whole class and tell us why you recommend this one.

Homework for week eight (writing task):

Recommend a movie to your classmates and say why you recommend it (in at least 120 words).

Lesson Night: Fantasy Literature

Task-Odd One Out

Skills: explaining and reasoning, generalising and summarising

Linguistic support: creature, extraordinary, hero, heroine, philosophical, witch, amber, play an important part in, associated with.

Intended outcome: being able to introduce a fantasy novel and its author

The Story of J.K. Rowling and Harry Potter

The elder stateswoman of British fantasy literature is J.K. Rowling, the gifted creator of Harry Potter. Joanne Rowling's roots are in the southwest of England, where she grew up. But the idea for Harry Potter came to her while she was on a delayed train between Manchester and London. She wrote down her ideas on the back of an envelope. She then went to teach English in Portugal, where she continued to add flesh to the bones of the first Harry Potter story. But her name is forever associated with Edinburgh in Scotland, where she lived and developed the format for the whole series of seven books.

There are many anecdotes about how, in 1990, J.K. Rowling began the first draft of *Harry Potter and the Philosopher's Stone*. She had the extra burden of looking after her baby daughter while she worked, and because she was too poor to own a typewriter, she wrote by hand. She spent many hours over a single cup of coffee in a warm cafeteria in Edinburgh because she had no money to pay for the heating at home.

Success was not swift and Rowling might have given up. But she was stubborn and overcame all the difficulties. It was only in 1997 that she completed the first Harry Potter story, which, because the publishers in the USA requested an adjustment to the title, was also known as *Harry Potter and the Sorcerer's Stone*.

Rowling always intended that her output would be a book every year until she had finished the series. In fact, it took her about ten years to complete. But after the first book, the success of each of the following titles was automatic. The fifth book, *The Order of the Phoenix* sold about seven million copies the day it was published.

Rowling's style has been a target for some criticism, but what makes the books so important is that, because they appeal to readers of all ages, they create a special literary bond between parents and children. In an age of computer games and television programmes, it is also claimed they are responsible for a renewed interest in reading. Harry Potter has even become part of the school curriculum, much to the pleasure of the schoolchildren.

And the Harry Potter effect is not just restricted to the English-speaking world. Rowling's books have been translated into more than 55 languages, and it has been estimated that more than 250 million copies have been distributed around the world. In 2005 it was estimated that Rowling had accumulated more than one billion dollars on deposit in her bank. She has thus attained the status of being the first writer to become a billionaire.
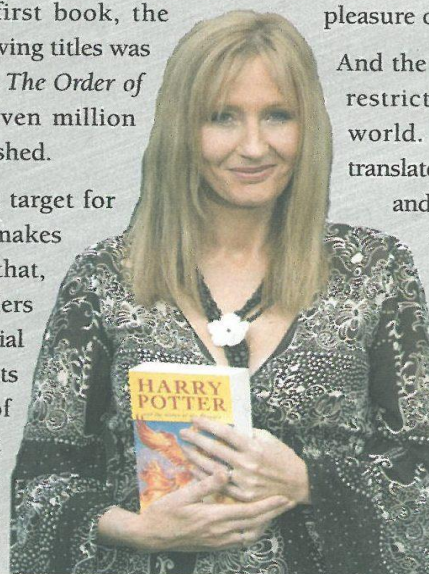
Introduction

One of the greatest British writers of fantasy literature was C.S. Lewis (1898—1963), who wrote *The Lion, the Witch and the Wardrobe*. Lucy discovers the winter land of Narnia where she and her two brothers and sister meet the White Witch. They also meet Aslan, the lion, who is the only one who can defeat the Witch and restore summer to Narnia. With Aslan, the children learn to be brave and to forgive. They learn great sorrow and happiness, and finally they learn wisdom. Their time in Narnia is the great adventure that every child dreams of.

Extract from *The Lion, the Witch and the Wardrobe*

And then she saw that there was a light ahead of her; not a few inches away where the back of the wardrobe ought to have been, but a long way off. Something cold and soft was falling on her. A moment later she found that she was standing in the middle of a wood at nighttime with snow under her feet and snowflakes falling through the air.

Lucy felt a little frightened, but she felt very inquisitive and excited as well. She looked back over her shoulder and there, between the dark tree trunks, she could still see the open doorway of the wardrobe and even catch a glimpse of the empty room from which she had set out. (She had, of course, left the door open, for she knew that it was a very silly thing to shut oneself into a wardrobe.) It seemed to be still daylight there. "I can always get back if anything goes wrong," thought Lucy. She began to walk forward, crunch-crunch over the snow and through the wood towards the other light. In about ten minutes she reached it and found it was a lamppost. As she stood looking at it, wondering why there was a lamppost in the middle of a wood, and wondering what to do next, she heard the pitter-patter of feet coming towards her. And soon after that a very strange person stepped out from among the trees into the light of the lamppost.

He was only a little taller than Lucy herself and carried over his head an umbrella, white with snow. From the waist upwards he was like a man, but his legs were shaped like a goat's (the hair on them was glossy black) and instead of feet he had goat's hoofs. He also had a tail, but Lucy did not notice this at first because it was so neatly caught up over the arm that held the umbrella so as to keep it from trailing in the snow. He had a red woollen muffler round his neck and his skin was rather reddish too. He had a strange, but pleasant little face, with a short pointed beard and curly hair, and out of the hair there stuck two horns, one on each side of his forehead. One of his hands, as I have said, held the umbrella; in the other arm he carried several brown-paper parcels. With the parcels and the snow it looked just as if he had been doing his Christmas shopping. He was a Faun. And when he saw Lucy he gave such a start of surprise that he dropped all his parcels.
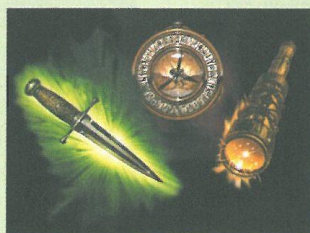
"Goodness gracious me!" exclaimed the Faun.

His Dark Materials
by Philip Pullman

His Dark Materials is one of the greatest fantasy stories ever written. There are three books in the series, *Northern Lights*, *The Subtle Knife* and *The Amber Spyglass*. The heroine is a young girl called Lyra and the hero is a boy called Will. In the first book, Lyra's scientist father makes it possible to enter other worlds. The children have many extraordinary adventures in these different worlds, and play an important part in a war that could destroy the universe. It's an exciting novel with witches, talking bears, and other strange creatures. It is also very philosophical, with ideas that both adults and children will enjoy.

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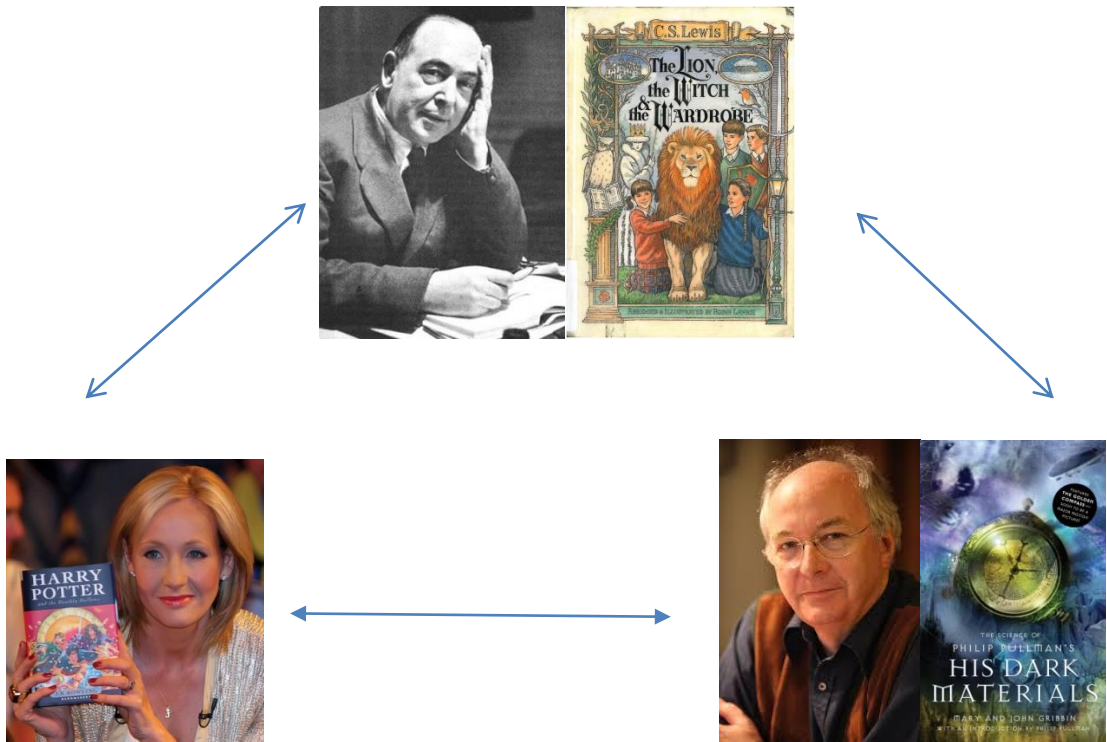
Examples:

1. 'The Lion, the Witch and the Wardrobe' is the odd one out. The authors of both 'Harry Potter' and 'His Dark Materials' are still alive.
2. 'His Dark Materials' is the odd one out. Both 'The Lion, the Witch and the Wardrobe' and 'Harry Potter' are children's literature.
3. 'Harry Potter' is the odd one out. The authors of both 'His Dark Materials' and 'The Lion, the Witch and the Wardrobe' are male.

Homework for week nine (writing task):

Recommend a fantasy literature to your classmates and say why you chose it (in at least 120 words).

Lesson Ten: Small talk

Skills: synthesising and reasoning, evaluating and judging

Tasks: Six Thinking Hats

Linguistic support: social skills, communication, conversation, since, body language, confidence, avoid, impress, remember.

Intended outcomes: being able to provide suggestions

Working in groups:

1.   Put on your white hat (focus on the facts, figures and information available). Discuss: what actually happen when you talk to a people when the first time you meet.

2.   Put on your Red hat (description of emotions, feelings, hunches and intuition without giving reasons). Tell the group members about your feelings to talk to a people you do not familiar with.

3.   Put on your Black had (identifying faults or weaknesses). Think about this question and share your idea with group members: what are your worries in social communication?

4.   Put on your Yellow hat (identifying the value or advantages in something). Think about some good experience of your social communication.

5.   Put on your Green hat (focus on exploration of new and alternate proposals, suggestions and ideas). Provide your suggestions to socialisation.

6.   Now put on your Blue hat (focus is on thinking about thinking). Think about the thinking and discussion you did, focusing on the questions: what did we think about just now? What were the ways we thought about the issue? What were the ideas of our group?

7.   Now share your group suggestions with the whole class.

Homework for week ten (writing task):
We have learnt about some useful social skills, for example, small talk. Provide some other suggestions for what we should or should not do in a social event and say why you chose them (in at least 120 words).

Appendix D. CCTDI and CCTST

Description of Seven Sub-scales of CCTDI (Facione et al. 1994: 3–4)

1. Inquisitiveness scale measures one's intellectual curiosity and one's desire for learning even when the application of the knowledge is not readily apparent.

2. Open-mindedness scale addresses being tolerant of divergent views and sensitive to the possibility of one's own bias.

3. Systematicity scale measures being organized, orderly, focused, and diligent in inquiry.

4. Analyticity scale targets prizing the application of reasoning and the use of evidence to resolve problems, anticipating potential conceptual or practical difficulties, and consistently being alert to the need to intervene.

5. Truth seeking scale targets the disposition of being eager to seek the best knowledge in a given context, courage about the asking questions, and honesty and objectivity about pursuing inquiry even if the finding do not support one's preconceived opinions.

6. Self-confidence scale measures the trust one places in one's own reasoning process.

7. Maturity targets the disposition to be judicious (prudent) in one's decision-making.

Description of Five Dimensions of CCTST (Phillips et al. 2004)

1. The analysis subscale measures whether someone can comprehend and express the meaning in a wide variety of data, experiences, and judgments. It includes the skills of categorizing, determining significance, and clarifying meaning.

2. The evaluation subscale measures an individual's ability to access information and the strength of actual or inferential relationships. It also relates to the ability to state the result of one's reasoning.

3. The inference subscale measures one's ability to identify and secure information needed to draw conclusions. For example. Can the person form conjectures and hypotheses, consider relevant information, and come up with potential consequences.

4. The deductive reasoning subscale measures the subject's ability to begin with a premise, and by assuming it is true, conclude that the findings are also true (as with algebraic, geometric and mathematical proofs).

5. The inductive reasoning subscale measures a person's ability to begin with a premise and by applying related knowledge and experience, reach a conclusion that is likely to be true. Statistical inferences, use of similar experiences, and relevant cases (as in legal reasoning) are

Appendix E. Self-Evaluation Questionnaire

姓名：   时间:

Name: Date:

以下问题是关于你对自己和小组在课堂的小组讨论中的表现的满意度的调查:

1=非常不满意， 2=不满意， 3=有点不满意，4=有点满意， 5=满意，6=非常满意。

The following questions are about how satisfied you are with group discussion in class, including your personal performance and group performance. There are six scales to choose from 1=Very unsatisfied, 2=Unsatisfied, 3=Slightly unsatisfied, 4=Slightly satisfied, 5=Satisfied, 6=Very satisfied.

1	我在小组讨论中发言了 I talked in group discussion	
2	我问了问题 I asked a question/questions	
3	我回答了组员的问题 I answered a question/questions	
4	我提出了自己的观点 I proposed my opinion/opinions	
5	我解释了原因 I gave a reason/reasons	
6	我想到了一些有用的信息并且跟我的组员分享了 I thought of some useful information and shared it with my group members	
7	我认真的听别人发言，并且给出了我的反馈意见 I listened to others and provided feedback	
8	我们想出几个不同的观点 We thought of several different ideas	
9	我们做出小组决定 We made a group decision	
10	我们意见不同时，我们一起讨论解决 We talked it over when we had different opinions	
11	我们讨论每个组员提出的想法 We talked about everyone's ideas	
12	每个人都在听别人的发言 Everyone listened when another group member was speaking	

以下问题是关于你对小组讨论的感受和想法。

1=非常不同意，2=不同意，3=有点不同意，4=有点同意，5=同意，6=非常同意。

The following questions ask about your attitude towards group discussion. There are six scales to choose from 1=strongly disagree, 2= Disagree, 3=Slightly disagree, 4=Slightly agree, 5=Agree, 6=strongly Agree.

13	小组讨论促进我思考 Group discussion provoked my thinking	
14	小组讨论让我有了几个新的想法 Group discussion helped me to think of new ideas	
15	小组讨论让我改变了自己的想法 Group discussion helped me change my mind	
16	我喜欢小组讨论 I enjoyed group discussion	
17	我融入不了小组讨论 I could not join in the group discussion	
18	我觉得在小组讨论中发言是件很困难的事情 I found it difficult to talk in the group	

Appendix F. Post-Intervention Questionnaire

关于思考课和英语写作的问卷调查
(Questionnaire)

1. 从前有英语写作课么？如果有，你对以前的英语写作课有什么看法？
    (Did you have English writing classes before this semester? If you did, what do you think about writing lessons?)

2. 你期待中的英语写作课是什么样的？
    (What do you expect English writing lessons to be like?)

3. 你希望有课堂活动么？
    (Do you expect to have activities in class?)

4. 你喜欢思考课么？如果喜欢，为什么？如果不喜欢，也请说说原因。
    (Do you like thinking lessons? If yes, please explain why? If no, please explain why not?)

5. 思考课上的课堂活动（odd one out, fact or opinion and six thinking hats） 你最喜 欢哪一个？为什么？
    (Which type of tasks (odd one out, fact or opinion and six thinking hats) did you like the most? Why?)

6. 你觉得思考课对你的思考有帮助么？如果有的话，有什么样的帮助呢？
   (Do you think thinking lessons help your thinking? If yes, how did they help?)

7. 你觉得思考课对你的英语写作有帮助么？如果有的话，有什么样的帮助呢？
   (Do you think thinking lessons help your English writing? If yes, how did they help?)

8. 你觉得思考课对你的英语学习有帮助么？如果有的话，有什么样的帮助呢？
   (Do you think thinking lessons help your English learning? If yes, how did they help?

9. 你认为小组讨论对你的英语学习有帮助么？如果有，有什么样的帮助？
   (Do you think group discussion helps your English Learning? If yes, how did it help?)

10. 你对思考可有什么样的评价和建议么？
    (What are your comments and opinions about thinking lessons?)

Appendix G. English Writing Rating Criteria of NECC

24-25:

1. Fully completes the writing task and covers all the key points.
2. Uses at least two different types of subordinate clauses, for example, relative clauses and adverbial clauses.
3. No more than two mistakes in grammatical structure or the use of vocabulary, which are caused by the attempt to use complex syntactic structure and sophisticated vocabulary.
4. The content and ideas are coherent, and the sentences and paragraphs are cohesive.
5. Scoring 24 and 25 requires the approval of the leader of the rating group.

20-23:

1. Fully completes the writing task and covers all the key points.
2. Uses at least two different types of subordinate clauses, for examples, relative clauses and adverbial clauses.
3. Grammatical structure and use of vocabulary are generally correct, but there are no more than four mistakes which are caused by the attempt to use more complicated sentences and less frequent vocabulary.
4. The content and ideas are coherent, and the sentences and paragraphs are cohesive.

15-19:

1. Completes the writing task and covers most of the key points.
2. Uses at least one subordinate clause.
3. Grammatical structure and use of vocabulary are generally correct, but there are some mistakes caused by the attempt to use more complicated sentences and less frequent vocabulary.
4. The content and ideas are coherent, and the sentences and paragraphs are cohesive.

10-14:

1. Basically completes the writing task.
2. Contains at least three grammatically coreect sentences which are relevant to the topic.
3. There are some mistakes in the sentence and the use of vocabulary, but the writing is understandable.
4. The writing is able to express some ideas.

6-9:

1. The writing did not complete the writing task appropriately.
2. There is some irrelevant content.
3. The structure of sentences is simple and the use of vocabulary is limited.
4. There are some mistakes in the structure of sentences and vocabulary, which lead to misunderstanding of the writing.
5. The writing is not able to express the idea to the reader.

1-5:

1. The writing did not complete the writing task.
2. The writing included some irrelevant content.
3. Expression is not clear.

Appendix H. Guideline of Clauses, T-units and Errors

Definition and example of T-unit and clauses

(Nippold et al. 2005)

T-unit

1.   Bill brought a new bicycle before he went to Europe.

One T-unit contains an independent clause (Bill brought a new bicycle) and a dependent clause (before he went to Europe).

2.   Bill went to France and then he went to Italy.

Two T-units contains two independent clauses (a. Bill went to France; b. he went to Italy) joined by the coordinating conjunction 'and'. Whenever a coordinating conjunction (e.g. 'and', 'but', 'so') initiates an independent clause, that clause is considered to be a new T-unit.

Independent clause

1.   Mother rode her bicycle to work today.
2.   It started to rain late last night.

Dependent (Subordinate) Clauses

There are three main types of dependent clauses: relative, adverbial, and nominal.

1. A relative clause (i.e., adjective clause) acts like an adjective and modifies the noun that precedes it: for example, ''the cat that was sleeping on the couch was content.''

2. An adverbial clause acts like an adverb and modifies a verb. It often describes a condition or cause and begins with a subordinate conjunction: for example, ''unless we can reach Los Angeles by eight o'clock, we'll miss the concert.''

3. A nominal clause is a noun-like element that can serve as either the subject of a sentence (e.g., ''whatever she told you about the wedding was a great exaggeration'') or its object (e.g., ''I told her what she needed to hear''). Nominal clauses often begin with wh-words: For example, ''I never know where I should park ''; ''my desire to become a nurse is why I study so hard''; ''Checkmate is when your opponent's king cannot escape.

Guidelines for T-units, Clauses, Word Counts, and Errors (Polio 1997)

T-units	Example cited from students' writing ((Please note: some alterations have been made to the students' English for the sake of clarity)	Number of T-units counted	Number of errors counted
Count run-on sentences and comma splices as two T-units with an error in the first T-unit.	Friends are importance in high school life, they make my life colourful.	2	1
Count both "so" and "but" as coordinating conjunctions. Count "so that" as a subordinating conjunction unless "so" is obviously meant.	I like animals very much, animal are friend of human. *But* some people make money by killing wildlife.	2	0
Count direct quotes as a T-unit.	I understand what 'no pain, no gain' means now.	2	0

Clauses	Example cited from students' writing ((Please note: some alterations have been made to the students' English for the sake of clarity)	Number of clauses counted	Number of errors counted
A clause equals an overt subject counts as one clause.	We can play games and talk about study after class.	1	0
A clause equals a finite verb as one clause.	I should learn to (be) brave.	1	0
Only an imperative does not require a subject to be considered a clause.	Don't give up.	1	0

Errors	Example cited from students' writing	note
Count spelling errors.	Knowledge	
Don't count American spelling as errors.	color	
Base tense error on preceding discourse. Do not look at the sentence in isolation.	I was poor in physics when I *am* in junior middle school. My teacher encouraged me I should persist in learning and doing more exercises, and I would improve. I think she *is* right.	Since the student was talking about his experience in junior middle school when he was studying in high school, he should use pass tense in the above sentences.
Base tense error the real situation.	I *learnt* a lot in high school.	Since the student was still study in high school, he should say '*have learnt'*.

Word Count	Example cited from students' writing	Number of word counted
Do not include essay titles in word account.	My dream (title of the essay)	0
Do not count hyphenated words as single words.	hard-working	2
Count words as they are written, even if they are incorrect.	bu	1

Appendix I. Example of Transcription of Interview

R: 你们以前有英语写作课么？

(Have you had English writing lessons before this semester?)

S1: 没有。

(No)

S2:没有。

(No)

S3:好像有。

(I think so.)

S4:有吧。

(Yes)

S5:没有。

(No)

R:如果有写作课的话，那你在之前的写作课上学到了什么？

(If you had, what did you learn in the lessons?)

S5: 单词，句型

(Vocabulary and structures of sentence)

S3: 还有语法

(And grammatical knowledge)

S4:一样啊，都是这些

(Yeah, the same)

R:希望在写作课上学到什么？

(What did you expect to learn in the class?)

S1:一些句型。

(Sentence structures)

S2:不知道，没想过。

(I do not know. I have not thought about this before.)

S4:一些写作技巧吧。

(Some writing skills)

R:你呢？

(What about you?)

S3:单词和语法，好像写作课讲的都是这些。

(Vocabulary and grammatical knowledge, they were commonly taught in all writing lessons)

S5:希望老师讲一些高考的写作。

(I hoped that the teacher would teach me some something relevant to the writing for the National College Entrance Examinations.)

R: 那你希望课堂上活动么？

(Did you expect that there would be classroom activities?)

S1: 希望。

(Yes, I hope so.)

S2:希望。

(Yes.)

S3:我也是。

(Me too.)

S4:希望。

(Yes.)

S5:一样。

(Me too)

R: 喜欢写作么？

(Do you like writing?)

S1:不喜欢

(No, I don't.)

S2: 我也不喜欢

(Me neither.)

R:你呢？

(What about you?)

S3:不是很喜欢

(Not very much)

S4: 我也不是很喜欢。

(Me neither)

S5:不是很喜欢。

(I do not like it.)

R:那好，那我这样问好了，口语，听力，阅读，写作，你们最喜欢哪一个呢？

(OK. Let me put the question another way: Out of speaking, listening, reading and writing, which one do you like the most?)

S1:我喜欢听力。

(I like listening.)

S2:我喜欢口语。

(I like speaking.)

S3:我也喜欢口语。

(I like speaking too.)

S4:我喜欢阅读。

(I like reading.)

S5:我也喜欢听力。

(I like listening as well.)

R:也就是说，没有人喜欢写作是么？那你们是有遇到什么样的困难么？

(So, none of you like writing? Why? Have you encountered any difficulties in writing?)

S1:想得很好说得不好。

(I can think of many good ideas, but do not how to express them.)

S2: 有的东西不会表达。

(I do not know how to express some ideas.)

S3: 不知道，不知道写什么好。

(I do not know. I do know what to write about.)

S4:没什么困难吧，不知道。

(I cannot think of any difficulty. I do not know.)

S5: 有时候觉得对于一些问题，很难想出一些有趣的东西

(It is difficult to think of useful or interesting ideas for some topics.)

R: 那平时会不会做一些课外的练习来提高写作？

(Whether or not you have done additional practice to improve your writing?)

S1: 没有，没时间。

（No. I have no time to.）

S2: 我也没有。

（No.）

S3: 有，看些课外读物。

（I did some reading.）

S4: 没有啊，作业太多。

（No, because the homework was too much.）

S5: 我也没有。

（No.）

R:那对于你们来说，一篇好的作文是什么样的呢？

(Then, for all of you, what is a good piece of writing?)

S1:会用一些好词。

(Using sophisticated words.)

S2:还有要用很多从句，难句吧

(Using many independent clauses.)

S3:要有好的想法吧。

(Writing about some good ideas.)

S5:语法错误少。

(Fewer grammatical mistakes.)

S4: 对呀，差不多就是这样。

(Yes, just like they said.)

R: 哦，这样。那你们觉得这个学期的写作课怎么样？

(OK. So what do you think about the writing lessons this term?)

S1:很好呀。

(Very good.)

S2: (点头)

(Nods the head.)

R: 不要点头哦，在录音，用说的。

(Please could you say, rather than just nodding your head? We are recording.)

S2:当然啊，我喜欢，我喜欢课堂活动。

(Of course, I like infusion lessons. I like the tasks.)

S3:对呀，还蛮喜欢的。

(Yes, I like it too.)

S4:我觉得比以前有趣，我喜欢。

(I think the writing lessons are more interesting than before. I like it.)

S5: 很好。

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(Good.)

R:哦，那好在哪里呢？

(Ok, why were they good?)

S1:课堂气氛很活泼。

(The atmosphere was active.)

S2:喜欢那些思考活动。

(I like the thinking tasks)

S3:对呀，就是大家都变得很活跃。

(Yeah, we all became more active in the class.)

S4:可以用到很多学过的知识吧。

(We could use a lot of the knowledge we had learnt.)

S5:对，就是大家的学习都变积极了。

(Yes, we became more positive and active in learning)

R:那这些课堂活动，Odd One Out, Fact or Opinion, 和 the Six Thinking Hats,

你们最喜欢哪一个呢？为什么？

(Those thinking tasks, Odd One Out, Fact or Opinion, and the Six Thinking Hats,

which one is your favourite?)

S1:我喜欢思考帽，那个平时也可以用到。

(I like the Six Thinking Hats. It could be used in usual (or normal) practices out of

the class.)

S2:那个最实用，我喜欢。

(Yes, it is the most practical task. I like it.)

S3:我喜欢 Fact or Opinion.

(I like Fact or Opinion.)

S4:我也是，但是那个最难！

(Me too, but it is the most challenging one.)

S5: 我不是，我喜欢 Odd One Out， 因为可以有很多不同的答案。

(I am not. I like Odd One Out, because there are many possible answers.)

S3: 但是那个很容易就想出很多答案了，没什么挑战。

(But, it is easy to think of many different answers, not challenging.)

S2: 对。

(I agree.)

R: 那你们觉得这样的课对你们的思考有什么帮助么？

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(Do you think the lessons were helpful for your thinking?)

S1: 我更积极主动去思考了。

(I become more active in thinking.)

S2: 我觉得我也是啊，就是更主动去想问题了。

(I think I am the same, more active in thinking about the questions.)

S4: 我有更多的想法

 (I can think of more ideas.)

S3:我知道一些思考的方法

 (I learnt how to think.)

R:比如呢？

 (For example?)

S3:如何从不同的角度去思考。

 (How to think from different perspectives.)

R:那你呢？

 (What about you?)

S5: 我觉得我会注意去解释原因，为什么我这么想。

 (I think I paid more attention to explaining the reasons, why I got these ideas.)

R: 那你觉得对你们写作有没有什么帮助？

 (Do you think they were helpful for your writing?)

S1: 有呀，能想出更多有趣的不同的东西。

 (Yes, I could think of more interesting and different ideas to write about.)

S2:我知道要写什么了，要注意解释自己的观点。

 (I know what to write about and the need to explain my ideas.)

S3: 我会花更多时间先去想这个题目要怎么写。

 (I spent more time in thinking about the topic.)

S4: 我以前都不太敢用一些难的词和句子，现我会在写作中用他们。

 (I did not dare to use unfamiliar words and independent clauses. Now I try to use them.)

S5: 对呀，我也是，用一些好词和从句什么的。

 (Yes, me too, I tended to use more sophisticated words and independent clauses.)

R:那你们觉得以后的课有什么需要注意和改进的呢？

 (Then, what would you suggest for future lessons?)

S1: 我觉得这学期的课很有趣，但是我们需要学更多的'模句'，

(The lessons were interesting, but we need more 'formulaic sentences'.)

R: 模句?

(Formulaic sentences?)

S1: 是呀，就是那种我们在写作中可以直接用的。

(Yes, those we can use in writing directly.)

S2：对，我想学些万能句式。

(I want to learn some 'universal sentences'.)

R:哦，那你们呢？

(OK. What about you?)

S3: 我想老师可以用一些课外的教材，这样会更有趣。

(I wish the teacher would use some material which is not in the textbook. That
would be more interesting.)

S4: 我希望老师可以多讲讲考点，帮助我们提高考试的分数

(I wish like the teacher to teach us more knowledge for the exams, to help
use improve the scores in the examinations.)

S5: 我希望继续有课堂活动。

(I would like to have lots more classroom activities.)

R: 好的，那我们今天的采访就结束了。谢谢你们。

(OK. This is the end of the interview. Thank you very much.)

Appendix J. Example of Students' Writing

Level of 6-9 (scoring 6, Pre-intervention writing task)

Animals and we live in a planet, they are lonely. I like animals very much, animal are friend of human. But some people in order to make money to killing wild life.

So protected animals is very important. I want to work for an animal protection society. When I grow up, protect out lovely friends.

Level of 10-14 (scoring 10, Pre-intervention writing task)

What sort of job you would like to do? I always asked myself this question. I want to do a job which works in business in future.

I like it very much. Because it is not only well paid, but also interesting. Although I am a child, I always read business magazine. Besides, I often learn from my mother in my free time.

I also want to become a successful person, so I can help other people. When I become a successful businessman, I can help more people as I can.

I like working in an office, and as long as I believe myself, I'm sure I can do it well.

Scoring 10-14 (Scoring 12, Post-intervention writing task)

I have studied in high school about 2 years. In this period, I have learnt a lot, such as belief, communicative skills, the suitable way of studying, and so on. But what is the most important things to me after all? I think working ability is the most.

As we known, working ability can help us to do something well. I think it really makes a difference in many ways. For example, when I organized an activity, I made a plan about what should we do and how to do it well; when I meet some difficulties, I quickly calmed sown and found a good way to solve them. When I did some works, I finished it quickly and perfectly.

There are many similar things, but I am not going to elaborate on them here. In short, I think working ability is very important, because it will have an effect in your life.

During this period when I studied in high school, I have learnt a lot. But the most important is working ability.

Level of 15-19 (Scoring 15, Pre-intervention writing task)

There are so many jobs in the world, but which one do I want to do the most? Thinking carefully a moment, I think I know which job I would like now. It is forensic scientist, a mystical job. You may feel surprise why I choose it. Ok, let me tell you the reason why I choose it.

Firstly, it is very mystical and interesting. It can allow me to experience different feelings from other jobs. Horrible atmosphere is surrounding.

Next, I like chemistry the most. It is so beautiful, magical and colorful. It is an important subjects and widely used in life.

Last but not the least, being a forensic scientist is a great job. I would like it. So when I grow up I will be a forensic scientist to collect criminal's evidence, to help to punish them, and make more people out of danger, and give them a good environment.

Scoring 15-19 (scoring 17, Post-intervention writing task)

I have learnt many things in high school, for example, knowledge, team work, and confidence. But for me, the most important one is friendship. It is very important in my high school life.

I was not good at making friends. My father has a lot of friends. They are very kind to me and always send me gifts in the festival. He told me that he made friends by heart, so he has many friends. I think it is very hard to make true friends, but I tried. I have many friends now.

A true friend can always be trusted. If you tell her a secret, she will not tell others. If you are sad, she is always by your side. If you lost your confident, she will encourage you. Therefore, friends are very important.

I love my friends. Although we may separate one day, we will be friend forever.

Scoring 20-23 (scoring 20, Pre-intervention writing task)

Many people have asked me what kind of job I want to do in the future. I think I want to be a teacher. Teaching is the most meaningful job in the world.

When I was young, I was shy and have fewer friends. I did not like to go to school. My teacher was good to me. She encouraged me to make friends and told me how to get along with other. She taught me interesting knowledge and built my confidence. I like her, and I will be a teacher like her.

Both my parents are teachers. They told me that teaching is not only teaching, but also need to learn. I like reading and learning. When I was a kid, I read many books in the bookshelf in my parents working room. I like them and learn a lot from them. I think being a teacher is suitable for me.

Last but not the least, teaching is an interesting job. Teacher can make friends with different students after class. You will feel happy to have so many friends in your life.

Therefore, I want to be a teacher, and I will apply for the Peiking Normal University to make my dreams come true.

Scoring 20-23 (scoring 20, Post-intervention writing task)

I have studied in senior high school for more than one year. I have learnt a lot of things, for example, different kind of knowledge, communication skills, and how to get along with others. I think that the most important thing I have learned is to be hard-working.

I was not good at mathematics. Sometimes I could not understand what the teacher said in class, so I could not finish the homework. I studied harder and header. My mathematics improved through being hard-working. There is a saying: 'no pain, no gain'. I understand its real meaning now. You cannot progress, unless through working hard.

Being hard-working is the only way to achieve your goal. All successful people work hard and focus only on their work, so that they can achieve their goals. Nobody can make your dreams come true, except yourself.

I know I need to study really hard, in order to get into a better university, and I will.

Appendix K. Example of Coding of Critical Thinking Elements in Writing

P1/After half a year study in high school, I think bravery is the most important thing I have learnt in high school.

R1/Because we will meet a lot problem in our life, it is important for us to be brave to solve the problems. **C-Per1**/My problem is living in the school. It is the first time for me to live in school. I had to wash clothes by myself, and take care of myself. I would worry about the weather, because the bad weather will make my cloth wet, so I have no clothes for change.

I told myself to be brave. I know I should learn to brave, **C-E1/**when I did not get along well with my friends, **C-E2/**when I did not pass the test, **C-E3/**when I was criticised by teachers, **C-E4/**when I felt upset, **C-E5/**when I found how difficulty to learn math, **C-E6/**when the first time to hold class meeting, **C-E7/**when the first time to give a speech.

Con/I think I have become better and better. No matter how difficult the problem it is, I will tell myself to be brave.

P: point
R: reason
C-E: clarifying in providing example
C-Per: clarifying in providing personal experience
C-FS: clarifying in citing famous sayings
C-Phl: clarifying in philosophically explanation
C-PD: clarifying in precisely defining words
Con: conclusion

The Frequency of:

Proposing point: 1

Providing reason: 1

Clarifying the reason: C-Per1+ C-E7=8

Drawing conclusion: 1