

**The relationship between teacher and student conceptions of critical thinking in
Liberal Studies**

By

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The Hong Kong Institute of Education
in Partial Fulfillment of the Requirement for
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Abstract

The term *critical thinking* has received much attention over the past few decades in both Western and Eastern countries and regions. From 1990s onwards, the Hong Kong educational authority undertook a series of educational reforms in order to encourage a new generation in critical thinking. In the New Senior Secondary curriculum – which commenced in 2009 - Liberal Studies is one of the core subjects in which the aim is to promote critical thinking among senior high school students. Despite this intention, there is no clear definition of what critical thinking is. The purpose of this study was to investigate teacher and student conceptions of critical thinking in Liberal Studies; and the relationship between these two conceptions. Fourteen teachers teaching Form 5 (Year 11) Liberal Studies in four secondary schools in Hong Kong, along with their 480 Secondary 5 students, completed a questionnaire consisting of 40 definers of critical thinking, and one teacher and eight students from each school participated in interviews. The results indicated that both teachers and students emphasised the skills dimension of critical thinking; and explicit and implicit relationships between teacher and student conceptions of critical thinking were found. The results have important implications for teacher education, as well as the successful implementation of Liberal Studies as a subject in the Senior Secondary Curriculum.

Keywords: conceptions of critical thinking, teachers and students, Liberal Studies

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List of Abbreviations

APA	American Psychological Association
ANOVA	Analysis of variance
AS Level	Advanced Supplementary Level
C&A	Curriculum and Assessment
CALM	Critical and Analytical Learning in Macroeconomics
CDC	Curriculum Development Council
CMI	Chinese as Medium of Instructions
EC	Education Commission
EDB	Education Bureau
EMI	English as Medium of Instruction
GPA	Grade Point Average
HKDSE	Hong Kong Diploma of Secondary Education
HKEAA	Hong Kong Examinations and Assessment Authority
IES	Independent Enquiry Study
IGCT	Institutional mean in student self-assessed Growth in Critical Thinking
LS	Liberal Studies
OSP	Ontario Skills Passport

MNSQ	Mean Square
MOI	Medium of Instruction
MOE	Ministry of Education
NSKS	Nature of Scientific Knowledge Scale
NOS	Nature of Science
NSS	New Senior Secondary
PCA	Principal Component Analysis
SBA	School-based Assessment
SRR	Standards-referenced Reporting
ZSTD	Standardized fit statistics

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Chapter 1 Introduction

1.1 Background of the study

There are many increasingly complex and interdependent problems in governmental, economic, social and environmental in the 21st century. “Critical thinking will become a survival need, an external imperative for every nation and for every individual who must survive on his or her own talents, abilities, and traits” (Paul, 1993, p. 13). In order to cope with this situation, educational authorities around the world have initiated educational reforms that emphasise critical thinking in schools.

In order to face the changing political and social context characterised by globalisation, knowledge-based economies and increasingly close ties with Mainland China, the Hong Kong Education Commission published, from 1994 to 2000, seven reports, reviewed reports and reform proposals (Education Commission [EC], 1999, 2000). The term “critical thinking” is used in many educational reports.

To prepare the return of sovereignty to China in 1997, Hong Kong’s educational authority had, from the 1980s onwards, introduced initiatives in which Hong Kong students were taught critical thinking. Advanced Supplementary (AS) Level Liberal Studies was introduced in 1992 with the aim to teach students critical thinking. It was an optional subject, which meant that Form 6

students could opt to take it or not. All Form 6 and 7 students who were studying Liberal Studies could choose two out of six modules. The aim of AS Liberal Studies was intended to “encourage students to visualize the complexity of the issues and to develop their abilities for critical thinking” (Curriculum Development Council [CDC], 1996, p. 6). Students should “develop a wide range of skills and techniques concerned with the collection, organization, presentation, interpretation and evaluation of information about the world, so as to promote critical thinking and to make sound judgments” (CDC, 1996, p. 7). Critical thinking was emphasised in AS Liberal Studies to help students cope with changeable environments in local and global contexts by increasing “student awareness of themselves, and to engender a critical awareness of the society in which they live and the way that society relates to an ever-changing world” (CDC, 1996, p. 7). From the statements made by the Hong Kong Curriculum Development Council, it is evident that the aim of AS Liberal Studies is to equip students with critical thinking skills for the 21st century skill mentioned by Paul (1993).

The importance of critical thinking is not only acknowledged in document papers, but also by the chief government official. In her speech to the Asia-Pacific Centre for Education Leadership, Mrs Anson Chan, the then-Chief Secretary for the Administration, noted that one of the roles of teachers is to:

“...cultivate their young minds to think critically and independently, discern right from

wrong, and make full use of the information which bombards them everyday” (Chan, 2000, p. 9).

Helping students to develop critical thinking is still one of the fundamental aims of education after Hong Kong’s return of sovereignty to China in 1997. The importance of critical thinking is demonstrated in numerous educational documents as follows:

- one of the generic skills in *Learning to Learn - The Way Forward in Curriculum* (CDC, 2001, p. vi);
- students should be able to learn independently (e.g. creative and critical thinking, mastering information technology, communication) in *Learning to Learn - The Way Forward in Curriculum* (CDC, 2001, p. 3);
- one of the Seven Learning Goals in which students should “develop creative thinking and master independent learning skills (e.g. critical thinking, information technology, numeracy and self-management)” (CDC, 2001, p. 4);
- secondary and higher education should nurture student critical thinking (EC, 2000, p. 7).

A major challenge in the information age that has revolutionised people’s daily lives, is learning how to distinguish good from bad. In her speech about leadership for the new millennium, the then-Chief Secretary Mrs. Anson Chan noted that “the most precious gift that we could give to our young people is the ability to become independent minded and critical learners throughout their

lives” (Chan, 2000, p. 9). Teachers are, therefore, necessary in order to “cultivate their (student's) young minds to think critically” (p. 9).

1.2 Critical Thinking through Liberal Studies

Before discussing the role of critical thinking in Liberal Studies, brief descriptions of Hong Kong education system and Liberal Studies in Hong Kong education system are explained first.

Hong Kong Education system

Under the British colonial system, Hong Kong education system was based on the UK model, in which there were 6 years of primary education and 5 years of secondary education. After the public examination (the Hong Kong Certificate of Education Examination, HKCEE), approximate 50% students continued their studies for two years and took another examination, i.e. the Hong Kong Advanced Level Examinations (HKALE) to strive for the opportunity to enter universities (Coniam & Falvey, 2016, p. 1). This system was replaced by the New Senior Secondary (NSS) curriculum in 2009 in which three years for junior secondary, three years for senior high secondary, and 4 years of university education, which was known as 3-3-4. There are three types of schools in Hong Kong education system: government; subsidized; and private. Subsidized schools usually administered by religious organizations and charities (Coniam & Falvey, 2016, p. 3). There are

three types of school bands in Hong Kong secondary schools according to the academic levels of the students from primary schools. Band One is the highest band while Band Three is the lowest (Coniam & Falvey, 2016, p. 3).

Liberal Studies in Hong Kong education system

Commencing from 1992 onwards, Liberal Studies was an optional AS subject for Form 6 and 7 students who studied two out of six modules. This subject aimed to “encourage students to visualize the complexity of the issues and to develop their abilities for critical thinking” (CDC, 1996, p. 6). With the commencement of the NSS, AS Liberal Studies was replaced by the core subject, NSS Liberal Studies. There were 3300 candidates took the 2009 AS Liberal Studies examination (Coniam & Falvey, 2016, p.95) while 66,000 candidates in DSE in 2015 (HKEAA, 2015, Annex 2, p. 2). Concerning the medium of instruction in Liberal Studies, 87.1% of candidates used Chinese in 2015 Liberal Studies HKDSE (HKEAA, 2015, Annex 2, p. 2).

After explaining the Hong Kong education system and Liberal Studies in Hong Kong education system, the role of critical thinking in Liberal Studies will be discussed here. In NSS, Liberal Studies was one of the core subjects alongside Chinese Language, English Language and Mathematics. Unlike the other three core subjects, Liberal Studies is a cross-curricular or interdisciplinary subject. The importance of Liberal Studies in the NSS was highlighted in the

New Academic Structure for Senior Secondary Education and Higher Education--Action Plan for Investing in the Future of Hong Kong in which “Liberal Studies plays a unique role in the NSS curriculum by helping students to connect concepts and knowledge across different disciplines, to look at things from more than a single perspective, and to study issues not covered by any single discipline, such as personal development and Chinese culture” (Education and Manpower Bureau [EDB], 2005, p. 36).

The Education Bureau notes that one of the curriculum aims of Liberal Studies is “to develop in students a range of skills for life-long learning, including critical thinking skills, creativity, problem-solving skills, communication skills and information technology skills” (CDC & Hong Kong Examinations and Assessment Authority [HKEAA], 2007, p. 5). Through the study of a wide range of issues, Liberal Studies broadens students’ knowledge and enhance their social awareness. By studying the six intertwined modules, students make connections across different fields of knowledge and thus broaden their horizons. The CDC even hopes that, by the end of the course, students should be able to “identify the values underlying different views and judgments on personal and social issues, and apply critical thinking skills, creativity and different perspectives in making decisions and judgments on issues and problems at both personal and social levels” (CDC & HKEAA, 2007, p. 6). It is evident that the Hong Kong educational authorities intend to promote student critical thinking through the introduction of Liberal Studies

in the curriculum.

As noted, Liberal Studies is one of the core subjects in the NSS. All Form 6 students are required to sit for the public assessment of Liberal Studies in the Hong Kong Diploma of Secondary Education (HKDSE). The mode of assessment consists of two parts, a public examination and a school-based assessment (SBA). The public examination includes two papers: Paper 1 includes data-response questions which contribute to 50% of the grading and Paper 2 includes extended-response questions that contribute 30%. Independent Enquiry Study (IES) is adopted as the mode of SBA in Liberal Studies. The IES is an “individual” and “self-directed” learning experience in which candidates are required to demonstrate various skills such as collecting, integrating and apply knowledge, problem solving, data gathering and analysis, and communication (CDC & HKEAA, 2007, p. 57).

Standards-referenced reporting (SRR) is adopted in Liberal Studies, for reporting candidate results. Candidate performance is reported with reference to a set of standards in five levels (Levels 1 to 5), with 5 being the highest. The seven level descriptors for Level 5 (HKEAA, 2014) are not categorized on the HKEAA website, however, in the 2008 teacher briefing sessions, the HKEAA presented level descriptors in which Level 5 are categorised into three broad dimensions: (1) multiple perspectives and importance of context; (2) critical thinking, and (3) mastering the

enquiry process and reflection. Among the seven level descriptors, four typical levels candidate:

(HKEAA, 2008, p. 22):

1. interpreting and analysing different and complex information from a variety of perspectives;
2. evaluating various viewpoints and synthesizing own opinions and suggestions with well-supported arguments and sufficient examples;
3. communicating ideas in a concise, logical, balanced and systematic way;
4. conceptualising evidence, consistently shows respect for evidence, open-mindedness and tolerance towards a wide range of views and values.

A comparison between the level descriptors in 2014 and those from the teacher briefing sessions in 2008 is shown as Table 1.

Table 1 Comparison between the level descriptors (Level 5) in 2014 and teacher briefing sessions in 2008

Dimensions	In 2008	In 2014
<ul style="list-style-type: none"> • Multiple perspectives • Importance of context 	<ul style="list-style-type: none"> • understands and applies relevant knowledge, and inter-relates a wide range of issues in a complex and relevant contexts • identifies, gathers, and organises applicable information from related and various sources 	<ul style="list-style-type: none"> • shows comprehensive knowledge and understanding of the key ideas and concepts of the subject by applying relevant knowledge and concepts to a diverse range of complex issues in particular contexts • identifies relevant information, organises and analyses information from a diverse range of sources
<ul style="list-style-type: none"> • Critical thinking 	<ul style="list-style-type: none"> • interprets and analyses different and complex information from a variety of perspectives • evaluates various viewpoints and synthesises own opinions and suggestions with well-supported arguments and sufficient examples • communicate ideas in a concise, logical, balanced and systematic way • conceptualises evidence, consistently shows respect for evidence, open-mindedness and tolerance towards a wide range of views and values 	<ul style="list-style-type: none"> • coherently interprets and analyses the interdependence of personal, local, national and global issues from different perspectives • evaluates various viewpoints and synthesises their own opinions and suggestions on the basis of logical arguments and sufficient examples • communicates ideas in a concise, logical and systematic way • solicits and conceptualises evidence and shows respect for evidence, demonstrating open-mindedness and tolerance towards a wide range of views and values
<ul style="list-style-type: none"> • Mastering the enquiry process • Reflection 	<ul style="list-style-type: none"> • works independently and systematically and reflects in an in-depth and comprehensive way upon the implementation of the enquiry learning process 	<ul style="list-style-type: none"> • shows initiative and self-management skills and reflects comprehensively and systematically throughout the enquiry learning process

It is evident that the HKEAA categorises the level descriptors into three broad dimensions, including critical thinking. The words and phrases used in the level descriptors in the dimension of critical thinking (HKEAA, 2008), can be categorised into two dimensions, i.e. skills and dispositions. The first dimension is skills dimension such as “conceptualises”, “demonstrates”,

“wide range of views and values”, “evaluates various viewpoints”, “synthesises”, “logical arguments”, “interprets and analyses”, “from different perspectives” while “open-mindedness and tolerance” is in the dispositional dimension. The term *skill* means an ability or proficiency acquired through training and practice (APA, 2009, p. 473). The term *skill* is interchanged with *ability* and *competency*. Disposition is “a temperament, set of attitudes, or personal disposition to prize and to use critical thinking in one’s personal, professional and civic affairs” (Facione & Facione, 1997, p. 1). Sometimes the term *disposition* is interchanged with *attitude*, *propensity*, *trait*, or *value*.

This means that critical thinking is a very important element in both the curriculum rationale and assessment in Liberal Studies. As noted, the CDC and the HKEAA intended to promote critical thinking through Liberal Studies.

The words and phrases used in the level descriptors reflected the conception of critical thinking from HKEAA, in which critical thinking includes skills and dispositional dimensions. It is, however, not clear about the conceptions of critical thinking from teachers and students. Since teachers and students are important stakeholders in Liberal Studies, how they conceive of critical thinking is significant in the implementation of the curriculum. This provides a direction for this study to investigate teacher and student conceptions of critical thinking in Liberal Studies. The

purpose of this study will be discussed in details below.

1.3 Purpose and Research Questions

As described by EDB, one of the curriculum aims of Liberal Studies is “to develop in students a range of skills for life-long learning, including critical thinking skills, creativity, problem-solving skills, communication skills and information technology skills”(CDC & HKEAA, 2007, p. 5).

Although EDB appears to recognise the importance of critical thinking in curriculum aims and assessment, there is no clear understanding of what critical thinking actually comprises in Liberal Studies. How teachers and students conceive of critical thinking is not known. As Stedman and Adams (2012) explain “without the correct concepts and perceptions of critical thinking, the teacher may believe they are encouraging or teaching critical thinking when they are not” (p. 9).

When teachers have a clear and correct conception of critical thinking, they can clearly put critical thinking into classroom practice and thus their students can learn critical thinking. Jones (2005, p. 345) found that student conceptions of critical thinking was “very strongly influenced by the teaching context in which the task was situated”. This is because when teachers are clear about what critical thinking is, they are able to design lessons that are able to enhance critical thinking, and student conceptions of critical thinking are shaped in these contexts. It is therefore important to determine teacher and student conceptions of critical thinking, because both are significant

stakeholders in Liberal Studies lessons. Do teachers and students share a similar understanding of critical thinking? Are student conceptions of critical thinking influenced by their teachers? Does classroom practice play a role in the relationship? These are the questions that direct this study.

There were studies about teacher conceptions of critical thinking in different countries and in different subjects. At the same time, there were also studies about student conceptions of critical thinking in different countries and different grade levels (the studies about teacher and student conceptions of critical thinking will be reviewed in the later sections). There are, however, few studies investigating both teacher and student conceptions of critical thinking, and the relationship between them. Moreover, existing research about conceptions of critical thinking, especially in a Hong Kong context, is rare. In other words, teacher and student conceptions of critical thinking are not reflected in the Liberal Studies documents. Driven by this context, the overarching question in this study is:

What is the relationship between teacher and student conceptions of critical thinking in Liberal Studies?

The research questions are:

1. What are teacher conceptions of critical thinking in Liberal Studies?
2. What are student conceptions of critical thinking in Liberal Studies?
3. What is the relationship between teacher and student conceptions of critical thinking in Liberal Studies?

1.4 Significance of the study

The significance of this study lies in understanding teacher and student conceptions of critical thinking in Liberal Studies, in that a significant curriculum goal is to help students develop this life-long learning skill (CDC & HKEAA, 2007, p. 5). NSS Liberal Studies is one of the core subjects, in which every senior high school student in Hong Kong takes the DSE examination. Teachers have been acutely aware of the consequences of high-stakes examinations, such as public reporting of examination results, and for Band Three schools, the closure of a school if student academic performance is continually at a low level (Vogler & Carnes, 2014, p. 38). As a result teachers tended to design their instructions in order to fit the requirements of the examinations. In other words, classroom practice is influenced by the pressure of high-stakes examinations (Firestone, Monfils, Camilli, Schorr, Hicks & Mayrowetz, 2002, p. 1516; Vogler & Carnes, 2014, p. 54). Accordingly, teachers were anxious to adopt those practices they believed best suited the requirements of the examinations. On one hand, the public examination of Liberal Studies

contributes 80% of the grading. On the other hand, the level descriptors suggested that students should possess critical thinking skills such as interpretation, analysis, evaluation, synthesis, and conceptualisation, together with dispositions like multiple perspectives, respect for evidence, open-mindedness and tolerance towards a wide range of views and values (HKEAA, 2014). Teachers were thus eager to design classroom practices that could help their students attain grades that would allow them to graduate and help their school improve examination grades (Vogler & Carnes, 2014, p. 56).

It is afraid that teachers cannot possibly teach what they do not understand. To be able to convey to their students an appropriate conception of critical thinking, teachers should themselves possess adequate conceptions of what critical thinking is. According to Onosko (1992), thoughtful teachers usually identify a great number of “intellectual dispositions (curiosity, confidence, a thirst for reason and willingness to take risk); and intellectual skills (interpret information, generalize from data, formulate conclusions)” (p. 43). Thoughtful teachers manifest lengthier, more elaborate, and more precise perspectives on what thinking entails, which suggests that their conceptual understanding of thinking will help improve their instruction in this area (p. 43). It is evident that thoughtful teachers promote thoughtful classroom practice, since they reflect thoughtfully on that practice (p. 43). Onosko (1992) revealed that teachers can do better teaching thinking skills if they have a clear awareness and understanding of the concept and pedagogy of thinking.

As Kennedy, Fisher, and Ennis (1991) note “agreement on a definition of and a vocabulary for critical thinking is needed in order to get a better idea of what should be assessed by critical thinking evaluation instruments” (p. 29). In their opinion, achieving agreement about the definition of critical thinking is a prerequisite in the area of studying critical thinking. Choy and Cheah (2009, p. 205) state that “critical thinking can only be taught by teachers who have in-depth knowledge of critical thinking skills and understanding of how to incorporate this into their lessons so that it is easier for students to adapt to this type of thinking”.

Critical thinking is a very important element in the Hong Kong NSS curriculum. Teachers, however, are not clear about what critical thinking is. Stapleton (2010) interviewed 72 Hong Kong high school teachers and found that while all respondents were able to provide a definition of critical thinking, they often had different meanings of what critical thinking is. Thirty seven teachers perceived critical thinking as “having diverse perspectives”, or in similar terms like “thinking.....from different/multiple/various viewpoints”, “thinking on both positive and negative sides of the issue”, “thinking from different angles” (p. 18). Some mathematics and science teachers believed that their subject entailed little critical thought because examinations require definitive answers. Those maths and science teachers thought that critical thinking was not important in their subject, however, most of the respondents thought that “critical thinking is important and needs to be taught because Hong Kong students are deficient in this area” (p. 20).

This opinion is in line with the AS Liberal Studies examination report, in which it was noted that “candidates should also be encouraged to develop their critical thinking so that they can support their standpoints with valid and objective reasons” (HKEAA, 2012, p. 121). It is evident that Hong Kong students are weak in critical thinking in Liberal Studies.

As Onosko (1992) argued, there is a correlation between thoughtful teachers who possess intellectual dispositions and the skills and thoughtful classroom atmosphere that enhances critical thinking. Stapleton (2011) concluded that unless an understanding of critical thinking is reached, teachers cannot fully capture the essence of teaching critical thinking in their classrooms (p. 21). Fisher and Scriven (1997) highlighted the importance of defining critical thinking, since the expected effect of teaching critical thinking derives from the fact that “it’s the teachers that set the standards and define the concept of critical thinking” (p. 1). No matter what goes on the classroom, or what teachers do outside the classroom, they are driven by their conception of critical thinking (p. 2). This means that classroom practices are influenced and designed by teachers with their own conceptions of critical thinking. Halonen (1995) also highlighted the importance of understanding the various ways the term ‘critical thinking’ is used, because of the increasing emphasis on academic accountability (p. 75).

Some studies have investigated the relationship between teacher and student conceptions

(Abd-El-Khalick, Bell, & Lederman, 1998; Bartos & Lederman, 2014; Lederman, 1985, 1987, 1992; Sargedine & BouJaoude, 2014; Zeidler & Lederman, 1989). These studies, however, they were concerned with the nature of science, not critical thinking itself, which is the focus of this study. It is hoped that this study will contribute to the comparative lacked literature in this field and context.

1.5 Chapter summary

Both teachers and students are significant stakeholders in the process of teaching and learning. Student understanding of teaching practice and their understanding of its concepts are equally important in the process of teaching and learning. As Ramsden (1988) states, “it is necessary for teachers to explore student conceptions and to devise ways in which changes towards the desired conceptions can occur” (p. 23). Before investigating the ways in which students learn critical thinking in the classroom, it is necessary to explore student conceptions of critical thinking. It is important, therefore, to find out, first, the teachers conceptions of critical thinking; second, the classroom practices that reflect teacher conceptions of critical thinking; and finally, how classroom practice influences student conceptions of critical thinking. It is assumed that with a clear and accurate understanding of teacher and student conceptions of critical thinking, a foundation for learning and education can be laid for educators (Elder & Paul, 2008, p. 89).

Some critics, however, claimed that it is not only classroom practice that influences student

conceptions of critical thinking, but that the translation of the term also served as a contributor. A major critic here has been Regina Ip, a current member of the Executive Council of Hong Kong, as well as the co-founder and current chairperson of the New People's Party and the think tank Savantas Policy Institute's former Secretary for Security. As early as 2007, Ip raised concern about the translation of the term *critical thinking* into Chinese as “批判性思考” in which it is rendered as skills “in the mode of levelling criticism” and this translation has “created the impression that students are encouraged to criticize” (Ip, 2007). In Ip's opinion, the mistaken translation of critical thinking encourages student conceptions of critical thinking as being critical of others. In response to the public misconception of the Chinese translation of critical thinking, the Education Bureau adopted the term “明辨（批判）性思考能力” as the Chinese translation of critical thinking (Legislative Council, 2014). The issue of translation of the term critical thinking will not be discussed since it is not the focus of this study.

The literature review in the following section will begin with a discussion of the existing theoretical framework of critical thinking. Important studies of how critical thinking is conceptualised will be reviewed. The research method of the current study will be presented in Chapter 3. Chapters 4 and 5 present the findings of the study. A comprehensive discussion about teacher and student conceptions of critical thinking, and their relationship, is outlined in Chapter 6. The final chapter will then explain the implications and limitations of the current study.

Chapter 2 Literature Review

2.1 Importance of Critical Thinking

Critical thinking is regarded as a survival skill (Johanson, 2010, p. 27; Wagner, 2008, p.15), and a 21st century skill (Rosefsky & Opfer, 2012, p. 8). As early as 1990, an international group of 46 recognised experts in critical thinking research presented the importance of critical thinking in the *Delphi Report*, as follows:

“Critical thinking is essential as a tool of inquiry.....critical thinking is a liberating force in education and a powerful resource in one’s personal and civic life.....critical thinking is a pervasive and self-rectifying human phenomenon” (Facione, 2011, p. 7).

As seen from the abovementioned statement, the importance of critical thinking lies in three dimensions: individual, in workplace, and in society, which will be discussed below.

2.1.1 Individual Dimension

In the individual dimension, critical thinking enhances an individual’s intellectual and social competence and helps that individual to meet more effectively the problems they encounter; and it also enables an individual’s better cooperation with others (Glaser, 1985, p. 27). Hare (1998)

concluded that one of the reasons to promote critical thinking as an aim of education is for an awareness of the mindless rote-learning in which some classrooms persist, which impede enhanced problem-solving by students (p. 38). When facing the overwhelming amount of information in daily life, critical thinking “enables us to reason effectively, evaluate myriads of information and consider alternative views to arrive at sound judgments” (Ku & Ho, 2010, p. 54). Critical thinking is especially important for individuals because “all of us encounter opportunities in our daily lives to engage problems and decisions using strong critical thinking” (Facione, 2011, p. 4). It is demonstrated that there are many problems and decision making opportunities in such an ever-changing society, and that everyone should therefore possess the ability to think critically in order to judge information, to make wise use of the information and to come to well-reasoned judgments. As Fok (2002, p. 84) states, critical thinking is important for a person in order “to meet the everyday personal, social, and professional demands of an ever-changing society”.

In addition to the intellectual abilities of an individual in facing the fast-changing atmosphere in 21st century, critical thinking was also found important to student academic achievement. Barzdzikiene, Urboniene and Klimoviene (2006), found a relationship between students who were taught the skills of critical thinking and having a good command of language (p. 81). Other studies also demonstrated the relationship between a critical thinking disposition and student academic achievement at different grade levels. There was a positive correlation between grade

point average (GPA) and critical thinking, in which faculty appreciated and rewarded their undergraduate students who had a strong critical thinking disposition and, therefore, awarded a higher grade (Giancarlo & Facione, 2001, p. 50). The positive relationship between GPA and critical thinking skills was also evident in undergraduate Iranian English students (Afshar, Rahimi, & Rahimi, 2014). The relatively direct impact of a critical thinking disposition on GPA was also demonstrated for university students (Bers, McGowan, & Rubin, 1996, p. 213; Stupnisky, Renaud, Daniels, Haynes & Perry, 2008, p. 526; White, Beck, Birrenkott, Skewes & Layfield, 2015, p. 51). A critical thinking disposition could also be predicted through the achieved goals of post-graduate students (Dehghani, Mirdoraghib & Pakmehr, 2011, p. 2429). For teacher candidates, there was also a relationship between critical thinking dispositions and academic achievements (Karagol, Bekmezci, 2015, p. 91). All these studies demonstrated that there was a positive relationship between critical thinking, in both skills and dispositions, and student academic achievements. Critical thinking, therefore, was found important in a student's individual dimension.

2.1.2 In the Workplace

Critical thinking is also important in the workplace. Companies have urged schools to educate students with such skills in order to compete within the new global economic realities but, as John Sculley, CEO of Apple Computer, Inc. complained, “[The] education system has not successfully made the shift from teaching the memorization of facts to achieving the learning of critical

thinking skills” (as cited in Peterson, 1995). Paul (1993, p. 34) explained that the “ever-changing economy demands abilities and traits characteristic of comprehensive critical thinking”. In the new millennium, the significance of critical thinking in the workplace is becoming more and more concerning. Hare (1998) emphasised the function of critical thinking as promising adaptability, resourcefulness and autonomy for students entering an uncertain future and a rapidly changing working environment (p. 38). From a survey of human resource officials, Borja (2006, p. 21) noted that 75% of the polled business leaders urged schools to take up their responsibility to teach students critical thinking, which implies that schools have fallen short of that responsibility. Rudd (2007) argued that students must be taught critical thinking skills and dispositions in order to be well-prepared for entry to and advancement through career and technical education (p. 46). Another survey by the American Management Association (2010, p. 31) found that critical thinking/problem solving is one of the top three entry-level skills desired by employers. It is evident that in the 21st century, critical thinking is a prerequisite for an individual to survive in the workplace, and thus employers are anxious for schools to teach critical thinking because they can recruit those graduates who are able to think critically.

2.1.3 Social Dimension

In the social dimension, educating critically minded citizens is in the national interest because informed citizenry is the key to the success of democratic institutions and for a competitive

free-market economic enterprise (Facione, 2013, p. 23). Glaser (1985) stated that the development of critical thinking ability is significant to a society because it “helps the citizen to form intelligent judgments on public issues and thus contribute democratically to the solution of social problems” (p. 27). It is hoped that people with critical thinking ability are able to form intelligent judgment on public issues, and can solve social problems. In the consensus statement of the Delphi Report, educating strong critical thinkers is described as “the basis of a rational and democratic society” (Facione, 1990, p. 26). Martin (1992) concludes that critical thinking should be the general aim of education in which students learn to expand their circle of concern and thus move towards a more humane world (p. 179). Facione (2011) highlights the crucial status of critical thinking in the social dimension in which “in a nation that values self-reliance and initiative, the stronger our critical thinking skills and habits of mind, the greater our prospects for success” (p. 4). Educating critical thinkers is a national goal that will bring benefits to the development of a democratic and humane world. Many political leaders strive for the goal to achieve “a population that makes thoughtful and informed judgment about the policy issues and social questions of its day” and “a society of knowledgeable people determined to apply strong critical thinking skills to evaluate the policy decisions of their leaders” (Facione, 2011, p. 4). Critical thinking is hopefully the road to achieve this goal.

2.1.4 Concluding comments

The importance of critical thinking is summarised by Facione (2011): “critical thinking - making well-reasoned judgments about what to believe and what to do - is essential to consistently successful decision making in business and professional practice, at every level of education, and wherever the quality of one’s decisions and the accuracy of one’s beliefs make a difference” (p. 6).

People are called upon to make decisions on a wide range of important personal, local and even global topics. The information glut and the ever-changing workplace require wisdom and reasoned judgment for survival in the 21st century. Critical thinking is needed now more than ever. An individual should possess critical thinking in tackling the problems in their daily life in the changing century. Employers also look for employees who can think critically, not just memorise facts. A democratic society also requires citizens who can make reasoned judgments on public issues and thus achieve a better society. It is difficult to imagine any area where critical thinking is not needed.

2.2 Critical Thinking in Educational Reforms

As Pithers and Soden (2000) note, “national development is tied up with education outcomes and because the pace of globalisation with increased economic competition is unrelenting” (p. 237), and accordingly national government policy and employers are demanding that education should enable graduates to think in smarter ways. In accordance with the growing importance of critical thinking in various dimensions, as noted above, educational documents have outlined the

educational aims in which critical thinking as one of their goals.

2.2.1 In Western countries

Critical thinking has a long history in education in the United States. Rothstein, Wilder and Jacobsen (2007) synthesised the goals that have persisted throughout nearly 300 years of United States education policymaking into eight broad categories: basic academic skills, critical thinking and problem solving, social skills and work ethic, citizenship, physical health, emotional health, the arts and literature, and preparation for skilled employment (p. 9). The National Education Goals Panel established an educational goal that the United States would strive to achieve in 2000 and beyond, so that “the proportion of college graduates who demonstrate an advanced ability to think critically, communicate effectively, and solve problems will increase substantially” (1991, p. 237). In the United Kingdom’s National Curriculum, there is a section called “Values, Aims and Purposes” which states that “by providing rich and varied contexts for pupils to acquire, develop and apply a broad range of knowledge, understanding and skills, the curriculum should enable pupils to think creatively and critically, to solve problems and to make a difference for the better” (Department for Education and Employment & Qualifications and Curriculum Authority, 1999, p. 11). In Australia, after consultation with university representatives and other stakeholders, critical thinking was one of the selected components of the initial Graduate Skills Assessment (Department of Education, Training and Youth Affairs, 2001, p. vii). In Turkey, the elementary

school curriculum also emphasises critical thinking. Koc, Isiksal, and Bulut (2007) found that one of the individual fundamental objectives of the elementary school curriculum is “creating environments that promote life-long skills such as creativity, entrepreneurship, and scientific, analytic and critical thinking” (p. 34). Alazzi and Khawalidah (2008) conclude that critical thinking is important “to help the Jordanian people cope with rapid economic, social, and political developments and to bring about meaningful participatory citizenship among younger students, vital critical thinking skills are needed” (p. 96). In Canada, the Ministry of Education has added the Essential Skill of Critical Thinking to the Ontario Skills Passport (OSP) which provides clear descriptions of the essential skills and work habits for work, learning and life (Canadian Ministry of Education, 2014).

2.2.2 In Asian countries

Critical thinking has become a focus of attention in education in Western and Asian countries. In Singapore, the then-Prime Minister Goh Chok Tong announced an educational reform called *Thinking Schools, Learning Nation* in which “schools must develop future generations of thinking and committed citizens, capable of making good decisions” (Singapore Ministry of Education, 1997). The vision statement of the Ministry of Education (MOE) stated “we should help the students to ask more searching questions, encourage curiosity and critical thinking, and not only to follow prescribed answers” (Ministry of Education, 2012). In Japan, the Ministry of Education

emphasises that the goal of primary and secondary education is to “foster solid academic abilities of children, including fundamental knowledge and skills, abilities to think logically as well as critically, to pass fair judgments and to express themselves well, and motivation to learn and learning habits” (Japanese Ministry of Education, Culture, Sports, Science and Technology, 2008).

In Taiwan, the Ministry of Education emphasises the importance of critical thinking in which teachers should teach critical thinking in schools. In the Administrative Plan - Towards a Learning Society, in order to achieve the aim of lifelong learning society, “in the process of teaching, cultivation of critical thinking and self-inquiry should be emphasised, and self-directed learning should be encouraged” (Taiwanese Ministry of Education, 2012). Over seven million NTD will be used to promote critical thinking training in elementary and junior high schools (MOE, 2009).

Like her counterparts, Hong Kong has emphasised critical thinking in her series of educational reforms. The spirit of self-motivation and self-learning, and the ability to think and create, that school education was obligated to nurture, enabled “students to have full self-confidence, with the drive to keep on learning for their own development and the advancement of the society” (EC, 1999, p. 18). Critical thinking was given as one of the objectives of senior secondary education (EC, 2000, p. 7). The key points about critical thinking in the educational reforms in different countries and regions were summarised as Table 2.1.

Table 2.1 Summary of the key points about critical thinking in the educational reforms in different countries/regions (in chronological order)

Country/ Region	Year	Critical thinking in educational reforms
United States	1991	To demonstrate an advanced ability to think critically, communicate effectively, and solve problems
Singapore	1997, 2012	To encourage curiosity and critical thinking
Hong Kong	1999	To nurture critical thinking in senior secondary education
United Kingdom	1999	To enable pupils to think creatively and critically
Australia	2001	To include critical thinking as one of the selected components of the initial Graduate Skills Assessment
Turkey	2007	To create environments that promote life-long skills including critical thinking
Japan	2008	To foster student abilities to think logically and critically
Jordan	2008	To cope with rapid economic, social, and political developments and to bring about meaningful participatory citizenship among younger students
Taiwan	2009, 2012	To encourage teaching critical thinking in schools
Canada	2014	To include critical thinking in the essential skills in the Ontario Skills Passport (OSP)

As shown as Table 2.1, some Western and Eastern countries or regions emphasise critical thinking in their educational reforms, where critical thinking is regarded as one of the essential and life-long skills, and schools and teachers are obliged to teach students how to think critically. This is not only beneficial to the students who will enter the workplace after graduation, but it is also necessary for a society that requires citizens with critical minds to make wise decisions about social issues.

2.2.3 Concluding comments

As critical thinking is significant for individual, for the workplace, and for society, schools are, accordingly, obliged to teach students critical thinking. Numerous countries have recognised that the world is changing under the impact of globalisation and the need for a citizenship that can think critically is imperative in many countries. This may be the reason why critical thinking has gained unprecedented attention in education in many parts of the world. Educational authorities in Western and Asian countries aim to enhance critical thinking in order to equip students to face the challenges from the ever-changing 21st century.

2.3 The definition of “conceptions”

Before reviewing the conceptions of critical thinking from the viewpoints of scholars, teachers and students, the term “conceptions” should first be defined. According to Pratt, conceptions are:

“...specific meanings attached to phenomena which then mediate our response to situations involving those phenomena” (Pratt, 1992, p. 204).

People associate meanings with the phenomena that they encounter and then they modify their response to the phenomena. Different people, therefore, have different conceptions of the same phenomena. Pratt (1992) further explains how conceptions form: “we form conceptions of virtually every aspect of our perceived world, and in so doing, use of those abstract

representations to delimit something from, and relate it to, other aspect of our world” (p. 204).

This means that people make sense of the perceived world and try to connect it with other parts of the world that they encounter. People interpret and act in accordance with their understanding of the world - their conceptions. People view the world through conceptions that “significantly influence our perceptions and interpretations of event, people, and phenomena surrounding us” (p. 204).

Paul (1993) explains the word “concept” as “a generalized idea of a class of things” (p. 109).

Conceptualisation is “a process by which the mind infers a thing to be of a certain kind, to belong properly to some given class of things” (p. 109). This means that when we call or interpret something as being a cat, for example, we place it into a class of things, the class of cats. Paul (1993) further illustrates that “we learn thousands of concepts which enable us to make countless legitimate inferences about the objects of our experience” (p. 109). During the learning process, however, “we cannot give anyone the meaning of a word or phrase; meaning must be individually created by every person who learns it” (p. 109). Accordingly, people learn by their own experience, and, therefore, they build up their conceptions from that experience.

It is the same situation in the classroom. Teachers and students have their own conceptions toward, for example, the learning and teaching process, the learning tasks and the classroom

atmosphere. It is assumed that teachers and students have their own conceptions of critical thinking that are influenced by their experience in the classrooms. As Johnson (1992) suggests, one of the criteria for evaluating a definition of critical thinking depends on a “broadly reflective of current practice” (p. 52). If we want to investigate teacher and student conceptions of critical thinking, the subject Liberal Studies is therefore an appropriate portal since it emphasises critical thinking.

2.4 Conceptions of Critical Thinking from scholars

Critical thinking has gained attention in many regions. It is, however, not clearly understood (Alazzi & Khawaldeh, 2008; Choy & Cheah, 2009; Griggs, Jackson, & Marek, 1998; Howe, 2000; Innabi & Sheikh, 2006; Stapleton, 2011; Stedman & Adams, 2012). Before introducing the various conceptions of critical thinking from the views of different scholars, the reasons for their divergence should be illustrated here. Johnson (2009) noted that the divergent definitions of critical thinking may be due to two factors: the richness in meaning of the term “critical thinking” and the ambiguity of the word “critical”, so that inevitably there are various ways of interpretation (p. 61). This is in line with what Pratt (1992) and Paul (1993) noted above. We perceive the world through our own conceptions and we create our own meaning of certain phenomena, words or phrases. As a result, there is lack of consensus among teachers about the definition of critical thinking, as demonstrated by the study of Griggs, Jackson and Marek (1998). After examining the

37 full-length introductory psychology textbooks published from 1995 to 1997, Griggs et al. (1998) found that there were 25 definitions of critical thinking. Among the 68% of textbooks that had defined critical thinking, “they differ greatly both in the manner and extent of their coverage” (p. 264). Critical thinking is thus a concept for which no one definition is widely accepted (Halonen, 1995, p. 75). In spite of this, many scholars had contributed their conceptions of critical thinking. Two dimensions of conceptions were introduced by scholars: (1) skills dimension, (2) dispositional dimension. These conceptions of critical thinking are introduced in chronological order according to the dimensions.

2.4.1 Conception 1: Skills Dimension

Many scholars regarded critical thinking as skills. As mentioned, the term skill means an ability or proficiency acquired through training and practice (APA, 2009, p. 473). To different scholars, the term *skill* is used interchangeably with other terms such as *ability* and *competency*.

Glaser (1941, 1980)

In a seminal study on critical thinking and education in 1941, Glaser (1941) introduced that critical thinking involves:

“knowledge of the methods of logical inquiry and reasoning, and some skill in applying those methods” (p. 5).

As noted, Glaser thought that critical thinking involves the skill of applying methods of logical inquiry and reasoning. At the same time, he explained that critical thinking includes the following abilities:

- 1. to recognise problems;*
 - 2. to find workable means for meeting those problems;*
 - 3. to gather and marshal pertinent information;*
 - 4. to recognise unstated assumptions and values;*
 - 5. to comprehend and use language with accuracy, clarity and discrimination;*
 - 6. to interpret data;*
 - 7. to appraise evidence and evaluate statements;*
 - 8. to recognise the existence of logical relationships between propositions;*
 - 9. to draw warranted conclusions and generalisations;*
 - 10. to put the generalisations and conclusions arrived at to the test;*
 - 11. to reconstruct patterns of beliefs from wider experience;*
 - 12. to render accurate judgments about specific things and qualities in everyday life*
- (Glaser, 1941).

Glaser introduced this detailed list of abilities that provided a foundation for the development of the definition of critical thinking as early as 1941.

In the manual for the famous and widely-used test of critical thinking, the Watson-Glaser Critical Thinking Appraisal, Glaser (1980) amended the definition of critical thinking as:

- *Knowledge of the nature of valid inferences, abstractions, and generalizations in which the weight or accuracy of different kinds of evidence are logically determined;*
- *Skills in employing and applying the above attitudes and knowledge (p. 1).*

In both 1941 and 1980, Glaser had a consistent view of critical thinking as consisting of skills.

Ennis (1962, 1987, 1996)

In his seminal article “A Concept of Critical Thinking: A Proposed Basis for Research in the Teaching and Evaluation of Critical Thinking Ability”, Ennis (1962) introduced critical thinking as twelve competencies:

- (1) grasping the meaning of a statement;*
- (2) judging whether there is an ambiguity within a line of reasoning;*
- (3) judging whether certain statements contradict each other;*
- (4) judging whether a statement is specific enough;*
- (5) judging whether a conclusion follows necessarily;*
- (6) judging whether a statement is actually the application of a certain principle;*
- (7) judging whether an observation statement is reliable;*
- (8) judging whether an inductive conclusion is warranted;*
- (9) judging whether the problem has been identified;*
- (10) judging whether something is an assumption;*
- (11) judging whether a definition is adequate;*
- (12) judging whether a statement made by an alleged authority is acceptable (p. 9).*

From this list of skills, it is obvious that Ennis conceived critical thinking in the skills dimension as focused on the skill of judging.

Ennis has not stopped developing his conception of critical thinking since the release of his article in 1962. Ennis (1987) provided a short and understandable working definition of critical thinking as “reasonable reflective thinking that is focused on deciding what to believe or do” which combined the five key ideas: *practical, reflective, reasonable, belief* and *action* (p. 10). Working with Norris, Ennis (1989) modified critical thinking as being able to:

- (1) *focus on a question;*
- (2) *analyse arguments;*
- (3) *ask and answer questions of challenge;*
- (4) *judge the creditability of sources;*
- (5) *make and judge observations;*
- (6) *make and judge deductions;*
- (7) *make and judge inductions;*
- (8) *make and judge value judgments;*
- (9) *define terms and judge definitions;*
- (10) *identify assumptions;*
- (11) *decide on an action;*
- (12) *interact with others* (p. 183).

In contrast to the skills introduced in 1962, which focused on judging, this list of skills covered a

variety of skills, such as analysing, defining and identifying. The skills listed are not only concerned with the personal level, but also interacting with others, or interpersonal skills. Late in 1996, Ennis further introduced FRISCO, as the six elements underpinning critical thinking:

- (1) *Focus*: to address the main point, issue, questions, or problems;
- (2) *Reasons*: to get an idea of the reason(s) in order to make an acceptable reason before making a final judgment;
- (3) *Inference*: to make a good inference that steps from reason to the conclusion;
- (4) *Situation*: to give meaning to what the thinker is doing, or judging the situation, including the physical and social environment;
- (5) *Clarity*: to make sure the meaning of the terms and their presentation in speaking and writing are clear and understandable;
- (6) *Overview*: to check what has been inferred and do this continuously (1996, p. 4).

This simple acronym, FRISCO, provided a element for critical thinking, using the listed skills.

Scriven and Paul (1987)

On behalf of the National Council for Excellence in Critical Thinking, Scriven and Paul (1987) defined critical thinking in their presentation at the 8th Annual International Conference on Critical Thinking and Education Reform as “*the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication,*

as a guide to belief and action.” (Scriven & Paul, 1987). Implicitly, Scriven and Paul contend that critical thinking included skills such as conceptualising, applying, analysing, synthesising, and evaluating.

Norris and Ennis (1989)

In the Critical and Creative Thinking Program in 1985, the professional educators included Ennis, Norris, Paul and Perkins, and concluded that critical thinking was “reasonable and reflective thinking that is focused upon deciding what to believe or do” (Norris & Ennis, 1989, p. 1). This precise and one-sentence definition presented critical thinking as “a process of inference leading from some basic support to a decision about belief or action” (p. 25). This process takes place within the context of problem solving. Norris and Ennis introduced 12 skills that related to critical thinking:

Elementary Clarification

1. *Focusing on a question;*
2. *Analysing arguments;*
3. *Asking and answering questions that clarify and challenge.*

Basic Support

4. *Judging the creditability of a source;*
5. *Making and judging observations.*

Inference

6. *Making and judging deductions;*
7. *Making and judging inductions;*

8. *Making and judging value judgments.*

Advanced Clarification

9. *Defining terms and judging definitions;*

10. *Identifying assumptions.*

Strategies and Tactics

11. *Deciding on an action;*

12. *Interacting with others* (Norris & Ennis, 1989, p. 14).

The abilities listed above develop from an elementary level to an advanced level. The applications of strategies and tactics to communicate with others are also necessary (Norris & Ennis, 1989, p. 13).

Facione (1990, 2011)

As discussed, the American Philosophical Association, after reaching a consensus as an international panel of expert scholars and theoreticians, released the 1990 *Delphi Report* which concluded the definition of critical thinking as:

“...purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference, as well as explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based.” (Facione, 1990, p.2).

For Facione, critical thinking is about skills that involve the interpretation, analysis, evaluation, inference and explanation that are required in order to make judgments. He also regarded critical thinking as the “process of reasoned judgment” (2011, p. 3).

Paul (1993)

In the explanation by Paul (1993), critical thinking is “thinking about your thinking while you are thinking in order to make your thinking better”. That means critical thinking is “self-improvement (in thinking) through standards (that assess thinking)” (p. 91). Many scholars introduced the term “critical thinker”; however, this term did not satisfy Paul who introduced “strong sense critical thinkers” who have:

- (1) an ability to question deeply their own framework of thoughts;*
- (2) an ability to reconstruct sympathetically and imaginatively the strongest versions of points of view and frameworks of thoughts opposed to their own;*
- (3) an ability to reason dialectically/multilogically in such a way as to determine when their own point of view is at its weakest and when an opposing point of view is at its strongest (1993, p. 486).*

To Paul, when someone is able to address problems, gather information in the hope of solving a problem, come to reasoned conclusions against criteria, assess assumptions with open-mindedness, and lastly communicate solutions with others, they can be regarded as a “strong sense critical thinker”.

Fisher and Scriven (1997)

Fisher and Scriven (1997, p. 21) provided a full and easy-to-remember definition of critical thinking in four pairs of terms:

*Critical thinking is the
skilled and active
interpretation and evaluation
of
observations and communications
information and argumentation*

Fisher and Scriven thought that critical thinking requires skills in which observations, communications of information and argumentation should be skilfully and actively interpreted and evaluated. Blair (2009) found the definition by Fisher and Scriven compelling because: 1) it was not building the disposition to exercise critical thinking abilities into the very conception of critical thinking; 2) its recognition that critical thinking should not be conflated with the ability to analyse and assess arguments (p. 270). Instead of including dispositions in the definition, Fisher and Scriven explained the importance of activities in interpretation and evaluation.

Elder and Paul (2008, 2010)

Elder and Paul (2008) defined critical thinking as “the process of analyzing and assessing thinking with a view to improving it”. In the Foundation for Critical Thinking Press 2008, Elder and Paul

defined critical thinking as a “mode of thinking- about any subject, content, or problem - in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them”. They clearly illustrated that “critical thinkers routinely apply the intellectual standards to the elements of reasoning in order to develop intellectual traits” (p. 21). Concerning what constitutes a critical thinker, Elder and Paul (2010) propose five competencies that are embedded in critical thinking that a person will:

1. *raise vital questions and problems, i.e. formulating the questions and problems clearly and precisely;*
2. *gather and assess relevant information, i.e. using abstract ideas to interpret it effectively and fairly;*
3. *come to well-reasoned conclusions and solutions, i.e. testing them against relevant criteria and standards;*
4. *think open-mindedly within alternative systems of thought, i.e. recognising and assessing their assumptions, implications, and practical consequences;*
5. *communicate effectively with others in figuring out solutions to complex problems (p. 38).*

In other words, Elder and Paul suggest that critical thinkers should possess some procedures that include addressing problems, gathering information in the hope of solving a problem, coming to reasoned conclusions against criteria, assessing assumptions with open-mindedness, and lastly communicating the solutions with others.

Halpern (2014)

Halpern (2014) provided a simple definition of critical thinking as “the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and goal directed - the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task” (p. 8). Halpern shared a similar view with other scholars, that critical thinking is conceived in the skills and dispositional dimensions. In the skills dimension, Halpern listed the following generic skills that a critical thinker should exercise:

- *recognise semantic slanting and guilt by association;*
- *seek out contradictory evidence;*
- *use the metacognitive knowledge that allows novices to monitor their own performance and to decide when additional help is needed;*
- *make risk: benefit assessments;*
- *generate a reasoned method for selecting between several possible courses of actions;*
- *give reasons for choices as well as varying the style and amount of detail in explanations depending on who is receiving the information;*
- *recall relevant information when it is needed;*
- *use skills for learning new techniques efficiently and relate new knowledge to information that was previously learned;*
- *use numerical information including the ability to think probabilistically and express thoughts numerically;*
- *understand basic research principles;*

- *demonstrate an advanced ability to read and write complex prose;*
- *present a coherent and persuasive argument on a controversial, contemporary topic;*
- *use matrices and other diagrams for communication;*
- *synthesise information from a variety of sources;*
- *determine creditability and use this information in formulating and communicating decisions* (2014, p. 19).

This detailed list of 15 skills not only focuses on the skills that are required in critical thinking, but also the importance of communicating information with others.

In the conceptions of critical thinking, there is a term, higher-order thinking, that always used interchangeably since they both represent similar cognitive processes (FitzPatrick, Hawboldt, Doyle & Genge, 2015, p. 1). Ennis (1985) contended that there was a relationship between critical thinking and higher-order thinking as “critical thinking incorporates a good deal of the directly practical side of higher order thinking” (p. 47). Ennis provided a definition of critical thinking as *reflective and reasonable thinking that is focused on deciding what to believe or do* (1985, p. 45), and, accordingly, “deciding what to believe or do is a higher-order thinking enterprise, and most practical higher-order thinking activity is focused on deciding what to believe or do” (p. 47). Lewis and Smith’s (1993) definition involved higher-order thinking as occurring “when a person takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations (p.

136). According to Miri, David and Uri (2007), higher order thinking is conceptualised as an *umbrella* that involves various forms of thinking, such as critical thinking. Accordingly, higher-order thinking is conceived as the strategy (the setting of meta-objectives) whereas critical thinking involves the tactics (the activities needed to achieve the proclaimed objectives). Critical thinking is therefore regarded as an operative example of higher-order thinking (Miri et al., 2007, p. 355). Research findings concluded that teaching efforts to promote higher-order thinking fostered critical thinking abilities in students (Miri et al., 2007, p. 360).

Bloom's Taxonomy of the Cognitive Domain (1956) has been considered to be a conceptualisation of higher-order thinking skills (Ennis, 1985, p. 45). Bloom was also regarded as a pioneer in critical thinking (Choy & Cheah, 2009; Duron, Limbach & Waugh, 2006; Lauer, 2005). Bloom's Taxonomy is a multi-layered model of classifying thinking according to six cognitive levels of complexity (see Table 6). The lowest three levels are: *knowledge*, *comprehension*, and *application*. The highest three levels are: *analysis*, *synthesis*, and *evaluation*, and are regarded as higher-order thinking (Ennis, 1985, p. 45; Kennedy, Fisher & Ennis, 1991, p. 13). Although research studies lack clear definitions of *higher-order thinking* (Eccarius, 2011, p. 266), the term is always regarded as the foundation of the theory of critical thinking (Duron et al., 2006, p. 160).

In the revised Bloom Taxonomy (Anderson & Krathwohl, 2001), there are 19 cognitive processes

that further clarify the scope of the six categories. In the action verbs list (see Table 2.2), some terms were found to be exactly the same as the skills dimension of critical thinking that scholars had noted before:

1. Evaluation: Ennis (1987); Facione (1990); Fisher and Scriven (1997); Scriven and Paul (1987)
2. Synthesis: Halpern (2014); Scriven and Paul (1987)
3. Analysis: Ennis (1987); Facione (1990); Norris and Ennis (1989); Scriven and Paul (1987)

The terms *evaluation*, *synthesis*, and *analysis* were categorised as higher-order thinking level in Bloom's Taxonomy, and were also used by the scholars to describe the skills dimension of critical thinking. It is evident that higher-order thinking, conceptualised by Bloom's Taxonomy, is closely related to the conceptions of critical thinking.

As noted, those scholars believe that critical thinking includes skills dimensions, and they clearly listed some skills embedded in the critical thinking process. There were many terms noted in the skills dimension of critical thinking. A detailed description will be presented in 2.4.3 Concluding Comments.

Table 2.2 Action verbs in Bloom's taxonomy

Bloom (1956)	Anderson & Krathwohl, 2001	Action Verbs
6. Evaluation	Create	Generating: hypothesising Planning: designing Producing: constructing
5. Synthesis	Evaluate	Checking: coordinating, detecting, monitoring, testing Critiquing: judging
4. Analysis	Analyse	Differentiating: discriminating, distinguishing, focusing, selecting Organising: finding coherence, integrating, outlining, parsing, structuring Attributing: deconstructing
3. Application	Apply	Executing: carrying out Implementing: using
2. Comprehension	Understand	Interpreting: clarifying, paraphrasing, representing, translating Exemplifying: illustrating, instantiating Classifying: categorising, subsuming Summarising: abstracting, generalising Inferring: concluding, extrapolating, interpolating, predicting Comparing: contrasting, mapping, matching Explaining: constructing models
1. Knowledge	Remember	Recognising: identifying Recalling: retrieving

2.4.2 Conception 2: Dispositional Dimension

In addition to skills, individual dispositions were also regarded as an important element in the conceptions of critical thinking. Disposition is “a temperament, set of attitudes, or personal disposition to prize and to use critical thinking in one’s personal, professional and civic affairs” (Facione & Facione, 1997, p. 1). Sometimes the term *disposition* is interchanged with *attitude*, *propensity*, *trait*, or *value*.

Scriven and Paul (1987)

In the 8th Annual International Conference on Critical Thinking and Education Reform, Scriven and Paul (1987) introduced the idea that critical thinking “*is based on universal intellectual values that transcend subject matter divisions: clarity, accuracy, precision, consistency, relevance, sound evidence, good reasons, depth, breadth, and fairness*”. As discussed, the term *value* is similar to *dispositions*.

Siegel (1988)

Siegel (1988) conceives of critical thinking as being “the educational cognate of rationality” which involves “bringing to bear all matters relevant to the rationality of beliefs and action” (p. 32). Siegel emphasises the connection between reasons and principles in critical thinking, in which it “is principled thinking because principles involve consistency, critical thinking is impartial,

consistent, and non-arbitrary” (p. 34). This means that reason is a crucial element in critical thinking. Siegel (1988) thinks that a critical thinker is “appropriately moved by reasons” (p. 32); “appreciates and accepts the importance, and convicting force, of reasons” (p. 33). A critical thinker is also a rational person who “believe(s) and act(s) on the basis of reasons” (p. 32). Siegel thinks that a critical thinker “both thinks and acts in accordance with, and values, consistency, fairness, and impartiality of judgment and action” (p. 34). “When assessing claims, making judgments, evaluating procedures, or contemplating alternative actions, the critical thinker seeks reasons on which to base (his or) her assessments, judgments, and actions” (p. 33).

Norris and Ennis (1989)

Norris and Ennis emphasise both the skills and dispositional dimensions of critical thinking. They present critical thinking as involving the following 14 actions that critical thinkers should take:

- 1. seek a statement of the thesis or question;*
- 2. seek reasons;*
- 3. try to be well informed;*
- 4. use creditable sources and report them;*
- 5. take into account the total situation;*
- 6. keep their thinking relevant to the main point;*
- 7. keep in mind the original or most basic concern;*
- 8. look for alternatives;*
- 9. be open-minded and*
 - a. seriously consider points of view other than their own;*

- b. reason from starting points with which they disagree without letting the disagreement interfere with their reasoning;*
 - c. withhold judgment when the evidence and reasons are insufficient;*
 - 10. take a position and change a position when the evidence and reasons are sufficient to do so;*
 - 11. seek as much precision as the subject permits;*
 - 12. deal in an orderly manner with the parts of a complex whole;*
 - 13. employ their critical thinking abilities;*
 - 14. be sensitive to the feelings, level of knowledge, and degree of sophistication of others*
- (Norris & Ennis, 1989, p. 12).

Among the 14 dispositions, Norris and Ennis thought that open-mindedness was the most important element (1989, p. 11). The relationship between the skills and dispositions of critical thinking was found to be positively correlated, as “having a disposition implies having the associated ability” (Norris, 2003, p. 327).

McPeck (1990)

As mentioned, McPeck argues that critical thinking is a combination of skills and dispositions. In the dispositional dimension, McPeck suggests that critical thinkers should “think for themselves, they do not simply believe everything which they may hear or read” (1990, p. 21). McPeck introduced the term ‘reflective scepticism’, as a prerequisite to making judgment. McPeck disagreed with the idea of the generalisability of critical thinking because students can learn

intelligent thinking if their teachers teach the disciplines properly. In McPeck's opinion, training and drilling in the so-called thinking skills is redundant since disciplinary thinking contains critical thinking and is similar to skills of reasoning (1990, p. 34).

Facione (1990, 2011)

Based on the consensual definition reached in the *Delphi Report*, Facione declared a conceptualisation of critical thinking dispositions in terms of seven traits: being inquisitive, open-minded, systematic, analytical, truth-seeking, confident in reasoning, and judicious (Facione, 2011, p. 30). One cannot claim that they are a critical thinker unless they possess these dispositions, together with skills such as interpretation, analysis, evaluation, inference and explanation. From an aggregated data analysis, Facione and Facione (1997) found that there was a positive relationship in critical thinking between skills and dispositions (p. 81).

Ennis (1996, 1987)

With the introduction of the skill dimension of critical thinking, i.e. FRISCO (focus, reasons, inference, situation, clarity, overview), Ennis (1996) introduced the following three dispositions:

(1) Care about coming up with the best, most unbiased answer:

Before making any judgment, ensure that all the points of views from others are seriously considered without any bias.

(2) Care to be honest and clear about thinking, speech and writing:

Take into account their own position and also those of others.

(3) *Care about the dignity and worth of every person:*

Be humane by listening to the viewpoints, feelings, and about the welfare of others
(Ennis, 1996, p. xviii).

These three points highlight the importance of critical thinking, and that skills alone are not enough, caring about finding an answer without bias, and considering the positions and feelings of others are also necessary in a critical thinker. Ennis (1987) also summarised the important features of critical thinking:

focusing on belief and action,
making statements in terms of things that people actually do or should do,
including criteria to help us evaluate results,
including both dispositions and abilities, and
being organized in such a way that it can form the basis of a
thinking-across-the-curriculum program as well as a separate critical thinking course at
the college level (p. 25).

For Ennis, the conception of critical thinking is ever developing. Like other scholars, he viewed critical thinking in two dimensions, skills and dispositions, and provided clear descriptions of each dimension.

Elder and Paul (2008)

Elder and Paul (2008) emphasised the importance of intellectual standards which include clarity, accuracy, relevance, logicalness, breadth, precision, significance, completeness, fairness and depth. These standards, serving as criteria for evaluating reasoning, must be applied to the eight elements of purposes, questions, points of view, information, inferences, concepts, implications and assumptions. By doing so, people can develop the intellectual traits or virtues: intellectual humility, intellectual autonomy, intellectual integrity, intellectual courage, intellectual perseverance, confidence in reason, intellectual empathy and fair-mindedness. These intellectual traits or virtues are the ultimate goal in developing people as critical thinkers.

Johnson (2009)

Johnson (2009) distinguished the difference between critical thinking and being a critical thinker. The former is an activity that occurs in a specific setting while the latter is the person who regularly carries out such activity (p. 63). A critical thinker is someone who possesses the skills and traits that he called *properties*. He introduced the dialectical properties of a critical thinker as:

- (1) *Someone who overcomes resistance to criticism:*

A critical thinker is not dogmatic, instead they are interested in the criticism of their views.

- (2) *Someone who knows what would count against their position as well as for it:*

Critical thinkers are aware of the weaknesses and strengths in their position, so that they are able to indicate the contrary evidence that will cause them to abandon that position.

- (3) *Someone who changes their mind when it is appropriate to do so:*

Since a critical thinker is not dogmatic, they will change their mind if necessary.

- (4) *Someone is defined by what they do not say or do as by what they do say or do:*

A critical thinker will often not say certain things because they think about their views in relationship to alternatives and are aware of possible objections and limitations (p. 66-67).

To Johnson, critical thinkers are interested in seeking out criticism of their views. If they find contrary evidence then they will abandon their positions since they are aware of the weaknesses and strengths of their positions. They are flexible and willing to change their minds for a better or the right reason. They will not rush to make judgments; rather they will spend time in reflection.

Halpern (2014)

In addition to skills, Halpern (2014) also highlighted the importance of attitude in differentiating between good and poor thinkers. The attitudes that a critical thinker should possess are:

- *willingness to plan;*
- *flexibility;*
- *persistence;*
- *willingness to self-correct, admit errors, and change mind when the evidence changes;*
- *being mindful;*
- *consensus-seeking* (p. 20-25).

A critical thinker, Halpern argued, should possess various skills and positive attitudes that not only aim for personal benefits, but also for the goodness for others in working toward a solution.

Scholars provided many other terms that described the dispositional dimension of critical thinking such as attitude, disposition, property, trait and value. A person cannot be regarded as a critical thinker unless they possess the dispositions. A detailed description will be presented in 2.4.3 Concluding Comments.

2.4.3 Concluding comments

The conceptions of critical thinking held by scholars have been theorised from different dimensions. Table 2.3 presents a summary of the dimensions of critical thinking illustrated by scholars.

Table 2.3 Summary of the dimensions illustrated by scholars

Scholars	Conception 1: Skills dimension	Conception 2: Dispositional dimension
Glaser (1941, 1980)	to equip with skills in applying methods; to have knowledge of logical inquiry and reasoning	to consider in a thoughtful way
Scriven & Paul (1987)	to conceptualise, apply, analyse, synthesise, evaluate	to use clarity, accuracy, precision, consistency, relevance, fairness
Siegel (1988)		to judge and act by values, consistency, fairness, and being impartial
Norris & Ennis (1989)	to analyse arguments; to make and judge observations, deductions, inductions, value judgments; to identify assumptions; to interact with others	to seek a statement; to search for alternatives; to be open-minded; to employ critical thinking abilities; to be sensitive to feelings of others
Facione (1990, 2011)	to interpret, analyse, evaluate, to make inferences and explanation	to be inquisitive, open-minded, systematic, analytical, truth-seeking, confident in reasoning, and judicious
Paul (1993, 2010)	to address problems, identify reasoned conclusions from criteria, assess assumptions with open-mindedness, and communicate the solutions to others	
Ennis (1996)	to equip FRISCO: Focus, Reasons, Inference, Situation, Clarity, Overview	to care about coming up with the best, most unbiased answer; care about the dignity and worth of every person
Fisher & Scriven (1997)	to use skills and activities to interpret and evaluate observations and communications, information and argumentation	
Elder & Paul (2008, 2010)	to reach well-reasoned conclusions; to think open-mindedly; to communicate effectively with others	intellectual humility, autonomy, integrity, courage and perseverance, intellectual empathy and fair-mindedness
Johnson (2009)		to be resistant to criticism; to be aware of weaknesses and strengths in position; to change mind when necessary; to be aware of alternatives
Halpern (2014)	to formulate inferences, to calculate likelihoods, to make decisions; to use skills that are thoughtful and effective for the particular context and type of thinking task	to be willing to plan; to be flexible; to be persistent; to be willing to self-correct; to be mindful; to seek consensus

As noted, there are three categories of conceptions of critical thinking. Critical thinking was regarded as skills (Elder & Paul, 2008; Ennis, 1996; Glaser, 1941; Facione, 1990, 2011; Fisher & Scriven, 1997; Halpern, 2014; McPeck, 1981, 1990; Norris & Ennis, 1989; Paul, 1993, 2010; Scriven & Paul, 1987); and as dispositions (Elder & Paul, 2008; Ennis, 1996; Glaser, 1941; Facione, 1990, 2011; Halpern 2014; Johnson, 2009; McPeck, 1981, 1990; Norris & Ennis, 1989; Scriven & Paul, 1987; Siegel, 1988).

Many scholars, such as Elder and Paul (2008); Ennis (1996); Facione (1990, 2011); Halpern (2014); Norris and Ennis (1989); Scriven and Paul (1987) conceived of critical thinking as being in two dimensions, usually categorised into skills and dispositional dimensions. When considering the skills dimension of the conceptions of critical thinking discussed, the scholars usually used the terms to describe critical thinking skills (as shown in Table 2.4) and; In the dispositional dimension of critical thinking, the terms were used (as shown in Table 2.5).

Table 2.4 Terms in the skills dimension used by scholars

Terms in skills dimension	Scholars
Application	Scriven & Paul (1987)
Analysis	Ennis (1989); Facione (1990); Norris & Ennis (1989); Scriven & Paul (1987)
Assumptions identification	Ennis (1989); Halpern (2014); Norris & Ennis (1989)
Drawing conclusions	Elder & Paul (2008); Halpern (2014)
Evaluation	Facione (1990); Fisher & Scriven (1997); Scriven & Paul (1987)
Clarity	Elder & Paul (2008); Ennis (1996); Norris & Ennis (1989); Scriven & Paul (1987)
Convergent thinking	Halpern (2014)
Conceptualization	Scriven & Paul (1987)
Deductive reasoning	Halpern (2014)
Explanation	Facione (1990); Halpern (2014)
Inference	Elder & Paul (2008); Ennis (1996); Facione (1990); Norris & Ennis (1989)
Interpretation	Elder & Paul (2010); Facione (1990); Fisher & Scriven (1997)
Reflection	Scriven and Paul (1987)
Self-regulation	Facione (1990)
Synthesis	Halpern (2014); Scriven & Paul (1987)

Table 2.5 Terms used in the dispositional dimension by scholars

Terms used in dispositional dimension	Scholars
Accuracy	Elder & Paul (2008); Scriven & Paul (1987)
Confidence in reasoning	Facione (1990)
Consensus-seeking	Halpern (2014)
Consistency	Halpern (2014); Scriven & Paul (1987), Siegel (1988)
Fairness	Elder & Paul (2008); Scriven & Paul (1987); Siegel (1988)
Inquisitiveness	Facione (1990)
Judiciousness	Facione (1990)
Logic	Elder & Paul (2008); Halpern (2014)
Open-minded	Elder & Paul (2010); Facione (1990); Norris & Ennis (1989)
Persistence	Halpern (2014)
Systematicity	Facione (1990)
Self-correction	Halpern (2014); Lipman (2003)
Truth-seeking	Facione (1990)

In their conceptions of critical thinking, the scholars thought that the skills of synthesis (Halpern, 2014; Scriven & Paul, 1987); evaluation (Facione, 1990; Fisher & Scriven, 1997; Scriven & Paul, 1987); interpretation (Elder & Paul, 2010; Facione, 1990; Fisher & Scriven, 1997); analysis (Ennis, 1989; Facione, 1990; Norris & Ennis, 1989; Scriven & Paul, 1987); and inference (Elder & Paul, 2008; Ennis, 1996; Facione, 1990; Norris & Ennis, 1989) were important, as well as the dispositions of accuracy (Elder & Paul, 2008; Scriven & Paul, 1987); fairness (Elder & Paul, 2008; Scriven & Paul, 1987; Siegel, 1988); consistency (Halpern, 2014; Scriven & Paul, 1987; Siegel, 1988); self-correction (Halpern, 2014); and open-mindedness (Elder & Paul, 2010; Facione, 1990; Norris & Ennis, 1989). The conception of critical thinking as two dimensional was introduced by scholars such as Elder and Paul (2008), Ennis (1996), Facione (1990, 2011), Halpern (2014), Norris and Ennis (1989) and Scriven and Paul (1987), and was accepted as the conceptual framework for this study.

Some scholars categorised critical thinking as different dimensions while some scholars provided a definition of critical thinking in a sentence:

1. critical thinking is *a combination of ...a willingness, or disposition, together with the appropriate knowledge and skills, to engage in an activity or problem with reflective skepticism* (McPeck, 1990, p. 42);
2. critical thinking is *the intellectually disciplined process of actively and skillfully*

conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action (Scriven & Paul, 1987);

3. critical thinking is *a reasonable and reflective thinking that is focused upon deciding what to believe or do* (Ennis, 1987, p. 10; Norris & Ennis, 1989, p. 1);
4. critical thinking is *a purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference, as well as the explanation of the evidential, conceptual, methodological, criteriological, or contextual considerations upon which that judgment is based* (Facione, 1990, p.2);
5. critical thinking is *thinking about your thinking while you are thinking in order to make your thinking better* (Paul, 1993, p. 91);
6. critical thinking is *skilled and active interpretation and evaluation of observations and communications, information and argumentation* (Fisher and Scriven, 1997, p. 21);
7. critical thinking is *thinking that facilitates judgment because it relies on criteria, is self-correcting, and is sensitive to context* (Lipman, 2003, p. 212);
8. critical thinking is *the process of analysing and assessing thinking with a view to improving it* (Elder & Paul, 2010, p. 38);
9. critical thinking is *the use of those cognitive skills or strategies that increase the probability of a desirable outcome. It is used to describe thinking that is purposeful, reasoned, and*

goal-directed - the kind of thinking involved in solving problems, formulating inferences, calculating likelihoods, and making decisions, when the thinker is using skills that are thoughtful and effective for the particular context and type of thinking task (Halpern, 2014, p. 8).

The definitions listed above include the purpose of critical thinking as: for reflective skepticism (McPeck, 1990); as a guide to belief and action (Scriven & Paul, 1987); making judgment (Facione, 1990); make thinking better (Paul, 1993); for self-correction (Lipman, 2003) and improvement (Elder & Paul, 2008). The elements of the process of thinking are conceptualising information, applying, analysing, synthesising, and evaluating (Scriven & Paul, 1987); the interpretation and evaluation of observations and communications, information and argumentation (Fisher & Scriven, 1997); solving problems, formulating inferences, calculating likelihoods, and making decisions (Halpern, 2014).

2.5 Conceptions of critical thinking in the Hong Kong education authority

In order to prepare for the foreseeable impact of globalisation, Hong Kong's education authority had, from the 1980s onwards, introduced initiatives in educational reform in which the term "critical thinking" was emphasised. In the *Education Blueprint for the 21st Century: Review of the Academic System: Aims of Education (Consultation Document)*, the Hong Kong Education

Commission declared that one of the aims of school education should be to “nurture in students a spirit of self-motivation and self-learning, and the ability to think and create” (1999, p. 18). The commission stated that one of the objectives of the nine-year period of basic education was “to encourage students to take the initiative to learn, develop the ability to think and create, and cultivate positive attitudes and values” (EC, 2000, p. 6). In *Learning for Life, Learning Through Life: Reform Proposals for the Education System in Hong Kong*, the commission highlighted the importance of critical thinking as one of the aims of education for the 21st century (2000, p.4). The role of critical thinking in Hong Kong education is explicitly stated.

2.5.1 Conceptions of Critical Thinking in AS Liberal Studies

As mentioned, the introduction of Advanced Supplementary Level Liberal Studies in 1992 was intended to “encourage students to visualize the complexity of the issues and to develop their abilities for critical thinking” (CDC, 1996, p. 6). Students are expected to “develop a wide range of skills and techniques concerned with the collection, organization, presentation, interpretation and evaluation of information about the world, so as to promote critical thinking and to make sound judgments” (CDC, 1996, p. 7). It echoed what some scholars argued were the skills of collection, organisation, presentation, interpretation and evaluation, as essential for making sound judgments. There is no doubt that the CDC concerned about the skills dimension of critical thinking in AS Liberal Studies, but neglected the dispositional dimension of critical thinking.

2.5.2 Conceptions of Critical Thinking in NSS Liberal Studies

As noted, NSS Liberal Studies emphasises the role of critical thinking in the curriculum and assessment. In the curriculum, one of the aims of Liberal Studies is “to develop in students a range of skills for life-long learning, including critical thinking skills, creativity, problem-solving skills, communication skills and information technology skills” (CDC & HKEAA, 2007, p. 5).

As shown in Table 1, the words and phrases in the level descriptors for Level 5 (HKEAA, 2014) are closely related to critical thinking. Elements of critical thinking are implicit in the level descriptors in the NSS Liberal Studies (HKEAA, 2014, see Table 1). Nevertheless, in the teacher briefing sessions in 2008, the HKEAA presented the level descriptors in for Level 5 which are categorised into three broad dimensions: multiple perspectives and importance of context, critical thinking, and mastering the enquiry process and reflection (see Table 1). Of the seven level descriptors, four typical levels candidate :

- interpreting and analysing different and complex information from a variety of perspectives;
- evaluating various viewpoints and synthesising own opinions and suggestions with well-supported arguments and sufficient examples;
- communicating ideas in a concise, logical, balanced and systematic way;
- conceptualising evidence, consistently shows respect for evidence, open-minded and tolerant of a wide range of views and values (HKEAA, 2008, p. 22).

As seen in Table 1, the dimension of critical thinking within the level descriptors can be divided

into skills and dispositional dimensions as follows:

1. critical thinking skills: conceptualising evidence; evaluating various viewpoints and synthesizing own opinions and suggestions with well-supported arguments and sufficient examples; interpreting and analysing different and complex information from a variety of perspectives.
2. critical thinking dispositions: consistently shows respect for evidence, open-mindedness and tolerance of a wide range of views and values. (HKEAA, 2008, p. 22).

The terms used by the HKEAA concerning the dimension of critical thinking, in the level descriptors were the same as used by the scholars, as illustrated in Table 2.6.

Table 2.6 The terms used by HKEAA and scholars

NSS Liberal Studies Level Descriptors, HKEAA (2008)	Scholars
Evaluate	Glaser (1941); Facione (1990, 2011); Fisher & Scriven (1997); Scriven & Paul (1987)
Synthesize	Halpern (2014); Scriven & Paul (1987)
Interpret	Elder & Paul (2010); Glaser (1941); Facione (1990, 2011); Fisher & Scriven (1997)
Analyse	Ennis (1989); Facione (1990, 2011); Scriven & Paul (1987); Norris & Ennis (1989)
Open-minded	Elder & Paul (2010); Facione (1990, 2011); Norris & Ennis (1989); Paul (1993)

As illustrated by Table 2.6, it is evident that both HKEAA and scholars shared a similar view. The

scholars conceived critical thinking as consisting skills such as evaluation, synthesis, interpretation, and analysis; as well as dispositions such as open-mindedness. At the same time, the HKEAA also regarded these terms as critical thinking; and therefore put these terms as the Level Descriptors in level 5, the highest level in the assessment rubric of Liberal Studies.

2.5.3 Conceptions of Critical Thinking in Civic Education

Although it is evident that the curriculum aims and assessment of Liberal Studies strongly emphasise critical thinking, the Hong Kong education authorities, including CDC and HKEAA, do not define what critical thinking actually is, but only listed the skills and dispositions that Level 5 candidates should possess. As early as 1996, however, the Working Group on the Review of the Guidelines on Civic Education from the CDC defined critical thinking in the Guidelines on Civic Education in Schools. It defined critical thinking as “a truth-seeking mental exercise that involves careful, precise, persistent and objective analysis of any knowledge claims and belief to judge its validity worth” (Education Department, 1996, p. 76). Critical thinking is a “reflective thinking that is focused on deciding the authenticity, accuracy and worth of information and claims” (p. 76). Critical thinking is useful in dealing with information and claims.

The guidelines further elaborate critical thinking in two dimensions, frame of mind and core skills.

A student’s frame of mind should include:

- *An awareness of the need to evaluate information;*
- *A desire to test opinion;*
- *A willingness to consider all viewpoints* (Education Department, 1996, p. 76).

The term *frame of mind* was used along with the core skills; therefore it was conceived as having similar meaning to the dispositions that many scholars used to describe the attitudes, property, traits, or values discussed before. It is very similar to “disposition” in which the latter is “a temperament, set of attitudes, or personal disposition to prize and to use critical thinking in one’s personal, professional and civic affairs” (Facione & Facione, 1997, p. 1). The guidelines conclude that a critical thinker deals with information, assertions and claims with “healthy skepticism about what is really true or accurate” (Education Department, 1996, p. 76).

The guidelines further identify ten critical thinking core skills that students should possess:

- *Distinguishing between verifiable facts and value claims;*
- *Determining the reliability of a source;*
- *Determining the factual accuracy of a statement;*
- *Distinguishing relevant from irrelevant information, claims or reasons;*
- *Detecting bias;*
- *Identifying unstated assumptions;*
- *Identifying ambiguity of equivocal claims or arguments;*
- *Recognising logical inconsistencies of fallacies in a line of reasoning;*

- *Distinguishing between warranted or unwarranted claims;*
- *Determining the strength of an argument* (Education Department, 1996, p. 76).

Despite the different terms used to describe dispositions, the Hong Kong Education Department conceived critical thinking in the skills and dispositional dimensions as being the same as the conceptions the scholars had discussed previously.

2.5.4 Concluding comments

As a result of the unprecedented challenges brought by globalisation and the fast changing 21st century, Hong Kong has undergone a series of educational reforms. Like their counterparts, the Hong Kong education authorities (EC, CDC, HKEAA, Education Department) emphasised critical thinking as an aim of education. It is expected that students will be equipped critical thinking and thus adaptable to changes. The Working Group on the Review of the Guidelines on Civic Education from the Hong Kong Curriculum Development Council defined critical thinking in the Guidelines on Civic Education in Schools as early as 1996. The group had similar conceptions to the scholars for whom critical thinking is categorised into two dimensions, skills and dispositions, although it used the term *frame of mind* in the guidelines. The role and significance of critical thinking is clear in AS Liberal Studies as an elective subject and the core NSS Liberal Studies; however, CDC and HKEAA did not clearly define what critical thinking is.

2.6 Studies of Teacher Conceptions of Critical Thinking

As discussed, Elder and Paul (2010, p. 38) note that “teaching for critical thinking presupposes a clear conception of critical thinking in the mind of the teacher”. It is, therefore, necessary to investigate teacher conceptions of critical thinking in order to study the effectiveness of instruction. Teachers have problems in articulating a clear conception of critical thinking and demonstrating how they foster it, although they acknowledge that critical thinking is important to their instruction (Baildon & Sim, 2009; Howe, 2000, 2004; Stapleton, 2011; Stedman & Adams, 2012). The following studies are discussed in chronological order.

2.6.1 Howe (2000) [Canada and Japan]

During 1998 to 1999, Howe collected data from 158 Canadian and Japanese secondary school teachers to examine their conceptions of critical thinking by choosing 50 definers of critical thinking. There was a cultural difference in conceptions between the respondents in which Canadian teachers related critical thinking to cognitive domains such as decision making, problem solving, divergent thinking, metacognitive skills, higher order thinking, deductive reasoning, and identifying/removing bias. Japanese teachers tended to favour the affective domain, including fairness, adequacy, objective, consistency, completeness, precision, and specificity (2000, p. 67). Among the fifty definers of critical thinking most frequently selected by Japanese teachers to describe behaviour and morality, for example, independent thinking was ranked number one (2004, p. 517). Those behaviour and morality concepts are emphasised in Japanese schools and society,

but absent in the Canadian curriculum. Although the aforementioned scholars conceive of critical thinking in different ways, the cultural difference between East and West in their conceptions of critical thinking is obvious.

In researcher's opinion, Howe's study was quantitative research so there is no interview. A sample size of 158 was large enough to generalise the cultural difference in secondary school teachers in their conceptions of critical thinking. The instrument is easy to administer because the participants only pick ten out of fifty critical thinking cards, with one critical thinking definer on each card, and then prioritise them. The idea of critical thinking definers was adopted in this study. (It will be described in detail in Section 3.3.1 The Survey)

2.6.2 Gordon (2000) [USA]

In the various branches of health science education, critical thinking is acknowledged as a significant learning outcome. In medical education, students are required to “acquire skills of critical judgment based on evidence and experience” (Liaison Committee on Medical Education, 2013, p. 8). In pharmacy education, teaching and learning methods must foster the “development and maturation of critical thinking and problem-solving skills” (Accreditation Council for Pharmacy Education, 2011, p. 19). In dental education, critical thinking is regarded as a competency for the new general dentist (American Dental Education Association, 2011, p. 933). In

nursing education, the American Association of the College of Nursing (2008) define critical thinking as “all or part of the process of questioning, analysis, synthesis, interpretation, inference, inductive and deductive reasoning, intuition, application, and creativity” (p. 37). Critical thinking is required in the ever-changing and complex healthcare environment and, therefore it is one of the essential outcomes of baccalaureate education for nursing (p. 11), through which it can “prepare baccalaureate graduates to involve others in the common good through use of information technologies, team work, and inter-professional problem solving”. Due to its significance in nursing education, critical thinking is set as one of the American Nursing Association Standards in the application of the “nursing process” and it is believed that skilled nursing depends upon a well-reasoned philosophy of nursing rooted in a deep and rich conception of critical thinking (The Critical Thinking Community, 2013). It is evident that critical thinking is recognised as an essential skill in health sciences programmes.

Gordon (2000) investigated 201 baccalaureate nurse educators about their conceptions of critical thinking. The findings suggested that there is a disparity in the conceptions of critical thinking between the nurse educators and scholars such as Facione (1990, 2011). On one hand, the nurse educators shared the same views as the scholars in regarding analysis, explanation, evaluation, inference, and self-regulation as critical thinking skills (p. 346) while leadership, trustworthy, and being sensitive to others were critical thinking dispositions (p. 347). On the other hand, the nurse

educators conceived (1) researching, empathising, and sensing as critical thinking skills; and (2) interpretation was not seen as a critical thinking skill, as different from the conceptions of the scholars.

As noted, critical thinking is an important element in nursing education (The American Association of College of Nursing, 2008; The Critical Thinking Community, 2013). It is, therefore, necessary to investigate the conceptions of critical thinking by nursing educators with the authority and obligation to implement critical thinking in their curriculum and assessment of the discipline, and also the daily practice of critical thinking in lessons. In researcher's opinion, this quantitative research with a sample 201 covered a large proportion of nursing educators in the region. Although it is not the focus of this study, it may be worth examining why there is a difference in the conceptions of critical thinking between nursing educators and teachers from other disciplines.

2.6.3 Walthew (2004) [New Zealand]

Walthew (2004) also investigated the conceptions of critical thinking by nurse educators, and interviewed twelve senior nurse educators from New Zealand. Walthew concluded that the participants held a traditional view of critical thinking, that rational and logical thinking is the central feature of critical thinking. They suggested that logical thinking includes information

gathering, recognising patterns, linking theory to practice, analysing the situation, presenting arguments, and problem solving (p. 409). In addition to critical thinking skills and knowledge, the participants also regarded attitudes and dispositions, such as curiosity, as essential in critical thinking.

In researcher's opinion, Walthew's study was qualitative research in which semi-structured interviews were conducted individually. The sample size of 12 was appropriate since the participants were senior in nursing education with over 10 years of experience.

2.6.4 Twibell, Ryan and Hermiz (2005) [USA]

Twibell, Ryan and Hermiz (2005) also conducted a study into conceptions of critical thinking with six clinical faculty members. Being interviewed three times in a semester, the six participants described critical thinking as *putting it all together*, which means “synthesizing various elements into an integrated whole” (p. 74). The following terms were included in *putting it all together*: information seeking, reflecting, assigning meaning, problem solving, predicting, planning, and applying to novel context. All these terms relate to the skills dimension as described by some scholars, for example information seeking (Elder & Paul, 2010; Glaser, 1941); assigning meaning (Ennis, 1996); applying to novel contexts (Lipman, 2003). The study showed that the clinical faculty shared similar views with the scholars in conceiving of critical thinking as involving skills.

Nurse educators had similar conceptions of critical thinking in that they emphasise the skills of analysis, problem solving, and information seeking or gathering. These are coincident with the wordings used by scholars such as Scriven and Paul (1987), and Facione (1990, 2011).

This was a longitudinal study that investigated the changes in conceptions of critical thinking from faculty members over a certain period of time. In researcher's opinion, along with the progression of the lessons in which students may grow in their critical thinking performance, the six participants were interviewed three times in a semester. Although the sample was only six, there were 18 total interviews conducted, which is appropriate for a qualitative study.

2.6.5 Innabi and Sheikh (2006) [Jordan]

As discussed, Jordan began a significant educational reform in which “curricula should be built in order to enhance student critical thinking” (MOE, 1987, p. 10). Having undergone fifteen years of education reform, however, teacher conceptions of critical thinking had not resulted in any significant change. Innabi and Sheikh (2006) collected data from twelve schools in 1988 and 2004 by interviewing 47 Mathematics teachers in order to determine whether there was any change in their conceptions of critical thinking after 15 years of educational reform. Innabi and Sheikh found that the Jordanian secondary school Mathematics teachers were “narrow in scope, fragmented in structure and lacking clarity and consistency” (p. 65). When answering *what does critical thinking*

mean to you and *which of the following situations best represents critical thinking*, the participants tended to emphasise different aspects of critical thinking, most commonly purpose, conditions and the requirements of critical thinking (p. 64). It is evident that the teachers lacked a comprehensive understanding of critical thinking, including (1) that critical thinking is needed when they face a dilemma or a very difficult situation (p. 64); (2) they could not identify critical thinking situations from others that require algorithmic or associational thinking (p. 65); and (3) they could not demonstrate how critical thinking is related to the learning of Mathematics (p. 65). Despite 15 years of educational reform, no improvement was found in conceptions of critical thinking among secondary mathematics teachers.

This was a longitudinal study conducted in 1988 and 2004. It adopted a qualitative approach in which semi-structured interviews were conducted in the same respondent schools. In researcher's opinion, the sample size was appropriate for a longitudinal study, with 24 teacher respondents in 1988 and 23 in 2004.

2.6.6 Jones (2007) [Australia]

In the study by Jones (2007), teacher conceptions of critical thinking were found to be influenced by the disciplinary culture and its underpinning epistemology. Six history teachers and six economics teachers at two different institutions were interviewed. The history teachers conceived

critical thinking from a range of perspectives:

- (1) an ability to examine the logic of an argument that involved the ability to examine the evidence, and the biases of the text in question (p. 91);
- (2) an element of otherness included seeking other evidence, voices and perspectives (p. 91);
- (3) involved exploring contradiction, ambiguities and ambivalence (p. 92);
- (4) concerned with political dimension such as power relationship (p. 92);
- (5) self conscious about their craft in that there are limits in a historian's own theorising (p. 92).

The economics teachers conceived critical thinking as:

- (1) the application of logic that involved an examination of understanding, the use and application of the theories or models (p. 96);
- (2) encompassed notions of scepticism, and that people should be able to take a contrary or sceptical view of what is being expressed (p. 97).

This study concluded that the epistemic culture of the disciplines influenced the way critical thinking is conceived.

This was a qualitative study where semi-structured interviews were adopted appropriately, since the aim of study was to investigate how critical thinking was understood by teachers in two different disciplines. In researcher's opinion, the findings were contradictory, where Lederman (1992) concluded that "academic background variables are not significantly related to teachers' conceptions" (p. 345). There is an assumption that there are numerous factors leading to the formation of teacher conceptions and disciplinary culture is only one of them. Further study should be conducted in order to investigate what constitutes teacher conceptions.

2.6.7 Lee (2007) [Hong Kong]

Lee (2007) interviewed eight ASL Liberal Studies teachers in order to investigate their conceptions of critical thinking. Five themes of conceptions were found:

- A. *critical thinking as a set of skills*: critical thinking included a set of skills that are teachable. It includes (1) logical thinking skills such as detecting logical fallacies; (2) thinking skills such as categorisation (p. 59).
- B. *critical thinking as dispositions of being critical*: critical thinking consists of a positive attitude and persistent motivation for critical thinking (p. 65).
- C. *critical thinking as skills together with relevant content knowledge*: critical thinking was seen as thinking skills together with relevant content knowledge (p. 61).
- D. *critical thinking as skills together with dispositions of being critical*: critical thinking includes

not only a set of thinking skills but also appropriate dispositions (p. 67).

E. *critical thinking as skills, relevant knowledge together with dispositions of being critical*: a complex series of conceptions of critical thinking, seen as consisting of three components: thinking skills, relevant content knowledge, and appropriate dispositions.

Lee categorised the above five themes into three hierarchical levels:

1. Level 1: a bottom level with the least complexity of conceptions, it includes conceptions A and B since they considered only one dimension of critical thinking.
2. Level 2: a middle level which includes conceptions C and D because they considered rather complex conception from two dimensions of critical thinking.
3. Level 3: conception E lay in this very complex level which considered critical thinking as a tri-dimensional conception.

Lee's study focused on investigating teacher conceptions of critical thinking in Liberal Studies, which is one of the areas of interest of this study, however, in researcher's opinion, there are two main limitations to her study. First, the qualitative research methodology consisted of only eight teachers. Therefore quantitative approach is recommended in order to provide a more comprehensive picture of the topic. Second, the study investigated AS Liberal Studies, not the NSS LS curriculum that commenced in 2009. An updated study would be ideal to provide more

insight into the current situation. Despite the limitations listed, Lee's study provides much information for this study because it investigated the conceptions of critical thinking of Hong Kong Liberal Studies teachers.

2.6.8 Alazzi and Khawaldeh (2008) [Jordan]

Like Innabi and Sheikh (2006), Alazzi and Khawaldeh (2008) noted similar findings in their study in Jordan. Twelve Social Studies secondary schools were interviewed and their lessons were observed in order to investigate their conceptions of and methods for enhancing critical thinking.

It was found that the teachers were not familiar with the definition and teaching strategies of critical thinking, although most claimed to be teaching critical thinking in their lessons (p. 97).

There was a disparity between teacher intentions and learning outcomes, in that the teachers had the intention of teaching critical thinking, but their students indicated that they were not taught critical thinking (p. 98). This was, in the eyes of teachers, due to the negative attitudes of students towards learning critical thinking, since it is not tested in the Jordanian school curriculum. It is clear that the Jordanian educational reform, even though it was introduced fifteen years ago, did not provide a clear and common picture for teachers when teaching critical thinking.

Interviews and lesson observations are common research methods in qualitative study. In researcher's opinion, using both methods in a single study can increase the reliability of the data.

In this study, the teachers were interviewed and claimed that they taught critical thinking in their lessons. It was, however, found that they were not familiar with the teaching strategies of critical thinking. The discrepancy demonstrated that data from interviews is not reliable. Only this kind of triangulation can improve the reliability of such data.

2.6.9 Lawrence, Serdikoff, Zinn and Baker (2008) [USA]

Critical thinking has a long history in psychology (Halpern, 1996, p. 6), however, there are various definitions of critical thinking in psychology texts and supplements (Griggs, Jackson & Christopher, 1998). Psychology teachers also conceived of critical thinking in different ways. Lawrence, Serdikoff, Zinn and Baker (2008) investigated conceptions of critical thinking in 20 psychology faculties, and how it is addressed in classrooms. The clinical psychologists conformed to Halonen's definition, that critical thinking is "the propensity and skills to engage in activity with reflective skepticism focused on deciding what to believe or do" (1995, p. 76). Halonen combined the definitions of McPeck, "a propensity and skill to engage in an activity with reflective skepticism" (1990, p. 42), and Ennis, "reasonable reflective thinking focused on deciding what to believe or do" (1987, p. 10). The psychology faculties agreed with Halonen's conceptions that critical thinking lies in skills and dispositional dimensions; that it is a process of reflective scepticism; and that the purpose of this process is to make a decision about a belief or action.

In researcher's opinion, the research method was not clearly explained. First, the procedure of data collection was not clearly described. Second, apart from Halonen's definition of critical thinking, how many definitions did the respondents have to choose from was also not mentioned. Third, whether the respondents need to explain the reason for their choice was not reported. These questions undermined the reliability of this study.

2.6.10 Baidon and Sim (2009) [Singapore]

Similar to Alazzi and Khawaldeh (2008), Baidon and Sim (2009) also investigated teacher conceptions of critical thinking in Social Studies. As discussed, Singapore began educational reform with the launch of *Thinking Schools, Learning Nation* in 1997. Social Studies is a compulsory and examinable subject at upper secondary level, as from 2001. It is “an integrated subject that includes elements of history, economics, political science and human geography and focuses on national, regional and international issues central to the development of Singapore as a nation, it was designed primarily as a vehicle for National Education and to prepare students to live in a global society” (Baidon & Sim, 2009, p. 409). Baidon and Sim (2009) collected qualitative data from 24 social studies teachers who were studying for a Master of Arts in the Social Studies program. Three tensions were identified: (1) actual classroom practice is constrained by a high stakes examination culture; (2) the contradictory nature of the educational reform, political context and “out of bound markers” that set limits on critical thinking; and (3) the

conflicting idea of the role of teachers as civil servants which hinders teacher autonomy in teaching critical thinking (p. 413). The Singaporean teachers revealed that they were constrained in teaching critical thinking in their classrooms due to cultural and bureaucratic contexts.

The data was collected using a comparative method that included teacher discussion board entries, observation notes and lessons artefacts. In researcher's opinion, such comprehensive data can improve the reliability of the data in which triangulation is achieved. The respondent teachers addressed the tensions in teaching critical thinking in Singapore, rather than investigating teacher conceptions of critical thinking.

2.6.11 Choy and Cheah (2009) [Malaysia]

Thirty teachers in institutions of higher learning in Malaysia were interviewed to investigate their conceptions of critical thinking (Choy & Cheah, 2009). Twenty-five teachers defined critical thinking as intellectual stimuli, a process of analysing information, while another five teachers reported that critical thinking involves logical reasoning (p. 200). Teacher conceptions of critical thinking were similar to the scholars' definitions of critical thinking. For example, Scriven and Paul (1987) thought that critical thinking skills involve conceptualisation, application, analysis, synthesis, and evaluation. McPeck (1981, 1990) argued that critical thinking is about equipping people with reasoning ability, and Siegel (1988) concluded that critical thinking was about making

judgment with reasons.

In researcher's opinion, interviewing is an appropriate research method to explore in-depth understanding of teacher conceptions of critical thinking. The sample size of thirty was large enough for interviews. A list of eight interview questions was found easy to handle, and therefore has been adapted in the current study. (This will be described in detail in Section 3.3.2 Semi-structured Interviews)

2.6.12 Jenkins (2011) [USA and Thailand]

As critical thinking is receiving much attention in the fields of nursing and healthcare, studies were conducted in order to investigate the conceptions of critical thinking among nurse educators (Gordon, 2000; Walthew, 2004). Jenkins (2011) interviewed five nurse educators from the United States and another five from Thailand. The ten participants were in senior positions in nurse education, as well as experts in critical thinking in nurse education. The findings showed that the nurse educators in the US and Thailand shared many common essential components of critical thinking, seeing it as:

nursing knowledge, synthesizing, considering big picture, evaluating, problem solving, analyzing, questioning, investigating, linking theory to practice, flexibility, creativity, individualized planning, reflecting, staying calm, knowing what you don't know (p. 271).

Comparing these components of critical thinking to the definitions from Facione (1990, 2011), McPeck (1981, 1990), Scriven and Paul (1987), Siegel (1988), there are also common words such as synthesising, evaluating, problem solving, analysing, questioning, investigating, flexibility, planning, and reflecting. It is clear, from this cross-cultural study, that the American and Thai nurse educators conceived of critical thinking similarly, as well as similarly to the conceptions of the scholars.

In this study, there was no cultural discrepancy was found between the American and Thai nurse educators. However, there was a cultural discrepancy between the conceptions of critical thinking of Canadians and Japanese in Howe's study (2000). In researcher's opinion, the reason of the difference between two studies may due to: (1) differences in research method. Quantitative and qualitative research methods gained different data; (2) differences in time. Howe conducted his study in 2000 but Jenkins' study was in 2011. Maybe the discrepancy between conceptions of critical thinking in the West and East is becoming smaller.

2.6.13 Stapleton (2011) [Hong Kong]

As discussed, Stapleton (2011) conducted a survey that interviewed 72 Hong Kong high school teachers, who taught a variety of subjects, about their attitudes toward critical thinking. He found that the teacher conceptions of critical thinking were “incomplete and in many cases disturbingly

narrow” (p. 21). Similar to scholars’ conceptions of critical thinking, the respondents viewed critical thinking in two dimensions. A quarter of the teachers defined critical thinking as comprising cognitive skills only; 34% defined it as disposition only; and 41% conceived of critical thinking in both skills and dispositional dimensions (p. 19). This finding revealed that different teachers who teach different subjects had a confused understanding of critical thinking.

The study by Stapleton had an adequate sample size of 72 interviews. The teachers who taught different subjects were found to have different conceptions of critical thinking. In researcher’s opinion, it is assumed that teachers teaching the same subject share a similar conception of critical thinking. The assumption of the current study is that teachers of a common subject, Liberal Studies, share similar conceptions regarding critical thinking.

2.6.14 Krupat, Sprague, Wolpaw, Haider, Hatem, and O’Brien (2011)[USA]

Like Gordon (2000), Walthew (2004), Twibell et al. (2005), and Jenkins (2011), Krupat Sprague, Wolpaw, Haider, Hatem, and O’Brien (2011) were also interested in investigating the conceptions of critical thinking of medical educators. Ninety-seven medical educators at five medical schools were surveyed with an open-ended question *I would define critical thinking as...* There were three categories of results regarding the definitions of critical thinking: (1) as a process (p. 628); (2) as a skill or ability (p. 628); (3) through a dispositional definition: characteristics of the individual,

personality traits of habits of mind (p. 629). This showed that there were many differing conceptions of critical thinking and that the lack of consensus constitutes a major obstacle to enhancing critical thinking. The findings from this study coincided with those of scholars who conceived of critical thinking as a process (Elder & Paul, 2008; Scriven & Paul, 1987). Although recognition of the dispositional dimension was least common in the results of this study, critical thinking was regarded as two-dimensional, as per the scholars (Scriven & Paul, 1987; Norris & Ennis, 1989; Facione, 1990, 2011; Ennis, 1996; Elder and Paul, 2010; and Halpern, 2014).

In this study, the second data collection method was a scenario description with the question *describe a challenging clinical scenario, real or imagined, in which critical thinking would make a crucial difference to the way the situation is handled*. In researcher's opinion, this scenario description was based on self-reported examples rather than direct observation and thus might be found insufficient in capturing the full complexity of many clinical situations. In addition to direct observation, interviews can also be used as a tool of triangulation. The sample size of the medical educators and the sample schools was not large enough to generalise to other populations.

2.6.15 Steffen (2011) [USA]

Steffen (2011) conducted a questionnaire to investigate teacher conceptions of critical thinking.

This study was conducted in a high school with a rich history of intentionally teaching critical

thinking skills within the context of content area classes. Thirty-two high school teachers were asked about their conceptions of critical thinking. In answering the open-ended question *to me critical thinking is...*, some responded that critical thinking involved multiple perspectives. Critical thinking is “the ability to look at an issue from many sides in order to make a decision about it”, it looks at a subject “from multiple perspectives, evaluating the information, and then deciding what is fact/fiction, biased/unbiased or significant”, it looks at a problem “from multiple perspectives in order to analyze the situation” (Steffen, 2011, p. 107). Other teachers reported “using specific strategies to make quality decisions and solve problems,” “stretching and applying content,” “remain open minded” (p. 107). In describing critical thinking, the term analyse was used: to “look at a problem from multiple perspectives in order to analyze the situation”; “the ability to understand and analyze materials on a higher level” (p. 106). These statements made by teachers were in agreement with ideas advocated by scholars: that critical thinking involves two dimensions. In the skills dimension, critical thinking includes skills such as decision making, evaluating, analysing, and problem solving. In the dispositional dimension, critical thinking contains traits such as multiple perspectives, being without bias, and open-mindedness.

This was an ethnographic study which aimed to investigate teacher conceptions of critical thinking in a school. In researcher’s opinion, the research method was appropriate since it may not easy to find a suitable sample school with a rich history of intentionally teaching critical thinking skills

within the context of content area classes. Although only 32 teachers completed the questionnaire and this sample size was too small for a quantitative study, it was reasonable since it was a small school with 333 students.

2.6.16 Stedman and Adams (2012) [USA]

Teachers at university are also not clear about the definition and practice of critical thinking. The understanding of basic critical thinking concepts and personal perceptions of critical thinking from 61 teachers in a college of agriculture and life sciences, were examined, and the findings showed that they lacked knowledge of critical thinking (Stedman & Adams, 2012, p. 13). When answering the ten true/false questions regarding “the nature of critical thinking”, there was no single question that all respondents answered correctly (p. 11). It was found that they were not familiar with critical thinking concepts (p. 11). Despite their poor understanding of the concepts of critical thinking, all the higher education teachers confirmed the significance of critical thinking in engaging higher order thinking in students, such as analysis, synthesis, and evaluation; and in encouraging students to become active learners (p. 12).

In this quantitative study, three instruments were used to investigate respondent conceptions of critical thinking. In researcher’s opinion, the respondent teachers might have found it time-consuming, and the authors concluded that the study was not taken completely seriously.

Shortening a study can help to guarantee the interest and motivation of respondents completing questionnaires.

2.6.17 Moore (2013) [Australia]

Similarly to Jones (2007) and Stapleton (2011), Moore (2013) conducted a study exploring teacher conceptions of critical thinking from different disciplines. Seventeen academics working in three disciplines in a university: history, philosophy and cultural studies, were interviewed.

Seven definitions were found:

- (1) critical thinking as a judgment (p. 510);*
- (2) critical thinking as a sceptical and provisional view of knowledge (p. 512);*
- (3) critical thinking as a simple originality (p. 513);*
- (4) critical thinking as a careful and sensitive reading of text (p. 514);*
- (5) critical thinking as rationality (p. 516);*
- (6) critical thinking as the adopting of an ethical and activist stance (p. 516);*
- (7) critical thinking as self-reflexivity (p. 518).*

In researcher's opinion, it is evident that the respondent academics from different disciplinary backgrounds clearly understood the notion of critical thinking, although they had variety of opinions about what critical thinking is. Moore concluded that instead of establishing the meaning

of critical thinking from the huge literature, it is meaningful to explore the actual conceptions of critical thinking as held by practicing academics, and to determine how these conceptions were practiced in their classrooms (p. 508). It is, therefore, the objective of the current study to investigate teacher conceptions of critical thinking and the classroom practice that may influence student conceptions.

2.6.18 Rowles, Morgan, Burns, and Merchant (2013) [USA]

Health sciences education emphasises critical thinking (Accreditation Council for Pharmacy Education, 2011; American Association of Colleges of Nursing, 2008; American Dental Education Association, 2011; Liaison Committee on Medical Education, 2013). To understand the conceptions of critical thinking held by health care professionals, Rowles, Morgan, Burns, and Merchant (2013) conducted an online survey with 133 faculty members. In answering the survey item: “I would define critical thinking as....”, five themes of responses were obtained. They were: (1) ability that included process, skill set and action (p. 25); (2) cognitive processing of information or evidence included analysis and evaluation (p. 25); (3) decision making or problem solving. Approximately 75% of the responses were of these three types (p. 25); (4) affective dispositions included having awareness of multiple contexts or perspectives, diverse or different points of view, personal bias, ethics, open-mindedness, and attitudes (p. 26); (5) broad and all-encompassing way that combine some elements of critical thinking in a single response, such

as “thinking that assesses itself to improve quality and fairness” (p. 26). The majority of the faculty surveyed saw critical thinking as an ability or skill to make reasoned judgment or solve problems. The respondents described critical thinking as encompassing cognitive as well as affective dispositions as per scholars such as Elder and Paul (2008); Ennis (1996); Facione (1990, 2011); Halpern (2014); Norris and Ennis (1989); Scriven and Paul (1987).

The results of this study were coincident with the conceptions of the scholars who regarded critical thinking as two dimensions, i.e. skills and dispositions. In researcher’s opinion, however, there were approximately three quarters of the response were about the skills dimension. The biggest limitation of this study was it was a convenience sample of health sciences faculty within a single institution, so that the results may not generalise to other populations.

2.6.19 Beistle and Palmer (2014) [USA]

Critical thinking is emphasised in 21st century health care, including dental hygiene education. A qualitative study was conducted by Beistle and Palmer (2014) in which the conceptions of critical thinking of dental hygiene faculty were examined. Among the 20 respondent faculty members, most of the responses consisted of fundamental elements of critical thinking, including clearly formulating important questions and problems; assessing related information; reaching reasoned conclusions and solutions; thinking open-mindedly with alternative thoughts, and communicating

with others effectively (p. 397). Although they tried to provide these elements of critical thinking, over 75% of faculty only offered a partial or segmented definition of the concepts of critical thinking (p. 397).

In researcher's opinion, conceptions of critical thinking among the dental faculty members was only one line of research, and it was, therefore, not deep enough to explore findings such as the categorisation of the elements of their conceptions of critical thinking in depth. Twenty was a large enough sample size for a qualitative study. One of the interesting findings of this study was the discrepancy between the segmented conceptions of critical thinking of the faculty members and their jobs in their faculty. The respondents were chosen because they were teaching clinical theory courses within the 11 accredited associate degree dental hygiene programmes, and the focus of the courses was helping students to learn to think critically. The reasons for this discrepancy are worth further study.

2.6.20 Bosco and Gross (2015) [Ghana]

Bosco and Gross conducted a study to investigate the conceptions of critical thinking in nursing education. Of the 118 responses from 106 nurse educators in Ghana, the cognitive domain was most frequently referred to (82 occurrences, 69%) compared to 19 occurrences (16%) of the dispositional domain (p. 557). In the cognitive domain, analysis (31 occurrences) was the most

frequently cited, and reflection (6 occurrences) was referred to most often in the dispositional domain (p. 557). Only 4.7% of respondents conceived a two dimensional nature of critical thinking, that critical thinking consisted of skills and dispositional dimensions (p. 559).

In researcher's opinion, the main limitation of this study was the lack of qualification of the respondents. As 90.6% of the respondents were underqualified teachers from nurses training colleges, they might not have had proper training to be nurse educators. This might affect the validity and reliability of the results of the study.

2.6.21 Concluding comments

Table 2.7 illustrates teacher conceptions regarding critical thinking in the above studies. From Table 2.7, teachers conceived critical thinking in rather different ways, regardless of their cultural backgrounds or the subjects they teach.

Table 2.7 Summary of teacher conceptions of critical thinking from studies

Writer(s)	Region	Participants	Teacher conceptions of critical thinking
Howe (2000)	Canada & Japan	secondary school teachers	Japanese: dispositional Canadian: skills
Gordon (2000)	USA	nurse educators	skills: analysis, explanation, evaluation, inference, self-regulation dispositions: leadership, trustworthy, being sensitive to others
Walthew (2004)	New Zealand	nurse educators	skills: information gathering, recognising patterns, linking theory to practice, analysing the situation, presenting arguments, problem solving dispositions: curiosity
Twibell et al. (2005)	USA	nurse educators	skills: information seeking, reflecting, assigning meaning, problem solving, predicting, planning, applying to novel context
Innabi & Sheikh (2006)	Jordan	secondary school mathematics teachers	teachers emphasised the aspects of purpose, conditions and requirements of critical thinking
Jones (2007)	Australia	History and Economics academics	history: examine the logic of an argument; concern for others; to explore contradiction, ambiguities and ambivalence; concerned with political dimension; self-conscious economic: application of logic; sceptical
Alazzi & Khawaldeh (2008)	Jordan	secondary school social studies teachers	teachers cannot give a clear definition of critical thinking
Lawrence et al. (2008)	USA	psychology faculties	critical thinking is a process of reflective scepticism involves skills and propensity
Baildon & Sim (2009)	Singapore	secondary school social studies teachers	teachers are constrained to teach critical thinking in their classrooms
Choy & Cheah (2009)	Malaysia	higher education teachers	critical thinking is a process of analysing information and logical reasoning

Table 2.7 Summary of teacher conceptions of critical thinking from studies (cont'd)

Writer(s)	Region	Participants	Teacher conceptions of critical thinking
Jenkins (2011)	USA & Thailand	nurse educators	synthesising, evaluating, problem solving, analysing, questioning, investigating, flexibility, planning, reflecting
Stapleton (2011)	Hong Kong	high school teachers	25%: skills dimension 34%: dispositional dimension 41%: skills and dispositional dimensions
Krupat et al. (2011)	USA	medical educators	(1) as a process (2) skill or ability (3) dispositional
Steffen (2011)	USA	high school teachers	skills: decision making, evaluating, analysing, problem solving dispositions: multiple perspectives, no bias, open-mindedness
Stedman & Adams (2012)	USA	teachers in Agriculture and Life Sciences	lack of knowledge about critical thinking
Moore (2013)	Australia	History, Philosophy and Cultural Studies academics	critical thinking as judgment; scepticism; a simple originality; as sensitive reading; rationality; activist engagement with knowledge; self-reflexivity
Rowles et al. (2013)	USA	Health Science educators	About 75% skill: ability; cognitive processing of information or evidence; decision making or problem solving About 25%: affective disposition; broad
Beistle & Palmer (2014)	USA	dental hygiene faculty members	Above 75% provided segmented definitions
Bosco & Gross (2015)	Ghana	nurse educators	69%: cognitive domain 16%: dispositional domain

Critical thinking is emphasised in many subjects in secondary schools, such as Social Studies; and in higher education subjects such as psychology and nurse education. There are, however, various conceptions of critical thinking from the teachers in those subjects. It is argued that “critical thinking can only be taught by teachers who have in-depth knowledge of critical thinking skills

and understanding of how to incorporate this into their lessons so that it is easier for students to adapt to this type of thinking” (Choy & Cheah, 2009, p. 205).

In secondary schools, Jordanian social studies and mathematics teachers were found to have no clear definition or teaching strategies of critical thinking, although Jordan had undergone an education reform that emphasised critical thinking since 1987 (Alazzi & Khawaldeh, 2008, p. 97; Innabi & Sheikh, 2006, p. 65). Singaporean secondary school social studies teachers claimed that they were constrained in teaching critical thinking in their classrooms due to cultural and bureaucratic contexts (Baildon & Sim, 2009, p. 413). In Hong Kong and the United States, the majority of the responding secondary schools teachers in various subjects conceived of critical thinking as two dimensional, i.e. critical thinking comprises of skills and dispositions (Stapleton, 2011, p. 19; Steffen, 2011, p. 107).

In higher education, there is an increasing focus on investigating the conceptions of critical thinking from the faculties in colleges and universities. The psychology faculties conceived of critical thinking as a process of reflective scepticism involving skills and propensity, very close to Halonen’s conceptions of critical thinking (Lawrence et al., 2008, p. 23). Malaysian higher learning teachers shared a similar view, that critical thinking is a process of analysing information and logical reasoning (Choy & Cheah, 2009, p. 200). Teachers in a college of agriculture and life

sciences were found to lack knowledge about critical thinking (Stedman & Adams, 2012, p. 13). Disciplinary cultures were found to have significant influence on teacher conceptions of critical thinking (Jones, 2007). A multiplicity of conceptions of critical thinking was found by Moore (2013). As Barnett (1997) concluded, higher education conceived critical thinking as systemic knowledge that consists of synthesis, analysis and logical argument (p. 68). This conception of critical thinking as synthesis and analysis coincides with Facione (1990, 2011) and Scriven and Paul (1987).

In the field of health science education, critical thinking is strongly emphasised (Accreditation Council for Pharmacy Education, 2011; American Association of College of Nursing, 2008; American Dental Education Association, 2011; Liaison Committee on Medical Education, 2013). In the study by Rowles et al. (2013), health science faculty members conceived of critical thinking as two dimensional, i.e. combining skills and dispositions, with a large proportion of skills. In Western countries such as the United States and New Zealand, nurse educators held similar conceptions of critical thinking, in that they conceived of critical thinking in the skills and dispositional dimensions. Skills involve analysis, explanation, evaluation, inference, self-regulation, information seeking/gathering, reflecting, assigning meaning, problem solving; and the dispositional dimension of critical thinking includes leadership, trustworthy, curiosity, and being sensitive to others (Gordon, 2000; Twibell et al., 2005; Walthew, 2004). The two

dimensional nature of critical thinking was also found in the studies by Krupat et al. (2011) and Rowles et al. (2013), where medical and health science educators conceived of critical thinking as skills- and dispositional-based with a large proportion of the response in the skills dimension. A cross-cultural study, however, revealed that nurse educators from Thailand and the United States conceived of critical thinking in the skills dimension, in which it involves synthesising, evaluating, problem solving, analysing, questioning, investigating, flexibility, planning, and reflecting (Jenkins, 2011, p. 271). A dominance of critical thinking in the skills dimension was also found in the study by Bosco and Gross (2015) in which 69% of the respondents recognised critical thinking as more cognitive than dispositional. In contrast to their counterparts in health science, the dental hygiene faculty members in the study of Beistle and Palmer (2014) provided only segmented definitions of critical thinking (p.397).

With the introduction of the global educational reforms that have emphasised the importance of critical thinking in education (Canada Ministry of Education, 2014; United Kingdom Department for Education and Employment & Qualifications and Curriculum Authority, 1999; Australia Department of Education, Training and Youth Affairs, 2001; Hong Kong Education Commission, 1999; Japan Ministry of Education, Culture, Sports, Science and Technology, 2008; Singapore Ministry of Education, 1997; The National Education Goals Panel, 1991; Taiwan Ministry of Education, 2012), teacher conceptions of critical thinking have aroused interest in different

countries from the last two decades onwards.

Despite the importance of critical thinking in education, studies revealed that teachers lacked a clear understanding of critical thinking (Alazzi & Khawaldeh, 2008; Innabi & Sheikh, 2006; Stedman & Adams, 2012; Beistle & Palmer, 2014) and were constrained in teaching critical thinking in their classrooms (Baildon & Sim, 2009). In order to teach critical thinking to students, there is a presupposition that teachers have a clear conception of critical thinking in their mind (Elder & Paul, 2010, p. 38). Unless an understanding of critical thinking is reached, teachers cannot fully capture the essence of teaching critical thinking in their classrooms (Stapleton, 2011, p. 21). When teachers have in-depth knowledge of critical thinking skills and an understanding of how to incorporate this into their lessons, it is easier for students to adapt to critical thinking (Choy & Cheah, 2009, p. 205).

It is clear, from the studies discussed above, some teachers are not familiar with, or possess a vague or segmented conception of what critical thinking is (Alazzi & Khawaldeh, 2008; Innabi & Sheikh, 2006; Stedman & Adams, 2012; Beistle & Palmer, 2014). At the same time, those teachers who hold quite clear conceptions of critical thinking shared similar conceptions with the scholars who conceived critical thinking in the skill and dispositional dimensions (Choy & Cheah, 2009; Gordon, 2000; Howe, 2000, 2004; Jenkins, 2011; Lawrence et al., 2008; Stapleton, 2011; Steffen, 2011; Twibell et al., 2005; Walthew, 2004; Rowles et al., 2013).

As revealed by the abovementioned studies (Gordon, 2000; Howe, 2000; Jenkins, 2011; Lawrence et al., 2008; Rowles et al., 2013; Stapleton, 2011; Steffen, 2011; Walthew, 2004;), teachers conceptions of critical thinking are clearly categorised into skills and dispositional dimensions (see Table 2.8). From these studies, teachers used some common terms to describe the skills dimension of critical thinking such as analysis (Gordon, 2000; Jenkins, 2011; Rowles et al., 2013; Steffen, 2011); evaluation (Gordon, 2000; Jenkins, 2011; Rowles et al., 2013; Steffen, 2011); inference (Gordon, 2000; Rowles et al., 2013). In the dispositional dimension, teachers used terms such as fairness (Howe, 2000; Steffen, 2011); open-mindedness (Rowles et al., 2013; Steffen, 2011). The analysis revealed that teachers shared common conceptions that critical thinking consisted of the skills of analysis, evaluation, and inference while fairness, and open-mindedness were regarded as the dispositions of critical thinking.

Table 2.8 Studies of teachers conceptions of critical thinking in two dimensions

Studies	Skills dimension	Dispositional dimension
Gordon, 2000	Analysis, Evaluation, Inference, Self-regulation	Being sensitive to others
Howe, 2000	Deductive Reasoning, Higher-order thinking	Fairness, Precision,
Jenkins, 2011	Analysis, Evaluation, Reflection, Synthesis	Flexibility, Creativity
Rowles et al., 2013	Analysis, Evaluation, Inference, Interpretation	Open-mindedness
Stapleton, 2011	Logical reasoning	Diverse perspectives
Steffen, 2011	Analysis, Evaluation	Fairness, Open-mindedness
Walthew, 2004	Problem solving	Curiosity

Moreover, the words teachers used in the studies are exactly the same as those used by scholars. A

summary of the terms used in the skill and in dispositional dimensions are given as Table 2.9 and Table 2.10 respectively.

Table 2.9 Summary of the terms used in the skills dimension by teachers and scholars

Terms	Respondent teachers	Scholars
Analysis	Choy & Cheah, 2009; Gordon, 2000; Jenkins, 2011; Steffen, 2011; Rowles et al., 2013	Ennis, 1989; Facione, 1990, 2011; Norris & Ennis, 1989; Scriven & Paul, 1987
Deductive reasoning	Howe, 2000, 2004	Norris & Ennis, 1989
Evaluation	Gordon, 2000; Jenkins, 2011; Steffen, 2011; Rowles et al., 2013	Glaser, 1941; Facione, 1990, 2011; Fisher & Scriven, 1997; Scriven & Paul, 1987
Inference	Gordon, 2000; Rowles et al., 2013	Ennis, 1996; Facione, 1990, 2011; Glaser, 1980; Norris & Ennis, 1989
Information Gathering/seeking	Twibell et al., 2005; Walthew, 2004	Elder & Paul, 2008; Glaser, 1941
Interpretation	Rowles et al., 2013	Elder & Paul, 2008; Facione, 1990, 2011; Fisher & Scriven, 1997
Logical reasoning	Choy & Cheah, 2009; Stapleton, 2011	Glaser, 1941
Metacognitive skills	Howe, 2000	Halpern, 2014
Reflection	Jenkins, 2011; Twibell et al., 2005	Scriven & Paul, 1987
Self-regulation	Gordon, 2000	Facione, 1990, 2011
Synthesis	Jenkins, 2011	Halpern, 2014; Scriven & Paul, 1987

Table 2.10 Summary of terms used in the dispositional dimension by teachers and scholars

Terms	Respondent teachers	Scholars
Fairness	Howe, 2000; Steffen, 2011	Elder & Paul, 2008; Scriven & Paul, 1987; Siegel, 1988
Consistency	Howe, 2000	Scriven & Paul, 1987; Siegel, 1988
Precision	Howe, 2000	Elder & Paul, 2008; Norris & Ennis, 1989; Scriven & Paul, 1987
Being sensitive to others	Gordon, 2000	Ennis, 1996; Norris & Ennis, 1989
Open-mindedness	Steffen, 2011; Rowles et al., 2013	Elder & Paul, 2010; Facione, 1990, 2011; Norris & Ennis, 1989; Paul, 1993

As seen in Tables 2.9 and 2.10, the teachers in the studies shared a similar view to that of the scholars. Both respondent teachers and the scholars used the terms of critical thinking such as analysis; deductive reasoning; evaluation; inference; information gathering/seeking; interpretation; logical reasoning; metacognitive skills; reflection; self-regulation; synthesis; fairness; consistency; precision; being sensitive to others; and open-mindedness. These terms were commonly used by the scholars and respondent teachers, therefore they are included in the survey in this current study in order to investigate teacher conceptions of critical thinking. (The detailed discussion is in 3.3.1).

Teacher conceptions of critical thinking have been examined. The next section is about studies of student conceptions of critical thinking in different countries and in different grade levels.

2.7 Studies of Student Conceptions of Critical Thinking

Critical thinking is essential in the workplace (Hodge & Lear, 2011; Marchigiano, Eduljee & Harvey, 2011; Kaddoura, 2013; Willingham, 2008). Despite the importance of critical thinking in education, its vague definition has gained criticism. Barnett (1997) complained that “critical thinking is a defining concept of the Western universities. Almost everyone is in favor of critical thinking, but we have no proper account of it. “Higher education, which prides itself on its critical thought, has done no adequate thinking about critical thinking” (p. 2). It is evident that critical

thinking has been a major concern in Western higher education, however, a discussion of what critical thinking is and how to enhance it in classrooms is not enough. As Ramsden (1988) confirmed, teachers are important in exploring student conceptions and thus designing methods to encourage the ideal conceptions (p. 23). In addition to the aforementioned studies of teacher conceptions of critical thinking, several studies investigated student conceptions of critical thinking. The following studies are discussed in chronological order.

2.7.1 Jones (2005) [Australia]

Some studies examined teacher conceptions of critical thinking in a cross-cultural context (Howe, 2000; Jenkins, 2011), and there are also studies of student conceptions of critical thinking. In exploring the effect of teaching context on student learning, Jones (2005) investigated a critical thinking task from the perspectives of four Chinese-speaking international and four English-speaking local students in Australia. In the Critical and Analytical Learning in Macroeconomics (CALM) project at the university, critical thinking was defined as a set of abilities:

- *distinguish between positive and normative statements;*
- *determine the reliability of a source;*
- *determine the factual accuracy of a statement;*
- *distinguish the relevant from the irrelevant;*
- *identify unstated assumptions;*
- *identify inappropriate use of assumptions and ambiguous arguments;*

- *recognise logical inconsistencies in the line of reasoning;*
- *determine the strength of an argument (p. 342).*

In the CALM project, students were required to submit a response electronically to a real-world macroeconomic issue. Students then electronically viewed and selected a response from one of the other students and wrote a 200-word comment. Their critical thinking elements were examined through the comments to the response. Before submitting the response and later comments, students were provided with guidelines on writing a comment:

- Is the material presented in the response accurate and unambiguous?
- Is the material presented in a logical manner?
- Has there been a consistent and accurate use of key concepts and terms?
- Can you identify any value judgments?
- Has the student been clear about the assumptions that are made?
- Does the student establish clear relationships between the ideas presented?
- Is the argument circular?
- Has the student made any errors in reasoning?
- Is the response a “true synthesis of ideas” or just a collection of quotations and paraphrases?

The eight students were then interviewed about the most important elements in writing a good comment. Regardless of the cultural and linguistic differences, this qualitative study found similarities in understanding critical thinking, as reported by the two groups of students. The

interviewees conceived of critical thinking in the first or skills-based level of critical thinking (Barnett, 1997). In their understanding, critical thinking involves abilities such as an awareness of structure and content; as well as dispositions such as balance and tenor (Jones, 2005, p. 350). It was argued that difference in race and language did not play an important role in student conceptions of critical thinking; instead it was greatly influenced by the teaching context in which the subject and assessment task was situated (p. 345).

In researcher's opinion, since the students were provided with guidelines before submitting response and comments, their understanding of critical thinking was influenced by those guidelines. In other words, if the guidelines suggest that skills and dispositional dimensions of critical thinking are equally important, students will emphasize both dimension in their response and comments. This was also a qualitative study in which only eight interviewees participated. Cultural difference was not found to be a factor in conceptions of critical thinking compared to the teaching context in which the tasks were situated. Further study could be conducted in identifying the influences on student conceptions of critical thinking in different teaching contexts and tasks.

2.7.2 Tapper (2007) [Australia]

In order to examine student conceptions of critical thinking instruction and its development in their college life, Tapper (2007) interviewed 21 undergraduate students studying agriculture across four years of study. Information about Science and Communication as a subject noted that the

criteria for evaluating critical thinking were the quality of the written conference paper, the quality of the oral presentation, the contribution to the peer review process, and the level of critical thinking in which the critical thinking descriptors stated: “provides adequate detail, evidence, support, argues in a logical way with a clear link to the *Reason!Able* diagram, software designed to develop student critical thinking” (p. 207). The study found that the 12 first year students conceived of critical thinking as “support for claims and positions taken in argument in written assignment” (p. 212). They claimed that the term critical thinking is not overtly used if essays were not assigned in the subject. It was found that the students had a narrow scope of critical thinking (p. 217), however, critical thinking was perceived as important by the nine older students, who thought that critical thinking was important for their study. Although they did not know what critical thinking was, most of the later-year students related critical thinking with problem solving (p. 215). They seemed to have deeper conceptions of critical thinking than was embedded in assignments (p. 215). The results revealed that critical thinking becomes more and more important to learning as grade levels increase.

In this study, students were required to assess the critical thinking ability of other students in their written assignments, and this involved providing support for claims and positions taken in arguments. In researcher’s opinion, it is difficult to investigate student conceptions of critical thinking through essays. The dispositional dimension of critical thinking was not examined by

commenting on the assignments of other students.

2.7.3 Wong (2007) [Hong Kong]

The aim of Advanced Supplementary Level Liberal Studies was intended to “encourage students to visualize the complexity of the issues and to develop their abilities for critical thinking” (CDC, 1996, p. 6). Skills that students are expected to “develop a wide range of skills and techniques concerned with the collection, organization, presentation, interpretation and evaluation of information about the world, so as to promote critical thinking and to make sound judgments” are emphasised in the document (CDC, 1996, p. 7).

Wong (2007) conducted a study investigating the conceptions of critical thinking held by ten Hong Kong students in AS Liberal Studies by distributing a questionnaire containing 23 definers of the conceptions of critical thinking. She found five qualitatively different conceptions of critical thinking among Liberal Studies students, namely:

1. *critical thinking is a purposeful way of thinking*: critical thinking is a way of thinking that serves a purpose of making up one’s mind about what to do or what to believe;
2. *critical thinking is an action facilitated by cognitive skills*: critical thinking is a thinking process

that includes a wide range of cognitive and higher-order skills such as analysis, synthesis and evaluation. This is similar to findings reported by many scholars such as Facione (1990, 2011), and Scriven and Paul (1987);

3. *critical thinking is a way of thinking and fulfilling relevant standards*: this refers to meeting standards of objective, logical and evidence-based thinking. It is in agreement with Lipman (2003) who suggested that critical thinking should rely on certain criteria and also with Paul (1993) who claimed that critical thinking was “self-improvement (in thinking) through standards (that assess thinking)” (p. 91);

4. *critical thinking is a reflective thinking*: is a dispositional element which characterises a self-observing and self-correcting nature to improve the process and outcome of thinking. This also echoes Lipman’s (2003) idea that the purpose of critical thinking is self-correcting;

5. *critical thinking is a combined subject-specific and subject-generic thought*: critical thinking in Liberal Studies is “interchangeable to some arts and business disciplines, however, not to science ones” (Wong, 2007, p. 84). McPeck argued that critical thinking is subject-specific in that it is intimately connected with other fields of knowledge (1990, p. 34). Liberal Studies is a subject that focuses on “examining or analysing an issue from multiple perspectives and obtaining freedom to express personal opinions about an issue” (Wong, 2007, p. 84), therefore

critical thinking in this subject is “not interchangeable to the context of the subject matter which is either theory-based or whose answer excludes from any personal judgment” (p. 87).

Wong’s study focused on investigating student conceptions of critical thinking in Liberal Studies, which is one of the areas of interest of the anticipated study. In researcher’s opinion, however, there are three main limitations to Wong’s study. First, the number of participants was small, in that only ten girls were interviewed. Second, participants came from an EMI (English as Medium of Instruction) girls school, and was a top school in Hong Kong. Third, the study was conducted in 2007, and investigates the AS Liberal Studies, rather than the NSS LS curriculum that commenced in 2009. Despite its limitations, Wong’s study provides insights and foundation for the anticipated study because it was conducted in the Hong Kong context and investigated the same subject, Liberal Studies.

2.7.4 Lawrence, Serdikoff, Zinn and Baker (2008) [USA]

Lawrence et al. (2008) not only investigated conceptions of critical thinking in psychology faculties and how it is addressed in their classrooms, but 170 undergraduate psychology students also participated in their study. As did their teachers, the students chose the clinical psychologist Halonen’s definition, that critical thinking is “the propensity and skills to engage in activity with reflective skepticism focused on deciding what to believe or do” (1995, p. 76). Halonen’s

definition of critical thinking was adapted from McPeck, “a propensity and skill to engage in an activity with reflective skepticism” (1990, p. 42) and Ennis, “reasonable reflective thinking focused on deciding what to believe or do” (1987, p. 10). It is evident that the psychology faculties and students agreed with Halonen’s conceptions that critical thinking involves skills and dispositions; critical thinking is a process of reflective scepticism in which the aim is to make a decision about a belief or action.

In researcher’s opinion, there were some limitations in this study. What was the procedure of data collection? How was the sample selected? How many definitions did the respondents have to choose from, in addition to Halonen’s definition? Did the respondents need to explain the reason for their choice? There was no clear answer to these questions.

2.7.5 Sng (2011) [Singapore]

Sng (2011) also studied student conceptions of critical thinking. Twenty five international students, who were studying a Master of Divinity program in Singapore, declared that they were facing a dilemma. On one hand, they felt that critical thinking was important “to help them make the connection between theology and scriptural teaching in their Christian ministry” (p. 158), and that critical thinking also serves as an useful tool for them to think more deeply and “form a decision from the vast amount of knowledge and views presented in their theological education and

interaction with people of diverse background” (p. 160). Students explained that critical thinking is “to think about an issue in both breadth and depth” (p. 159) and “to think about what they believe” (p. 159). This is coincident with what the Ministry of Education proposed in the vision statement, that students should not simply follow prescribed answers, instead they should ask more searching questions that encourage curiosity and critical thinking (MOE, 2012). On the other hand, the Asian student respondents, including those from Singapore, China, Taiwan, Korea and Philippines, confessed that critical thinking is not encouraged, or accepted, because it is contrary to their cultural values and education systems, which are reserved and respectful of authority (Sng, 2011, p. 163). This echoed the study by Baildon and Sim (2009) in which Singaporean Social Studies teachers were constrained in teaching critical thinking. Ironically, this was contradicted when the Ministry of Education proposed that schools be obliged to teach students critical thinking (MOE, 2012), and develop “future generations of thinking and committed citizens, capable of making good decisions” (MOE, 1997).

This study aimed to explore opinions about the importance of critical thinking skills in ideological education and Christian ministry; and how cultural values shaped conceptions of critical thinking skills. In researcher’s opinion, this aim was fulfilled by adopting a mixed approach in a research methodology that combined both survey and focus group discussion.

2.7.6 Steffen (2011) [USA]

Steffen (2011) not only investigated teacher conceptions of critical thinking but also student conceptions of critical thinking. The study was conducted in a US high school with a rich history of intentionally teaching critical thinking skills within the context of content area classes. Among the 333 high school students asked, most believed that logical thinking was critical thinking. They regarded critical thinking as:

thinking logically or using techniques to help you figure something out;

thinking hard and logical about a certain answer;

thinking that is backed up by data and logic and that is unbiased and neutral;

think logically and constructive;

not always thinking logical but thinking beyond the norm;

look at the most logical perspective to make the clearest and most logical decision (p. 107).

The conception of critical thinking as logical thinking is consistent to Glaser (1941) who introduced critical thinking as “knowledge of the methods of logical inquiry and reasoning” (p. 5).

Steffen (2011) investigated perceptions of how teachers perceive their teaching of critical thinking skills and how students perceive their learning of critical thinking skills. In researcher’s opinion, there was a major limitation in that the study was conducted in one school with a rich history of intentionally teaching critical thinking skills within the context of content area classes. It was

assumed that the teachers and students from the responding school had clear and positive conceptions of critical thinking. The teacher and student conceptions of critical thinking from other schools are not known. Despite this major limitation, Steffen's study provided a framework for investigating teacher and student conceptions of critical thinking.

2.7.7 Chan (2013) [no specific place but in Chinese context]

In the aforementioned discussion, critical thinking was highly emphasised in the field of medical sciences education. It is one of the essential outcomes of the baccalaureate education for nursing (The American Association of College of Nursing, 2008, p. 11) and one of the American Nursing Association Standards in the application of the "nursing process" (The Critical Thinking Community, 2013). It is, therefore, necessary to investigate the conceptions of critical thinking of the key stakeholders. There are some studies exploring nurse educator conceptions of critical thinking (Gordon, 2000; Jenkins, 2011; Twibell et al., 2005; Walthew, 2004).

Chan (2013) conducted a qualitative study to investigate nursing student conceptions of critical thinking using group interviews and concept map drawing. The 36 respondents reported that critical thinking includes logical reasoning, sound evidence, and multi-dimensional perspectives (p. 560).

In researcher's opinion, the qualitative research approach is appropriate for 36 respondents. There

are two interesting findings in this study. First, the respondents admitted that they did not know what critical thinking is. Their conceptions of critical thinking were finally collected from referring to their own experience. Second, there was a debate about whether critical thinking was criticising others, and there was no conclusion from the interviews. This kind of debate has become common in recent Hong Kong. As mentioned in section 1.5, Ip (2007) raised concern about the translation of the term critical thinking into Chinese as “批判性思考” in which it is rendered as skills “in the mode of levelling criticism” and this translation has “created the impression that students are encouraged to criticize”. In Ip’s opinion, the mistaken translation of critical thinking encourages student conceptions of critical thinking as being critical of others. The respondent students shared a similar view with Ip and this debate was continued in Chan’s study in 2013.

2.7.8 Kaddoura (2013) [USA]

After interviewing sixteen US fresh graduate nurses about their conceptions of critical thinking, Kaddoura (2013) found that, on one hand, the nurses defined critical thinking from their own perspectives (p. 15); on the other hand, their conceptions were in alignment with those of the scholars (p. 19). Broadly speaking, the responding nurses conceived of critical thinking in the following three themes:

- 1) multi-perspective thinking: includes expansive thinking, anticipating, problems, and reflection;

2) analytical activities: includes analysis, inquisitiveness, and problem solving;

3) nursing process functions: includes assessment, planning, and taking action (p. 8).

In researcher's opinion, although the fresh nurse graduates had their own perspectives on what critical thinking is, their conceptions were in conformity with those of the scholars. The conception of multi-perspective thinking coincides with Halpern, who suggested synthesising information from a variety of sources as one of the generic skills of a critical thinker (2014, p. 19). The conception of analytical activities is similar to what Facione concluded in the *Delphi Report* that critical thinking is a purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation and inference (1990, p.2); and Scriven and Paul (1987) defined critical thinking as "the intellectually disciplined process of actively and skilfully conceptualising, applying, analysing, and synthesizing. The conception of nursing process functions, which includes assessment, planning, and taking action, is in harmony with Norris and Ennis who proposed deciding on an action as one of the critical thinking skills (1989, p. 14).

2.7.8 Concluding comments

As shown in Table 2.11, there have been studies investigating student conceptions of critical thinking in a number of different countries. This is because, in facing the rapidly changing 21st century, "critical thinking will become a survival need, an external imperative for every nation and for every individual who must survive on his or her own talents, abilities, and traits" (Paul, 1993, p. 13). Critical thinking has therefore become a major concern in educational reforms in

Table 2.11 Summary of student conceptions of critical thinking from studies

Writer(s)	Region	Participants	Student conceptions of critical thinking
Jones (2005)	Australia	undergraduate students	skills: awareness of structure and content dispositions: balance and tenor
Tapper (2007)	Australia	Agricultural undergraduate students	for early-year students: support for claims and positions taken in argument in written assignments; For later-year students: problem solving
Wong (2007)	Hong Kong	senior high school students	critical thinking is: <ul style="list-style-type: none"> ● a purposeful way of thinking ● an action facilitated by cognitive skills ● a way of thinking fulfilling relevant standards ● is a reflective thinking ● is a combined subject-specific and subject-generic thought
Lawrence et al.(2008)	USA	psychology students	critical thinking is a process of reflective scepticism involves skills and propensity
Sng (2011)	Singapore	international master's students	critical thinking is to think about an issue in both breadth and depth and to think about what they believe
Steffen (2011)	USA	senior high school students	core element of critical thinking is logical thinking
Chan (2013)	Chinese context	nursing students	critical thinking includes logical reasoning, sound evidence, and multi-dimensional perspectives
Kaddoura (2013)	USA	fresh graduate nurses	critical thinking involves different skills: <ul style="list-style-type: none"> ● multi-perspectives thinking ● analytical activities ● nursing process functions

many countries, such as the United Kingdom, the United States, Canada, Singapore, Taiwan and also Hong Kong. In spite of the growing concern about teaching critical thinking in schools, there are some criticisms, from employers, that schools are not successfully equipping students with critical thinking, which includes the top three entry-level skills desired by employers (Borja, 2006; Sculley, 1992). Teacher conceptions of critical thinking have been explored, and student

conceptions should also be examined, thus teachers can design pedagogies in which changes towards the desired conceptions can occur (Ramsden, 1988, p. 23). It is hoped that this can provide educators with the foundation for learning and education with a clear and accurate understanding of the teacher and student conceptions of critical thinking (Elder & Paul, 2008, p. 89).

Student conceptions of critical thinking were investigated in secondary schools. Wong (2007) found that Hong Kong senior high school students conceived of critical thinking as a purposeful way of thinking; an action facilitated by cognitive skills; a way of thinking and fulfilling relevant standards; a reflective thinking, and a combined subject-specific and subject-generic thought. The student conceptions of critical thinking were in harmony with those of scholars such as Facione (1990, 2011); Lipman (2003); Paul (1993); and Scriven and Paul (1987). Another study of secondary school students was conducted by Steffen (2011) who examined students from a single high school in the United States. The students conceived of critical thinking as logical thinking (p. 107), which is similar to the conceptions of Glaser (1941), that critical thinking is a “knowledge of the methods of logical inquiry and reasoning” (p. 5).

In higher education, critical thinking has played a significant role in the college experience.

Facione et al. (1995) recognised that “hardly a college or university in the nation would fail to

identify the development of critical thinking as a vital outcome of its core curriculum” (p. 1). In Tapper’s study (2007), Australian undergraduate students claimed that critical thinking was more important as their grade levels increase. Jones (2005) identified the two dimensions of critical thinking from international and local university students in Australia. Awareness of structure and content are included as critical thinking skills, and balance and tenor are identified as dispositions. In the study by Lawrence et al. (2008), psychology students in the United States also explicitly defined critical thinking as a process of reflective scepticism involving skills and propensity, very close to the definition introduced by scholars. Studying international undergraduate students, Sng (2012), however, had a different results than Jones. The Asian students studying in Singapore expressed negative feelings about the way that critical thinking is not encouraged in their cultures, which are reserved and respectful of authority.

In the field of nursing, critical thinking is an important element in nursing education as well as in the workplace. Chan (2013) found that nursing students conceived of critical thinking as logical reasoning, sound evidence, and multi-dimensional perspectives. Kaddoura (2013) found that fresh graduate nurses in the United States conceived of critical thinking as skills involves multi-perspective thinking, analytical activities, and nursing process functions.

As mentioned, studies revealed that teachers conceived of critical thinking as two dimensions

which involved skills and dispositions. From the studies reviewed above, however, students regarded critical thinking as more inclined to the skills dimension. Table 2.12 shows the results.

Table 2.12 Studies of students conceptions of critical thinking in two dimensions

Studies	Skills dimension	Dispositional dimension
Jones, 2005	Awareness of structure and content	Balance and tenor
Wong, 2007	Analysis, Synthesis, Evaluation	Self-correction
Steffen, 2011	Logical thinking	
Chan, 2013	Logical reasoning, sound evidence, multi-dimensional perspectives	
Kaddoura, 2013	multi-perspectives thinking, analytical activities	

Among the five studies that respondent students clearly defined critical thinking, only two studies indicated that critical thinking was conceived as two dimensions. The other three studies found that students conceived of critical thinking as a skills dimension only. In other words, students emphasized the skills dimension of critical thinking while the dispositional dimension of critical thinking was neglected.

Student conceptions of critical thinking were investigated in the abovementioned studies. Jones (2005, p. 345) found that the “perception of (students’) critical thinking was very strongly influenced by the teaching context in which the task was situated”. No matter where they were studying, in high schools, in universities or even when graduated, or whatever subjects they were studying, they had different conceptions of critical thinking. It is, therefore, necessary to investigate classroom practice that influence student conceptions of critical thinking.

2.8 Studies of the Relationship Between Teacher and Student Conceptions

Many conclusions emphasise the strong relationship between teacher and student conceptions, with the key element, classroom practice, lying between them. Since teachers are important stakeholders who “set the standards and define the concept of critical thinking” (Fisher & Scriven, 1997, p. 1), they are driven by their conception of critical thinking and, therefore, responsible for what goes on in the classroom and what is done outside the classroom (p. 2). This is because classroom practices are influenced and designed by teachers who have their own conceptions of critical thinking. Stapleton also revealed the relationship between teacher conceptions and classroom practice, in that teachers can capture the essence of teaching critical thinking in their classrooms if they understand what critical thinking is (2011, p. 21). When teachers are clear about what critical thinking is, they are able to design lessons that enhance critical thinking and student conceptions of critical thinking are therefore shaped in these contexts.

2.8.1 Studies of the relationship between teacher and student conceptions of critical thinking

2.8.1.1 Tsui (2001) [USA]

Barnett (1997) argued that the concept of critical thinking is emphasised in Western higher education (p. 2). Some studies have investigated teacher conceptions of critical thinking in higher education (Choy & Cheah, 2009; Lawrence et al., 2008; Stedman & Adams, 2012), however, the influence of faculty conceptions of critical thinking on the development of student critical

thinking was questionable. Tsui (2001) investigated four institutions in the United States, and four students, four faculties and one administrator from each institution were interviewed. The findings showed that there were three types of faculty attitudes related to instructional efficacy that influence the development of student critical thinking (p. 22).

The findings revealed that, firstly, faculty confidence in student capabilities of higher-order thinking has an impact on expectations of students and the infusion of challenging tasks into the curriculum. When teachers are frustrated with poor academic preparation by students and they lack confidence in student potential, their willingness, interest and efforts to enhance student critical thinking will be limited (p. 10). Faculties in institutions with a high institutional mean in student self-assessed growth in critical thinking (IGCT) tended to design and deliver challenging work tasks for their students, while the students from low IGCT complained that introductory courses are unchallenging and the drop-out rate tended to increase to nearly half the freshmen class (p. 12). Secondly, teacher enthusiasm for teaching also influences student development in critical thinking. Frequent individual and group reflection on pedagogy provides the opportunity for collegial support, collaboration, and the exchange of ideas which focus on enhancing critical thinking in coursework (p. 14). Conversely, the faculty development and faculty interest in teaching were seen as the main obstacles to greater student critical thinking in the low IGCT schools (p. 16). Third, faculty perception of teaching as a mutual learning experience had effects

on the development of student critical thinking in teaching methods and classroom environments.

In the high IGCT institutions, faculties regularly adopt active learning methods, such as discussion, small group work, and student presentation, and the learning environment is engaging and comfortable, which allows greater student participation. Active teaching methods and an encouraging classroom environment promote “self-confidence for independent thinking that is essential to becoming authentic critical thinker” (p. 18).

The three types of faculty attitudes discussed above had significant influence on the development of critical thinking in students. If teachers are confident of their students being ready and willing to tackle coursework that involves higher-order thinking, they will teach critical thinking in their classrooms. In researcher’s opinion, teacher confidence in student capabilities of learning higher-order thinking had an influence on student conceptions of higher-order thinking. This will be discussed in section 6.3.

2.8.1.2 Slatter (2009) [Singapore]

Critical thinking has played a significant role in Singaporean educational reform. The mission of *Thinking Schools, Learning Nation* clearly stated that “schools must develop future generations of thinking and committed citizens, capable of making good decisions” (MOE, 1997). Instead of following prescribed answers, students should ask more searching questions in order to encourage

curiosity and critical thinking (2012).

Fifty-seven students and twenty-nine science teachers, from a high ability female secondary school in Singapore, completed a survey in order to examine their conceptions of classroom practice in promoting critical thinking (Slatter, 2009). In investigating the correlation between teacher confidence in using classroom practice and their frequency of using classroom practice, eight classroom practice listed, for example, Paul's Wheel of Reason, Paul's Intellectual Traits, and model critical thinking for the students. A strong correlation is found in that when teachers are confident in using a certain classroom practice, they implement it with high frequency. For example modelling critical thinking for students, which is frequently used, has had a positive influence on student thinking (p. 9). There is also a strong correlation in examining the correlation between the frequency of teacher classroom practice and frequency of students using critical thinking in science lessons. For example teachers frequently used Bloom's Taxonomy in science lessons, and students tended to use critical thinking (p. 11). Among the various subjects in that school, students reported that critical thinking is frequently used in science lessons (p. 12). It was concluded that the science teachers confidently and frequently used numerous classroom practices in an attempt to engage student critical thinking; while students reported this influence as frequently using critical thinking in science lessons.

In researcher's opinion, a further investigation is recommended in order to find out why science teachers frequently used numerous classroom practices to engage student critical thinking. Are science teachers well-equipped or well-trained with critical thinking classroom practices? Is there subject matter that science subject is easier to implement critical thinking classroom practices? These are examples for further study.

2.8.1.3 Carlson (2013) [USA]

Numerous studies investigated student conceptions of critical thinking in higher education (Jones, 2005; Lawrence et al., 2008; Sng, 2012; Tapper, 2007), however, there is lack of sufficient literature concerning the relationship between teacher conceptions of their selected teaching strategies and student conceptions of critical thinking instruction.

Six hundred and eighty-nine students on an undergraduate business program in the United States completed a survey (Carlson, 2013). The findings showed that, first, student conceptions of critical thinking instruction differed significantly in different grade level. The sophomore students held different conceptions of critical thinking instruction than those at junior and senior levels. The former regarded critical thinking as important and they responded to critical thinking instructional methods that reflect the synthesis, analysis and application of course materials (p. 31). Among the twenty suggested instructional methods, there were only four where students agreed

with their instructors that critical thinking instruction fosters a positive learning environment and reflects critical thinking within the course. These four instructional methods were lectures with discussion, brainstorming, discussion, and individual projects (p. 31) which are regarded as active learning that is beneficial to student development of critical thinking. It was, however, reported that there is a low percentage of active learning adoption by the instructors (p. 32).

There was a discrepancy of conceptions and implementation of the active learning instructional methods. Students found that four instructional methods were active learning that enhances their critical thinking, while their instructors adopted in a low percentage. In researcher's opinion, a further study should be conducted to find out the reason of this discrepancy. Are instructors not well-trained in adopting the active learning instructional methods? Is there any limitation that hinders the adoption? A further study may find out the answers.

2.8.2 Studies of the relationship between teacher and student conceptions of the nature of science (NOS)

This study aims to investigate the relationship between teacher and student conceptions of critical thinking. There are also numerous studies identifying the relationship between teacher and student conceptions of the nature of science (NOS), including Abd-El-Khalick, Bell and Lederman, 1998; Bartos and Lederman, 2014; Lederman, 1985, 1987, 1992; Sargedine and BouJaoude, 2014; Zeidler and Lederman, 1989. As early as 1992, Lederman conducted a literature review and

concluded that there are four types of related research in the area of NOS:

- (1) assessment of student conceptions of the NOS;
- (2) development, use, and assessment of curricular designed to improve student conceptions of the NOS;
- (3) assessment of, and attempts to improve, teacher conceptions of the NOS;
- (4) identification of the relationships between teacher conceptions, classroom practice, and student conceptions (1992, p. 332).

This current study was closely related to the fourth type of research, investigating the relationship between teacher conceptions of the nature of science, the classroom practice influenced by their conceptions, and student conceptions of the nature of science. The difference between them is the area of focus. This current study aims to investigate the relationship between teacher conceptions of critical thinking, the classroom practice that influenced by their conceptions, and student conceptions of critical thinking. Since the research on the NOS is not the focus of this study, three key related studies, together with the findings revealed, are discussed briefly below.

2.8.2.1 Lederman (1985) [USA]

Lederman (1985) investigated whether classroom variables are related to changes in student conceptions of the nature of scientific knowledge. Eighteen high school biology teachers and their lessons were compared with respect to 409 student conceptual changes on NOS. The pre-test and post-test scores from the Nature of Scientific Knowledge Scale (NSKS) were compared to

examine student conceptual changes. Two groups of students were categorised: *high* group represented the largest student' conceptual change while *low* group exhibited minimal student' change. In addition to this quantitative questionnaire, there was lesson observation for each teacher, and 18 classrooms were observed. During the lesson observation, there was a checklist of 44 classroom variables grouped into five categories: (1) teacher's general instructional approach; (2) teacher's content-specific characteristics; (3) teacher's non-instructional characteristics; (4) student characteristics; (5) classroom atmosphere (p. 8-9) (see Appendix 1 The list of 44 classroom variables). Here, Lederman did not define the two terms *teacher's general instructional approach* and *teacher's content-specific characteristics*. Judging from the variables, however, the former term could be defined as common teaching behaviour or methods in lessons, regardless of subjects, while the latter term describes those teacher behaviour in a specific subject lesson. In Lederman's study, *teacher content-specific characteristics* referred to the teacher dispositions in science subjects. To conclude, 30 classroom variables were found, significantly differentiating between the *high* and *low* group. For example, dynamic; frequent questioning; higher cognitive level questioning; receptive to unsolicited questions; variety of instructional media; demeanour; low anxiety; and rapport. To sum up, the class "stress on higher-level understandings and inquiry was strongly associated with changes in students' conceptions of the nature of science" (p. 19). Both the teacher's general instructional approach and the teacher's content-specific characteristics were found influential in shaping students conceptions of nature of science.

In researcher's opinion, Lederman's study provided a foundation for investigating classroom practice through the list of classroom variables, although it did not concern critical thinking and also did not define *classroom practice*. In this current study, a list of classroom variables was adapted (see Appendix 2 The list of 30 classroom variables of critical thinking).

2.8.2.2 Zeidler and Lederman (1989) [USA]

Zeidler and Lederman (1989) conducted a study to investigate the influence of teacher-student interaction on conceptual changes in student conceptions of NOS. Eighteen high school biology teachers and 409 students constituted the sample. The findings revealed that when teachers used ordinary language, students tended to adopt the realistic conception of science; when teachers used precise language, students tended to adopt an instrumentalist conception (p. 777). It was concluded that implicit messages embedded in teacher language produced varied student conceptions. Students then “come to formulate a conception that gravitates toward or finally matches teacher discourse characteristics” (p. 777).

Although this study was conducted over 25 years ago, in researcher's opinion, it provided significant value by showing that student conceptions were shaped by a teacher's implicit language and the way that teachers present subject matter to their students. This will be discussed in section 6.3.

2.8.2.3 Lederman (1999) [USA]

Using multiple data sources including classroom observations, open-ended questionnaires, semi-structured and structured interviews, and instructional plans and materials, Lederman (1999) investigated the understanding that five high school biology teachers had of the nature of science (NOS) and classroom practice. In order to supplement the conclusions reached, data collected by interview, from 10 students in each class. The results found that student conceptions of NOS “did not exhibit an understanding of science consistent with current wisdom and science education reforms” (p. 926). Together with the data from teachers, Lederman concluded that “unless a teacher clearly intends to address NOS and follows through with explicit emphasis during instruction, students will not develop an understanding of NOS” (p. 926). That means students will not understand NOS very well unless their teachers explicitly present it in the classroom. The relationship between teacher conceptions and student conceptions is, therefore, “contingent upon a teacher’s explicit attention to his/her views of NOS during instruction” (p. 927).

Although the aim of this study is not to investigate the relationship between teacher conceptions and student conceptions of NOS, the findings and conclusions highlighted the influence of a teacher’s explicit instruction in shaping student conceptions, instead of mere modelling. In researcher’s opinion, in order to investigate the influence of teacher classroom practice on student conceptions, more data collection is necessary such as through student interviews and lesson observation.

2.8.3 Concluding comments

Teachers are the key factor in promoting critical thinking in students, as they are the “curriculum agents who bring a complex autonomy to bear on curriculum plans, mediating them and thereby constructing their potential-in-practice” (Parker, 1987, p. 8). Teachers are empowered to design classroom practice for fully implementing the curriculum. Many studies indicated that when teachers are aware of, and understand, the conceptions and teaching strategies of thinking, they will and can do better in teaching thinking skills (Jones, 2005; Onosko, 1992). There are numerous studies concerning the relationships between teacher conceptions, classroom practice, and student conceptions in the discipline of science; for example Lederman’s study (1985) found a strong correlation between classes that emphasise higher-level understandings and inquiry, and the changes in student conceptions of the nature of science, however, there are few similar studies in the domain of critical thinking. Tsui (2001) argued that when faculty is confident in student capabilities of higher-order thinking, it has an explicit influence on their expectation on students, and they are more willing to infuse challenging tasks into the curriculum. A similar finding is drawn from Slatter (2009), that when teachers are confident in using a certain classroom practice, they implement it with high frequency. It is frustrating that instructors in university are found to seldom adopt active learning in their classrooms, and that their students regarded four instructional methods, lectures with discussion, brainstorming, discussion, and individual projects, are beneficial to student development of critical thinking.

There have been few studies concerning the relationships between teacher conceptions of critical thinking, the classroom practice influenced by their conceptions, and student conceptions of critical thinking. It is, therefore, necessary to explore this relationship in this study.

2.9 Chapter summary

Being a survival skill in the 21st century (Johanson, 2010, p. 27; Wagner, 2008, p.15), critical thinking has been found to be important in three dimensions: individual, in the workplace and in society. Its importance was recognised by the educational authorities in various countries, where educational reforms were then undertaken to promote critical thinking. Sharing a similar view with her counterparts in Western and Asian countries, Hong Kong also emphasised critical thinking in her educational reforms from the 1990s. A typical example was the introduction of a new core subject, Liberal Studies, in the NSS curriculum. Although the role of critical thinking was justified in the C&A Guide of Liberal Studies, the way that Hong Kong Liberal Studies teachers and students conceived of critical thinking were not clear.

Concerning the conceptions of critical thinking, some scholars argued that critical thinking consisted of two dimensions: skills and dispositions (Elder & Paul, 2008; Ennis, 1996; Facione, 1990, 2011; Halpern, 2014; Norris & Ennis, 1989; Scriven & Paul, 1987). In Hong Kong, the Working Group on the Review of the Guidelines on Civic Education also shared a similar view,

that critical thinking was conceived of as two dimensional, i.e. skills and dispositions (CDC, 1996).

Since critical thinking was a significant concern in the educational reforms of many countries, teacher and student conceptions of critical thinking have drawn much attention, because both teachers and students are the important stakeholders in education. There have been studies investigating teacher and student conceptions of critical thinking in various school settings, subjects, student grade levels, and countries. In teacher conceptions, critical thinking was still sometimes a vague term (Alazzi & Khawaldeh, 2008; Innabi & Sheikh, 2006; Stedman & Adams, 2012; Beistle & Palmer, 2014). On the other hand, teachers were found to share similar views with the scholars who conceived of critical thinking as two dimensional (Choy & Cheah, 2009; Gordon, 2000; Howe, 2000, 2004; Jenkins, 2011; Lawrence et al., 2008; Stapleton, 2011; Steffen, 2011; Twibell et al., 2005; Walthew, 2004; Rowles et al., 2013).

In student conceptions, critical thinking was conceived to be a set of skills such as problem solving (Tapper, 2007); logical thinking (Steffen, 2011); logical reasoning (Chan, 2013); and analysis (Kaddoura, 2013). Similarly to the scholars and teachers, students also recognised critical thinking as two dimensional (Jones, 2005; Lawrence et al., 2008).

In examining the relationship between teacher and student conceptions, some studies had been done on the nature of science (Lederman, 1985, 1987, 1992; Lederman & O'Malley, 1990; Saredidine & BouJaoude, 2014; Zeidler & Lederman, 1989); however, studies in the area of critical thinking were rare and thus more empirical investigations are needed. In this study, teacher and student conceptions of critical thinking in Liberal Studies were examined, and the relationship between these two conceptions was investigated.

Chapter 3 Research Design

This study was designed to investigate the relationship between teacher and student conceptions of critical thinking in Liberal Studies.

The following sub-questions are identified:

1. What are teacher conceptions of critical thinking in Liberal Studies?
2. What are student conceptions of critical thinking in Liberal Studies?
3. What is the relationship between teacher and student conceptions of critical thinking in Liberal Studies?

This study uses a mixed methods approach where qualitative research and quantitative research are entwined. Results from the quantitative surveys of teachers and students lead to findings about their conceptions of the teaching and learning of critical thinking. With the aim being to collect quantitative data about teacher and student conceptions of critical thinking, a structured questionnaire will be used for teachers and students. In a survey, the accuracy of data lies with the individuals providing it. The respondents, the teachers and students in this study, are “expected to be willing and able to provide honest and accurate information” (Picardi & Masick, 2014, p. 148).

The qualitative data that will be collected from interviews of teachers and students provides a

more in-depth interpretation of the classroom practice that facilitates the teaching and learning of critical thinking. Questionnaires are a time-saving way to collect a large amount of data; however, they provide little room for participants to express their own perspectives. Interview provides a way for researchers to access and understand the meaning of people's behaviour and actions in the context in which they are situated (Seidman, 1998, p. 4). In order to obtain a more in-depth understanding of the circumstances of the participant opinions, semi-structured interviews will be conducted with a number of teachers and students, allowing the investigation and understanding of more detail regarding how participants think and how they come to develop the perspectives they hold. The purpose of interviewing is "an interest in understanding the experience of other people and the meaning they make of that experience"; "an interest in other individual's stories because they are of worth" (Seidman, 1998, p. 3). It is assumed that "the meaning people make of their experience affects the way they carry out that experience" (p. 4). Interview is very suitable in the educational context, as "it is a powerful way to gain insight into educational issues through understanding the experience of the individuals whose lives constitute education" (p. 7).

The open-ended nature of interviews allows teachers and students to answer in their own words rather than from prearranged questions. In this way, loosely structured interviews will be used in order to make room for respondents to freely express their thoughts around the designated topic.

Semi-structured interviews are therefore advantageous for asking pre-set questions and additional

questions in response to their comments. Researchers can probe discussions, follow up on ideas and make comparisons of the data across the respondent teachers and students.

Only one teacher from each sample school was invited for interview. The interview for teachers was conducted on a one-on-one or individual basis; between the teacher and the researcher. This can prevent the responding teacher “refusing to offer information and answers to questions in the presence of others for fear of misrepresentation or retaliation” (Picardi & Masick, 2014, p. 158). A focus group interview is preferred for the student interviews, since it “is a carefully planned discussion designed to obtain perceptions on a defined area of interest in a permissive, non-threatening environment” (Krueger, 1994, p. 6). A *focus group* means “group members influence each other by responding to ideas and comments in the discussion” (Krueger, 1994, p. 6) and that interaction between the four students in a focus group was expected. The group dynamics can “stimulate discussion, gain insights and generate ideas in order to pursue a topic in greater depth” (Bowling, 2002, 394). The student interviewees come from the same class, their peer relationship is assumed to be good and intimate, and to allow a warm and comfortable atmosphere for discussion. Eight students taught by the interviewed teachers were selected from each school to participate in the interviews. Since a group of eight students is too large for discussion, students were divided into Group A and Group B, each of which consisted of four students.

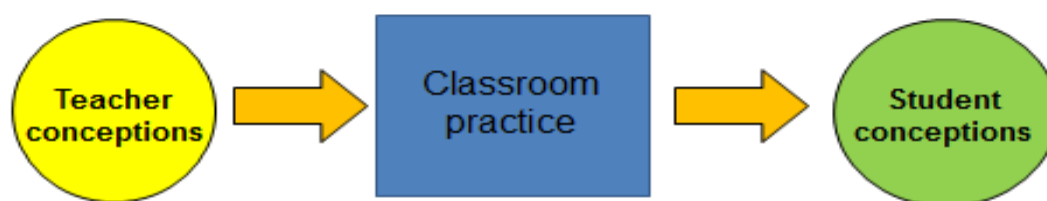
This is a mixed approach study where interviews and questionnaire are adopted. On one hand, a questionnaire provides a broad picture of people's experiences and views, and it "encourages frankness of response due to the anonymity afforded" (Roberts-Holmes, 2011, p. 165). On the other hand, interviews can draw deep understanding about the interviewee's opinion of the issue. The weakness of questionnaire can be solved by using interviews at the same time since "the interviews add the *flesh* to the *bones* provided by the questionnaire survey" (p. 165).

To gain the trust of the interviewees, a consent form was provided, as well as information about the research, such as the aims of study, research methods, data collection and analysis procedure, and the management of the data. It is hoped that this arrangement can build a trustful relationship between the researcher and the interviewees that promotes willingness and a feeling of comfort about participating in the study.

3.1 Conceptual framework of the anticipated study

The conceptual framework to be used for the study is laid out below, as taken from the literature reviewed:

Figure 1 Conceptual Framework of this Study



The above conceptual framework was based on the following hypothesis. First, since critical thinking was emphasised in the Liberal Studies curriculum and assessment, Liberal Studies teachers are assumed to have their own conceptions of critical thinking, which influence classroom practice since teachers are the significant designers of classroom practice. Here, *teachers conceptions of critical thinking* means how Liberal Studies teachers conceived of critical thinking; i.e. is critical thinking categorised into certain dimensions? Which dimensions are they? Second, situated in this classroom practice, student conceptions of critical thinking were assumed to be influenced. Here, *students conceptions of critical thinking* refers to what meanings students attached to critical thinking; i.e. is critical thinking categorised into certain dimensions? Which dimensions are they? Third, it was assumed that a relationship exists between teacher and student

conceptions, with the key element, classroom practice, in between them. Here, *classroom practice* means “a network of factors which interact to create the instructional milieu of each classroom” (Lederman, 1985, p. 15) including a teacher’s general instructional approach; a teacher’s content-specific instructional approach; teacher non-instructional characteristics/ attitudes; and classroom atmosphere (see section 3.3.2 for detailed description). The details of the sample, data collection instruments, the pilot study, the data collection procedures and data analysis procedures are reported as below.

3.2 Sample

Schools

The sample for this study was four secondary schools with which the researcher had a connection. Two of the sampled schools were Band One and the other two were Band Three. As mentioned, Band One schools are the highest level of student academic performance while Band Three schools are the lowest. Although this study is not aimed at investigating the student conceptions of critical thinking among different school bands, students from different school bands were deliberately invited in order not to focus narrowly on a certain school band. All the schools included both male and female students, and are Chinese Medium of Instruction (CMI) schools in the senior forms for Liberal Studies (the medium of instruction and learning materials used in Form 4 to 6 Liberal Studies lessons is Chinese). According to the 2015 Hong Kong Diploma of Secondary Education Examination Results, 87.1% of candidates used Chinese in Liberal Studies

HKDSE (HKEAA, 2015, Annex 2, p. 2). That means these four respondent schools were among the large proportion of secondary schools in Hong Kong using Chinese in Liberal Studies. Pseudonyms were used to protect confidentiality. Information about the sampling schools is given in Table 3.1.

Table 3.1 Information about the sampling schools

School Name	Band	LS teachers in Form 5	Classes in Form 5	Students in Form 5	Response Rate to the survey
Oxford School	1	2	5	166	90%
Omega School	1	3	5	163	89%
Trinity School	3	4	5	124	78%
Tiffany School	3	5	5	128	71%

*The names of Band One schools start with “O” and Band Three schools start with “T”

Teachers

All teachers teaching Form 5 Liberal Studies in each school were invited as respondents in the survey. This makes a total of 14 teachers. The demographic information of the respondents is shown in Table 3.2.

Table 3.2 Demographic information of teachers in survey

Gender	Total	Age 20-29	Age 30-39	Age 40-49	Age 50+	LS 1-2	LS 3-4	LS 5-6	AS LS <5	AS LS 5-9	AS LS 10-14	AS LS 15-20
Male	5	2	1	0	2	1	0	4	5	0	0	0
Female	9	4	4	1	0	1	1	7	7	2	0	0

Of the 14 teachers surveyed, one teacher from each school was invited to participate in the semi-structured interviews, which meant four teacher interviewees in total. Pseudonyms were used to protect confidentiality. Demographic information about the interviewed teachers is illustrated in Table 3.3.

Table 3.3 Demographic information of teachers in interviews

School Name	Teacher Name*	Gender	Age	LS teaching experience	AS LS teaching experience
Oxford School	Owen	M	20-29	1-2 years	<5 years
Omega School	Oliver	M	20-29	5-6 years	<5 years
Trinity School	Tracy	F	30-39	5-6 years	<5 years
Tiffany School	Terry	M	30-39	5-6 years	<5 years

*The names of Band One teachers start with “O” and Band Three teachers start with “T”

Students

All the Form 5 students from each school were invited to be respondents in the survey. This makes a total of 480 students. Since Form 4 students are too new to the senior high school curriculum, and Form 6 students are too busy for interviews after school, Form 5 students were assumed to be the best choice for the sample. Accordingly, their teachers of Liberal Studies were chosen as the sample teachers. 61.4% of the students were from Band One, and 38.6% from Band Three. 52.7% were male while 47.3% were female. The demographic information of students is illustrated as Table 3.4.

Table 3.4 Demographic information of students in survey

	Band	Respondents	Male	Female
Oxford School	1	150	70	80
Omega School	1	145	66	79
Trinity School	3	97	52	45
Tiffany School	3	88	65	23
		480	253	227

Of the students surveyed, eight students from each school were selected for the semi-structured interview which makes total 32 students. The criteria for selecting these eight students was the

following:

1. The students are taught by the interviewed teacher so that the relationship between both teacher and student conceptions of critical thinking can be easily compared;
2. The students are selected by their student numbers in the class and the numbers 2, 3, 5, 8, 10, 13, 18 and 27 were generated using a Random Integer Generator to avoid personal bias regarding specific students or student numbers.

Since eight students are too many for a group interview, they were divided into two groups, Group A and Group B. They could freely choose which group they belonged to. The interviews were scheduled on the same day but in different time slots, for example 4:00 and 5:00. Since the interviewed teacher may teach more than one class of Form 5 Liberal Studies, they could choose students with the abovementioned eight student numbers from any of their classes.

3.3 Data collection instruments

3.3.1 The survey

A set of questionnaires is used to answer research question 1: *What are teacher conceptions of critical thinking in Liberal Studies?* and research question 2: *What are student conceptions of critical thinking in Liberal Studies?* As noted, the term ‘critical thinking’ is neither well defined

nor clearly understood (Alazzi & Khawaldeh, 2008; Choy & Cheah, 2009; Griggs, Jackson & Marek, 1998; Howe, 2000, 2004; Innabi & Sheikh, 2006; Stapleton, 2011; Stedman & Adams, 2012). It is, therefore, necessary to provide some words or phrases describing critical thinking. The researcher took the idea from Howe's study (2000). There were 50 index cards with each card contained one definer of critical thinking. Respondent teachers had to choose 10 cards that, for them, best defined critical thinking, and then had to prioritize the 10 definers selected. As mentioned, Howe investigated and compared Japanese and Canadian teachers conceptions of critical thinking, meaning that the instrument of using index cards to investigate conceptions of critical thinking was conducted in the West and the East. The idea of using definers of critical thinking was adopted but the idea of using index cards was abandoned. Accordingly, the idea of using questionnaires was adopted since such a methodology is easy to administer, especially for students and in the classroom context.

In developing the items of the survey, a list of 40 definers of critical thinking was generated from a synthesis of literature reviewed (APA dictionary of Psychology; Birnbacher, 2001; Bloom, 1956; CDC & HKEAA, 2007; Elder & Paul, 2008, 2010; Ennis, 1962, 1987, 1996; Evans & Over, 1996; Facione, 1990, 2011; Fisher & Scriven, 1997; Glaser, 1941, 1980; Halpern, 1989, 1996, 2014; HKEAA, 2014; Howe, 2000, 2004; Inch & Warnick, 2010; Lewis & Smith, 1993; Lipman, 2003; Norris & Ennis, 1989; Paul & Elder, 2006; Polya, 1981; Scriven & Paul, 1987; Shaw, Montinari,

Piovesan, Olson, Gino, & Norton, 2014; Siegel, 1988; Von Bergen, C. W., Von Bergen, B. A., Stubblefield, & Bandow, 2012). 40 items on a questionnaire is appropriate especially for students. A description of each definer is given in Appendix 3. The list of 40 definers and the source is shown as Appendix 4.

The list of definers consists of two dimensions of critical thinking, skills and dispositions, with every definer carrying the same weight. The odd numbers of definers are related to the skills dimension of critical thinking, while the even numbers are related to the dispositional dimension. The English version of the questionnaire is shown as Appendix 5.

The four sample schools are CMI in teaching senior Liberal Studies, which means that the medium of instruction and the teaching materials are in Chinese. The definers, therefore, should be in Chinese to be easily understood by the teachers and students. In order to determine the relationship between teacher and student conceptions of critical thinking, the same instruments are used, except that teachers should provide demographic information such as their gender, age, and experience in teaching Liberal Studies. The critical thinking definers were each back-translated for a check of accuracy and reliability, translation and back translation. Back-translation is translating from the target language back to the source language (Chen & Boore, 2010, p. 235).

The job of translation and back translation was accomplished by an English teacher with strong qualifications in both English and Chinese. This teacher is bilingual with a good command of languages since she has a degree in both Chinese and English. She has taught English for 20 years in secondary school. She obtained a Master's of English Language Teaching and Level 4 in the Language Proficiency Assessment for Teachers in Hong Kong. The reliability of the definers is thus guaranteed by the bilingual and well-educated background of the teacher. She proofread the translation of both the written Chinese and English in this research. The list of 40 definers of critical thinking was written in Chinese for both teachers and students. There was a slight difference between the two sets of questionnaires in which teachers filled in their demographic information such as gender, age, and teaching experience in AS and NSS Liberal Studies. The Chinese versions of the teacher and student questionnaires are shown as Appendices 6 and 7 respectively.

A rating scale is commonly used to measure respondent attitudes toward the conceptions of critical thinking (Kumar, 2011, p. 168). "A rating scale is a numerical scale on which survey respondents indicate the direction and strength of their response" and "it is easy to convert the data to an ordinal or interval scale of measurement and proceed with statistical analysis" (Delbert, 1992, p. 92). The Likert Scale is a popular rating scale that presents a statement and "respondents are asked to rate their level of agreement with the statement" (p. 93). In this study, the definers

serve as a statement and the four scales are provided in order to force respondents to lean in one direction or another. Respondents were requested to categorise the given definers on the 4-point Likert Scale from 1=“not related to critical thinking at all” to 4=“strongly related to critical thinking”. All the definers on the scale have equal attitudinal value, or weight (Kumar, 2011, p. 170). In the teacher and student questionnaires, the definers with odd numbers were skill dimensions while the even numbers are dispositional dimensions.

Students with the student numbers 2, 3, 5, 8, 10, 13, 18 and 27 were selected for the later semi-structured interviews, and therefore they were asked to write their student numbers on the questionnaire for easy recognition of their individual questionnaires. The teachers and students completed the questionnaire before the interview. Students completed the questionnaire in their Liberal Studies lesson and teachers completed it in their free time. The researcher then garnered general ideas about the conceptions of critical thinking perceived by the respondents by going through the list before the interview. Since this was a self-completion questionnaire, it was relatively simple and straightforward so that teachers and students can understand what is required for successful completion. In doing so, the wordings of the questions were unambiguous and not vague because “the more specific and concrete the question, the easier it is to give a precise answer” (Denscombe, 2010, p. 163).

3.3.2 Semi-structured Interviews

Semi-structured interviews were used in answering research question 3: *What is the relationship between teacher and student conceptions of critical thinking in Liberal Studies?* Interviews are a person-to-person interaction, sometimes face-to-face, between two or more individuals with a specific purpose in mind (Kumar, 2011, p. 144). Interviews were adopted in this study because they allow topics to emerge during interview; a researcher can listen to the interpretation and perspectives of the interviewees; and thus collect more in-depth information on the topic (Morgan, 2014, p. 51).

Of the various types of interview, semi-structured interviews are conducted because the interviewees can develop their ideas and speak more widely in the process of interviewing. Their answers are open-ended, and there is more emphasis on elaborating their points of views (Denscombe, 2010, p. 175). In this study, one teacher from each school, a total of four teachers, were invited for interview in their free lessons or the period after school. Eight students from each school, which makes a total of 32 students, were selected for interview. They were being taught by the interviewed teacher so as to easily compare the relationship between both teacher and student conceptions of critical thinking. Also, in order to avoid any personal bias, the students were chosen via student numbers generated by Random Integer Generator. The student with the following number replaced someone if a student with the assigned number was absent. If the interviewed teacher taught more than one class of Form 5 Liberal Studies, they could choose

students with the abovementioned eight student numbers from any of their classes. Each student interview session lasted about an hour and was video recorded in order to recognise each student by video image, while each teacher interview session was audio recorded. According to Denscombe (2010), audio or video recording the interviews is advantageous because it does not pose too much of a disturbance to interview situations; provides a permanent record of speech; and can be checked by other researchers (p. 187).

To investigate student conceptions, a mixed approach is recommended, in which interviews were used because to “gather and clarify data about student beliefs appears to be essential to avoid the pitfalls of misinterpretation” (Lederman & O’Malley, 1990, p. 235). Following this recommendation, eight students were invited to participate in interviews. They were divided into two groups, each consisting of four students. This is known as a focus group: (1) “when the participants have a great deal to share about the topic or have had intense or lengthy experiences with the topic of discussion” (Krueger & Casey, 2009, p. 68). The students are studying in the senior form and they have experience of Liberal Studies lessons, and thus are assumed to have many insights to share; (2) the group of participants has commonality in certain ways such as the students are studying in Form 5, studying in the same class, and being taught by the same Liberal Studies teacher. It is significant that they provide their conceptions of critical thinking in Liberal Studies and how their teacher enhances critical thinking in Liberal Studies lessons; (3) it provides

qualitative data because, through the open-ended questions, a focus group is more interactive than the participants are influencing each other; (4) the focused topic is about understanding student conceptions of critical thinking and the relationship with classroom practice.

The interview guide was adapted from Choy and Cheah (2009), and consisted of seven questions aimed at investigating teacher conceptions of critical thinking. (See Appendix 8 for the interview guide from Choy & Cheah) As noted, the participants were all Chinese and the medium of instruction in Liberal Studies is Chinese; therefore the interview questions were translated to Chinese with the aim of easy communication between the researcher and participants. The interview questions in teacher and student interview guide are slightly different in wording; for example, when the interviewee is a teacher, the question asks “do you think that critical thinking takes place in your classroom when you are teaching your students?” but the question is changed to “do you think that critical thinking takes place in your classroom when you are taught?” when the interviewee is a student. The interview guides for teachers and students are presented as Appendices 9.1, 9.2 and 10.1, 10.2 respectively.

There were three categories of interview questions:

1. Conceptions of critical thinking (Questions 1 and 8);
2. Classroom practice used in Liberal Studies lessons (Questions 3, 4, 6);
3. Effectiveness of classroom practice in enhancing student critical thinking (Questions 2, 5, 7).

As interviews yield essential data, interview was adopted, with the main focus being to explore the classroom practice that may contribute to determining the relationship between teacher and student conceptions of critical thinking in Liberal Studies. During the interview, teachers and students were requested to clarify their questionnaire responses and the students to provide information about the sources of their conceptions, and factors causing conceptions to change.

Lederman (1985) had illustrated 44 classroom variables that contributed to changes in student conceptions of the nature of science, which consisted of five categories of classroom variable categories: a teacher's general instructional approach; a teacher's content-specific characteristics; a teacher's non-instructional characteristics; student characteristics; and classroom atmosphere. A teacher's general instructional approach is the common teaching behaviour or method in lessons, regardless of subjects, such as *lecturing*, and *frequent questioning*. A teacher's content-specific characteristics were those behaviours specifically related to science education, such as *arbitrary constructs* which meant that the arbitrary nature and utility of scientific constructs are (are not) stressed. (For details of these 44 classroom variables, see Appendix 1). Building on Lederman's work, a list of 30 classroom variables of critical thinking in Liberal Studies was designed (see Appendix 2). The original five categories of classroom variables were changed to four classroom variable categories. The first category was the **teacher's general instructional approach** in which certain variables were adopted from Lederman (1985) including *frequent questioning*; *higher cognitive level questions*; *periodic review*; *problem solving*; *receptive to unsolicited*

questions; sequential probing; and variety of instructional media. Two variables, i.e. *supportive*, and *use of humour* were categorised into the third category, i.e. teacher non-instructional characteristics/ attitudes because these two variables were better matched with teachers' attitudes than with the instructional approach. The second category, **the teacher's content-specific instructional approach**, was designed by the researcher that without any duplication with those from Lederman since the content was different. The third category, **teacher non-instructional characteristics/attitudes**, the variable *demeanour* was adopted. Two new variables were driven during the process of interviews, they were *respect for diversities*, and *impartial*. The fourth category was **classroom atmosphere**. The three variables *down time (wait time)*; *low anxiety*; and *rapport* were adopted. One variable *discipline* from drawn from the category of **student characteristics** to **classroom atmosphere** to describe the classroom rather than to describe the characteristics of students. The category **student characteristics** was deleted because it was not the main focus of this study. The variables were synthesized from the results of the pilot study. In this study, *teacher content-specific characteristics* were described as those teaching behaviours or methods in Liberal Studies lessons. During the interview, this list of classroom variables was discussed in order to explore how the classroom practice implemented by the teachers influences student conceptions of critical thinking.

Besides the survey and the semi-structured interviews, other methods were trialled but eventually

not adopted. First, classroom observation was proposed but this idea was rejected by the schools without explanation or reason. Second, document analysis was attempted but no useful data emerged. The latest assignment with teacher comments were examined but did not find any terms of critical thinking. Teachers only wrote down the comments such as “other important factors contributing to their relationship?”; “stable system contributes to the growth of Hong Kong financial industry”. Since these comments did not provide any useful data for examining the classroom practice, document analysis was abandoned.

3.4 The pilot study

A pilot study of the questionnaire and interviews were conducted in order to refine research instruments, to foreshadow research problems and questions, to highlight gaps and wastage in data collection, and to consider broader and highly significant issues such as research validity, ethics, representation and researcher health and safety (Sampson, 2004, 383).

A Liberal Studies teacher and her Form 6 students in a Band 3 school were invited to participate in this pilot study. The teacher had taught Liberal Studies for five years and she had experience of teaching AS LS in the same school. She was the panel head of Liberal Studies and was teaching Form 5 and 6 Liberal Studies. The teacher and her class of Form 6 students completed the questionnaire and finished the semi-structured interview in October 2014. In the questionnaire, the

Cronbach's Alpha of the skills dimension of critical thinking was .883 and the dispositional dimension was .660. The Cronbach's Alpha of 40 definers is .845. This means the reliability of the questionnaire was accepted (Bland & Altman, 1997, p. 572).

In order to predict how interviewees interpret the interview questions, a pilot study was carried out for the semi-structured interview. The teacher and three students from the Form 6 class were invited to participate in the interview. Since the term 'critical thinking' was not familiar to the students, the researcher was reminded to make sure the students understood the questions; to use examples to ensure that the concepts, sentences and words were adapted to the context of the students; that some questions may need to be rephrased; to ask logical questions for the students; and to ensure that the duration of interview is suitable (Hennick, Hutter, & Bailey, 2011, p. 120).

After conducting the pilot study for the interview, the interview question *Do you think your lessons are enjoyable to students? Why or Why not?* was found irrelevant to this study so it was deleted in the final version of the interview question guide. This question was replaced by question 8 *Please explain your answers on the questionnaire.*

3.5 Data collection procedures

The study was conducted in the second semester of 2014-15. Ethical issues were organised

beforehand, via informed consent. To conduct meaningful research, consent to participate should be provided by participants on an informed basis. The researcher is responsible not only for providing the relevant information about the research itself, and what participation will entail, but also for ensuring that this is understood by the participants (National Children's Bureau, 2011, p. 27). A Consent Form To Schools was distributed to the four participating schools to gain approval from the Principals for voluntary participation in the study. A Consent Form To Participants was also distributed to all the participants with the same objective. After giving their approval, teachers completed the printed copy of the teacher questionnaire which was collected on the day of the interview scheduled, for January and February 2015. Students acknowledged the research objectives and completed the printed copy of the student questionnaires in their Liberal Studies lessons. This kind of collective administration is advantageous in ensuring a high response rate (Kumar, 2011, p. 147).

The interviews were conducted after collecting all the completed questionnaires for data triangulation. Moreover, since teachers and students should clarify their answers on the questionnaire (Interview question number 8 *Please explain your answers on the questionnaire*), interviews should come later than the survey. Thirty two students were selected for the semi-structured interviews on a school day in February 2015. All the interviews were audio or video recorded for future analysis. All the data is safely stored and well managed by the

researcher. The students at Oxford School were interviewed twice, one in January and again in September 2015. This was because one student in each group had left the interview room earlier for some reason. In order not to miss any important data from each respondent, all eight respondent students at Oxford School were invited to participate in another interview in September when they were promoted to Form 6. The combination of the eight students was slightly different with the first interview for convenience purposes. The scripts of the second interview were cited as “Oxford School, second interview”.

3.6 Data analysis procedures

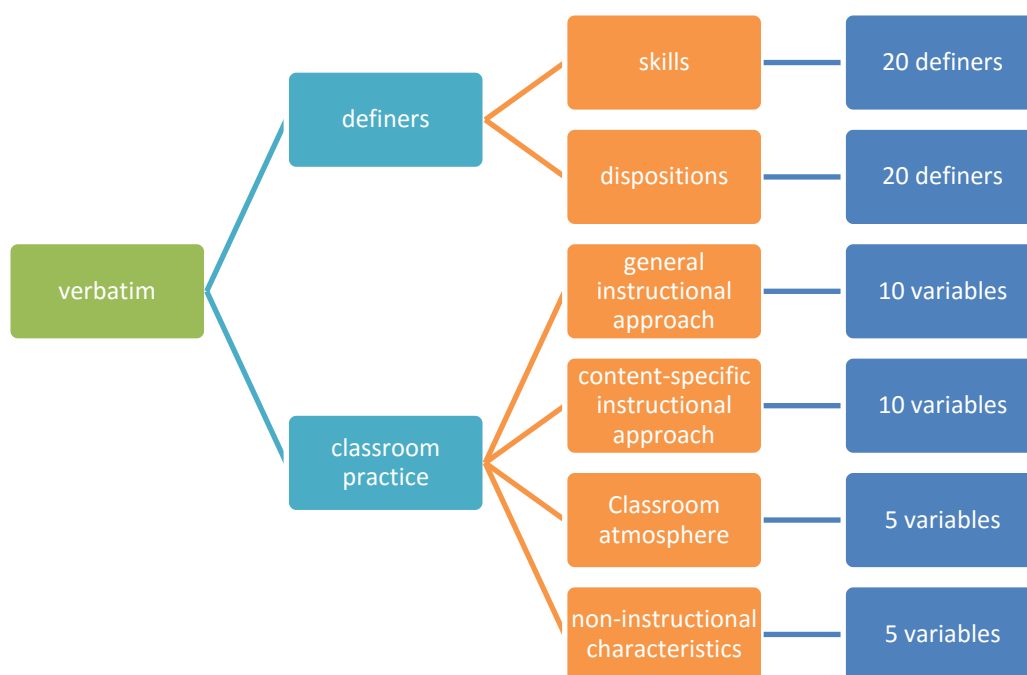
This study adopted a mixed approach. The quantitative and qualitative data collected from questionnaires and semi-structured interviews was analysed separately.

Once the data collected, the quantitative data from the teacher and student questionnaires was entered into computer for statistical analysis. First, descriptive statistics, including means and standard deviation were reported. Second, validity issues were handled such as reliability analysis, principal component analysis (PCA) and Rasch analysis (1960/1980). Third, mixed two-way ANOVA was conducted to investigate the relationship between school band and the choice of definers of critical thinking.

The qualitative data in this study was collected from the semi-structured interviews. The researcher served as the interviewer, recorder, and interpreter. There were three phases of data analysis. First, after collecting the data from interviews, the researcher transcribed the interviews verbatim into Chinese in order to ensure the ideas from the participants were preserved faithfully during the process of data analysis. Every word from the recording of the interviews was entered into Microsoft Word as a text file. Second, all the scripts were imported into NVivo version 8.0, which is a common qualitative software tool to lessen the workload of coding and analysing. After importation, the data was coded. A code represents and captures “a datum’s primary content and essence” (Saldana, 2013, p. 4). Coding is a method to organize and group similarly coded data into categories (p. 9). This coding process was achieved through theory-driven and data-driven approaches. The main codes were theory-driven in which the 40 definers of critical thinking, which categorized into skills and dispositional dimensions, were generated from literature reviewed including the conceptions of critical thinking from the scholars, while the 30 classroom variables were adapted from Lederman (1985) in which there were four categories describing the classroom practice that enhances critical thinking. The sub-codes in the classroom practice were developed based on the empirical data to show the actual teachers behaviours in the Liberal Studies classrooms. For example the variable *respect for diversities* was developed during the process of coding. This study adopted a Structural Coding method which is a question-based code that “acts as a labelling and indexing device, allowing researchers to quickly access data likely to

be relevant to a particular analysis from a larger data set” (Namey, Guest, Thairu, & Johnson, 2008, p. 141). This method is also “helpful for pulling together related data for development of data-driven thematic codes” (Namey et al., 2008, p. 141). As Saldana (2013, p. 84) noted, this is more suitable for interview transcripts than other data. As shown in Figure 2, the coding schemes were generated with total three levels of codes. A detailed list of codes is provided in Appendix 11.

Figure 2 Coding schemes



Third, a coding summary report was made. Translation into English was done only for the transcripts that were selected to be reported in this thesis. The list of codes was presented as Appendix 11.

3.7 Chapter summary

The focus of this chapter is to describe the methodology used in this mixed methods study. The conceptual framework of this study was based on the assumption that there is a relationship between teacher and student conceptions of critical thinking in Liberal Studies. The sample consisted of 14 Liberal Studies teachers and their 480 Form 5 students located in four secondary schools (two Band One and two Band Three) in Hong Kong.

This study was conducted in the second semester of 2014-15. The teachers and students in the four sampling schools completed the questionnaire, which consisted of 40 definers of critical thinking in which the respondents have to rate the level of agreement of the definer with the statement. Afterward, one teacher from each school, a total of four teachers, was interviewed individually. Eight Form 5 students from each school were chosen by the Random Integer Generator for the focus group interview, where the eight students were divided into two groups. A total of 32 students therefore participated in the semi-structured interviews. Each interview lasted about an hour and was audio or video recorded for analysis.

Since this is a mixed-approach study, the findings from quantitative and qualitative data are reported separately in Chapters 4 and 5 respectively.

Chapter 4 Findings of quantitative data

This study includes two kinds of data, quantitative data from teacher and student surveys, and semi-structured interviews with teachers and students. This section focuses on the findings of the quantitative data. First, the demographic data of the respondent schools, teachers, and students are presented. The second part is the descriptives, such as means and standard deviation. The third part involves the validity issues, in which reliability analysis, factor analysis, and Rasch analysis were used. Fourthly, a mixed two-way ANOVA was used concerning the relationship between school bands and dimensions of critical thinking.

The data was collected in January and February 2015. Students completed the questionnaire in Liberal Studies lessons and teachers completed it in their free time. There were different response rates among students, with an 89% and 90% response rate from two Band 1 schools and 71% and 78% from two Band 3 schools. The low response rate was due to drop-out, absence, and those who did not complete items 21 to 40 on page two of the questionnaire.

4.1 Demographics

Demographic data about school type, medium of instruction, school band, gender, age and teaching experience of teachers is presented below.

As mentioned, there are three types of schools in Hong Kong. All four respondent secondary schools were subsidized schools and also situated in the New Territories of Hong Kong.

All schools use Chinese in senior high school Liberal Studies, CMI. This means that the language used in lessons whilst teaching, the learning materials and examination materials were in Chinese.

Two schools (50%) were Band 1 and another two (50%) were Band Three. There were 295 (61.5%) students from Band One and 185 (38.5%) from Band Three.

There were 14 teachers teaching Form 5 Liberal Studies in survey. Five (35.7%) were male and nine (64.3%) female. Of the 480 students, 253 (52.7%) were male whilst 227 (47.3%) were female.

Six teachers (42.9%) were aged 20-29; 5 (35.7%) were aged 30-39; 1 (7.14%) were aged 40-49; and 2 (14.3%) were aged 50 or above.

Two participants (14.3%) had been teaching NSS LS 1-2 years; 1 (7.14%) had been teaching 3-4 years; and the majority (11 - 78.6%) had been teaching 5-6 years.

The majority taught had taught AL LS for 5 years or less (12 - 85.7%) and the rest of teachers (2 -

14.3%) had taught for 5-9 years.

4.2 Descriptives

Table 4.1 shows the results of the definers of critical thinking, ranked by their mean scores, from the 14 Liberal Studies teachers.

Table 4.1 Overall results of definers (from teachers)

Rank	Definers	S/D*	Mean	Std Deviation
1	Reflection	S	3.93	.75
1	Higher-order thinking	S	3.93	.84
3	Multiple perspectives	D	3.86	.73
3	Rational thinking	S	3.86	.77
5	Thoughtful judgments	S	3.79	.74
6	Analysis	S	3.71	.75
7	Respect for evidence	D	3.64	.79
7	Inference	S	3.64	.77
7	Synthesis	S	3.64	.87
7	Logic	D	3.64	.76
7	Tolerance towards a wide range of views and values	D	3.64	.95
12	Open-mindedness	D	3.50	.93
12	Evaluation	S	3.50	.88
12	Bias detection	S	3.50	.90
12	Assumptions identification	S	3.50	.87
12	Objectiveness	D	3.50	.88
17	Confidence in reasoning	D	3.43	.87
17	Clarity	S	3.43	.94
17	Inquisitiveness	D	3.43	1.01
17	Deductive reasoning	S	3.43	.87
17	Explanation	S	3.43	.83
22	Systematicity	D	3.36	.89
22	Judiciousness	D	3.36	.85
24	Interpretation	S	3.21	.86

24	Truth-seeking	D	3.21	.93
24	Self-correction	D	3.21	.89
24	Problem-solving	S	3.21	.94
24	Acceptance	D	3.21	.95
29	Convergent thinking	S	3.14	.94
30	Drawing conclusions	S	3.07	.91
31	Conceptualisation	S	2.86	.92
32	Fairness	D	2.71	.98
33	Application	S	2.64	.91
34	Self-regulation	S	2.36	.89
34	Responsibility	D	2.36	.96
36	Accuracy	D	2.50	.96
36	Specificity	D	2.50	.90
38	Consensus-seeking	D	2.20	.98
39	Persistence	D	2.07	1.34
40	Consistency	D	1.57	.98

*S=skill, D=disposition

Respondents were requested to categorise the given definers into one of the 4-point Likert Scales from 1=“not related to critical thinking at all” to 4=“strongly related to critical thinking”. Of the 40 definers, 30 definers had means over 3. According to Coniam (2013), there was a great *consumer validity*, i.e. “the validity of subjects’ attitudes and feelings towards a test” (p. 125). In this study, the respondent teachers and students *buy* the ideas that the 30 definers were related to critical thinking. Of these 30 definers that had great *consumer validity*, over 50% were skills. It is evident that, in teacher conceptions, the skills dimension of critical thinking was more strongly emphasised than dispositions. Of the top eleven ranked definers of critical thinking, seven were related to the skills dimension, *reflection*; *higher-order thinking*; *rational thinking*; *thoughtful judgments*; *analysis*; *inference*; and *synthesis*. Four were dispositions, *multiple perspectives*;

respect for evidence; logic, and tolerance towards a wide range of views and values. It is concluded that the teachers conceived of critical thinking as more inclined to the skills dimension.

Table 4.2 shows the results of the definers of critical thinking, ranked by their mean scores and standard deviation, from the 480 students.

Table 4.2 Overall results of definers (from students)

Rank	Definers	S/D*	Mean	Std Deviation
1	Multiple perspectives	D	3.53	.36
2	Rational thinking	S	3.47	.36
3	Analysis	S	3.42	.47
4	Thoughtful judgments	S	3.40	.43
5	Logic	D	3.34	.50
6	Inference	S	3.33	.50
7	Objectiveness	D	3.27	.52
8	Respect for evidence	D	3.26	.84
9	Higher-order thinking	S	3.22	.27
10	Reflection	S	3.17	.27
11	Judiciousness	D	3.14	1.08
12	Interpretation	S	3.12	.89
13	Explanation	S	3.07	.51
14	Assumptions identification	S	3.06	.52
15	Tolerance towards a wide range of views and values	D	3.04	.50
16	Clarity	S	3.02	.85
17	Synthesis	S	3.01	.50
18	Confidence in reasoning	D	2.96	.85
18	Conceptualisation	S	2.96	1.17
20	Drawing conclusions	S	2.95	1.00
21	Systematicity	D	2.93	.75

21	Deductive reasoning	S	2.93	.65
23	Evaluation	S	2.92	.86
24	Truth-seeking	D	2.91	1.12
25	Bias detection	S	2.90	.65
25	Fairness	D	2.90	.86
27	Self-correction	D	2.84	.80
28	Convergent thinking	S	2.78	1.03
29	Accuracy	D	2.76	1.02
30	Acceptance	D	2.72	.89
31	Problem-solving	S	2.70	.70
32	Open-mindedness	D	2.69	.94
33	Application	S	2.59	1.22
34	Specificity	D	2.53	1.02
35	Inquisitiveness	D	2.49	.51
36	Consensus-seeking	D	2.40	1.20
37	Self-regulation	S	2.34	1.01
38	Persistence	D	2.28	1.07
39	Consistency	D	2.21	1.02
40	Responsibility	D	2.11	1.01

*S=skill, D=disposition

In contrast to their teachers, the 480 students held a different view on which definers were related to critical thinking. As shown in Table 4.2, there were 17 definers with a mean higher than 3. This means, in student conceptions, less than half of the definers were closely related to critical thinking.

Similar to their teachers, students emphasised the skills dimension of critical thinking rather than the dispositional. Of the 17 closely related definers with mean higher than 3, only 6 were

dispositions (*multiple perspectives; logic; objectiveness; respect for evidence; judiciousness; and tolerance towards a wide range of views and values*). In the top ten ranked definers of critical thinking from students, 6 were skills dimensional (i.e. *rational thinking; analysis; thoughtful judgments; inference, higher-order thinking, and reflection*) and 4 were dispositional (i.e. *multiple perspectives; logic; objectiveness; respect for evidence*). It was evident that students slightly emphasised the skills more than the dispositional dimension.

4.3 Validity issue

In order to examine the validity of the questionnaire, the following analyses were conducted: reliability analysis, principal component analysis, and Rasch analysis. As mentioned, the sample size of teachers in the survey was 14 that was too small for calculations and it was not reliable, only the data from the 480 students were included in the analyses.

4.3.1 Reliability analysis

Item analysis was examined to consider reliability. Cronbach's alpha for the skills dimension, the odd number items, was .86 and ranged from .85 to .87, whereas Cronbach's alpha for the dispositional dimension, the even number items, was .80 and ranged from .79 to .81. Cronbach's alpha for all the 40 items was .91. This suggested that the questionnaire was generally well

constructed (Bland & Altman, 1997, p. 572).

4.3.2 Principal component analysis (PCA)

Some scholars have categorised critical thinking into two dimensions that includes skills and dispositional dimensions, such as Scriven and Paul (1987); Norris and Ennis (1989); Facione (1990, 2011); Ennis (1996); Elder and Paul (2010); and Halpern (2014). As mentioned, the list of 40 definers of critical thinking was thus generated from the literature and was categorised into two parts, the definers in odd numbers related to skills dimension of critical thinking and the definers in even numbers related to the dispositional dimension. In order to check whether the list of definers was really categorised into two groups, skills and dispositional dimensions, principal component analysis (PCA) was conducted. PCA decomposes the original data into a set of linear variates and is concerned with establishing which linear components exist within the data and how a particular variable might contribute to that component (also called variates, or factors) (Field, 2009, p. 638). A varimax rotated component matrix was adopted because it is a good general approach that simplifies the interpretation of factors (Field, 2009, p. 644). As suggested by Stevens (2002, p. 395), factor loadings less than 0.4 have not been displayed because the loadings were suppressed in the computation. The reason behind this was that this cut-off point was appropriate for interpretative purposes since loadings greater than 0.4 represent substantive values (Field, 2009, p. 666). After computation, five definers were not displayed since their factor loading

were smaller than 0.4; these were open-mindedness, confidence in reasoning, truth-seeking, tolerance towards a wide range of views and values, and convergent thinking.

A principal component analysis (PCA) was conducted on the 40 items with orthogonal rotation (varimax). The Kaiser–Meyer–Olkin measure verified the sampling adequacy for the analysis, $KMO = .90$ ('great' according to Field, 2009, p. 660). Bartlett's test of sphericity $\chi^2 (780) = 6278.04$, $p < .001$, indicated that correlations between items were sufficiently large for PCA. An initial analysis was run to obtain eigenvalues for each component in the data. Two components had eigenvalues over Kaiser's criterion of 1 and in combination explained 31.48% of the variance.

Table 4.3 shows the factor loadings after rotation.

Table 4.3 Rotated Component Matrix of definers of critical thinking

		Rotated Factor Loadings	
		Component	
	S/D*	1	2
Self-regulation	S		.48
Open-mindedness	D		
Reflection	S	.48	
Confidence in reasoning	D		
Higher-order thinking	S	.56	
Persistence	D		.41
Interpretation	S	.56	
Respect for evidence	D	.62	
Inference	S	.64	
Systematicity	D	.51	

Conceptualisation	S	.47	
Multiple perspectives	D	.71	
Synthesis	S	.47	
Responsibility	D		.62
Drawing conclusion	S	.43	
Consensus-seeking	D		.62
Evaluation	S	.42	
Judiciousness	D	.55	
Clarity	S	.59	
Consistency	D		.56
Bias detection	S	.43	
Truth-seeking	D		
Rational thinking	S	.75	
Self-correction	D		.45
Assumptions identification	S	.42	
Inquisitiveness	D		.47
Deductive reasoning	S	.44	
Tolerance towards a wide range of views and values	D		
Problem solving	S		.49
Acceptance	D		.51
Convergent thinking	S		
Fairness	D		.42
Explanation	S	.61	
Logic	D	.74	
Analysis	S	.74	
Specificity	D		.49
Thoughtful judgments	S	.70	
Objectiveness	D	.54	
Application	S		.51
Accuracy	D		.45
Eigenvalues		9.47	3.12
% of variance		23.68	7.80

*S=Skill, D=Disposition

As shown in Table 4.3, 22 items constituted component 1 which included 16 skills and 6

dispositions and 13 items in component 2 which included 3 skills and 10 dispositions. In other words, skill and dispositional definers appeared in both component 1 and 2. That means that the 40 definers were not clearly categorised into the two components. It seems that component 1 was more inclined to the skills dimension since it constitutes 73% skills dimensional definers whilst component 2 was more inclined to dispositions for it is composed of 77% dispositions.

4.3.3 Rasch analysis (1960/1980)

Rasch analysis is a method for “obtaining objective, fundamental, linear measures from stochastic observations of ordered category responses” (Linacre, 2006, p. 12). The Rasch model is a latent trait model which requires that “the data fit the model”. This means the collected data must meet specific requirements in order to achieve fundamental measurement (Yan & Bond, 2011, p. 184). One of the criteria for investigating the quality of the indicators is item fit statistics, such as Infit/Outfit MNSQ, ZSTD. Outfit is a t standardised outlier-sensitive mean square fit statistic which is “more sensitive to unexpected behaviour by persons on items far from the person's measure level” (Linacre, 2006, p. 201). MNSQ is the mean-square outfit statistic with expectation 1. Values substantially less than 1 indicate dependency in the data; values substantially greater than 1 indicate the presence of unexpected outliers. In this study, a stricter standard was adopted, and between 0.7 and 1.3 since MNSQ can be accepted as good fit between data and model (Yan & Mok, 2012, p. 274). As shown in Table 4.4, the values of Outfit MNSQ for 39 items (definers)

were greater than 0.7 and less than 1.3. Item 14, Responsibility, was 1.34 MNSQ. This is slightly greater than 1.3 and it was accepted if used the lenient MNSQ suggested that the value of Outfit MNSQ lies between 0.5 - 1.5 means productive of measurement (Linacre, 2006, p. 201). The results indicated that there was a good fit between data and model. This means that all the items (definers) appear to be measuring critical thinking conceptions.

Table 4.4 Rasch analysis - Misfit order

ENTRY	TOTAL	TOTAL	MODEL	INFIT	OUTFIT	PT-MEASURE	EXACT MATCH						
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	CORR.	EXP.	OBS%	EXP%	
ITEM													
14	1013	480	1.22	.06	1.31	5.0	1.34	5.3	A .32	.51	34.9	40.8	Q14
20	1060	480	1.07	.06	1.28	4.7	1.29	4.7	B .33	.50	37.4	40.6	Q20
6	1073	479	1.03	.06	1.24	4.1	1.28	4.5	C .31	.50	37.0	40.6	Q6
26	1195	480	.67	.05	1.23	4.0	1.24	4.0	D .39	.49	40.5	41.1	Q26
2	1289	480	.39	.06	1.16	2.8	1.21	3.4	E .33	.48	41.5	42.9	Q2
16	1154	480	.79	.05	1.19	3.3	1.18	3.1	F .38	.50	38.6	40.8	Q16
1	1125	480	.88	.05	1.13	2.3	1.16	2.8	G .30	.50	39.2	40.7	Q1
28	1457	480	-.15	.06	1.15	2.4	1.14	2.1	H .46	.44	43.0	47.1	Q28
22	1399	480	.04	.06	1.12	2.0	1.14	2.2	I .41	.46	47.8	45.4	Q22
38	1570	480	-.58	.06	1.13	1.9	1.13	1.8	J .46	.40	50.9	50.2	Q38
30	1306	480	.34	.06	1.08	1.5	1.10	1.7	K .43	.47	43.4	43.1	Q30
5	1546	480	-.48	.06	1.06	1.0	1.08	1.2	L .41	.41	45.1	49.3	Q5
12	1695	480	-1.18	.08	1.07	.9	1.02	.3	M .46	.35	64.9	59.8	Q12
31	1332	480	.26	.06	1.05	.9	1.07	1.2	N .43	.47	46.3	43.7	Q31
32	1390	480	.07	.06	1.06	1.0	1.05	.8	O .51	.46	46.1	45.3	Q32
21	1394	480	.06	.06	1.00	.0	1.04	.6	P .43	.46	46.6	45.3	Q21
11	1422	480	-.03	.06	1.02	.4	1.03	.5	Q .47	.45	46.6	46.2	Q11
4	1421	480	-.03	.06	1.01	.2	1.02	.4	R .41	.45	51.4	46.2	Q4
19	1448	480	-.12	.06	.98	-.3	1.02	.3	S .54	.44	48.4	46.7	Q19
36	1213	480	.62	.05	.95	-1.0	.98	-.3	T .43	.49	43.4	41.6	Q36
8	1566	480	-.56	.06	.87	-2.0	.98	-.3	t .48	.40	53.9	50.2	Q8
39	1241	480	.53	.05	.97	-.5	.97	-.4	s .44	.49	47.2	42.0	Q39
13	1446	480	-.11	.06	.94	-.9	.97	-.4	r .47	.44	46.6	46.7	Q13
15	1415	480	-.01	.06	.97	-.6	.96	-.6	q .49	.45	53.0	45.8	Q15
29	1295	480	.37	.06	.96	-.6	.96	-.7	p .49	.48	42.8	43.0	Q29
40	1327	480	.27	.06	.96	-.6	.96	-.7	o .52	.47	45.5	43.7	Q40
9	1596	480	-.69	.07	.91	-1.4	.95	-.7	n .48	.39	56.4	51.5	Q9
17	1401	480	.04	.06	.94	-1.0	.95	-.9	m .46	.45	45.9	45.6	Q17
10	1407	480	.02	.06	.93	-1.2	.94	-.9	l .48	.45	47.2	45.6	Q10
27	1406	480	.02	.06	.90	-1.7	.94	-1.0	k .47	.45	48.6	45.6	Q27
7	1499	480	-.30	.06	.94	-1.0	.92	-1.1	j .49	.43	51.4	48.1	Q7
25	1471	480	-.20	.06	.93	-1.2	.93	-1.0	i .50	.44	49.5	47.6	Q25

	18	1507	480	-.33	.06	.91	-1.4	.90	-1.5 h	.52	.43	53.9	48.2	Q18	
	24	1363	480	.16	.06	.90	-1.8	.91	-1.5 g	.49	.46	50.7	44.7	Q24	
	37	1633	480	-.85	.07	.90	-1.4	.85	-2.0 f	.48	.38	57.2	53.6	Q37	
	23	1666	480	-1.02	.07	.89	-1.5	.81	-2.4 e	.52	.36	63.9	57.3	Q23	
	35	1641	480	-.89	.07	.88	-1.7	.79	-2.9 d	.55	.37	61.8	54.8	Q35	
	3	1520	480	-.38	.06	.83	-2.7	.86	-2.1 c	.42	.42	55.3	48.4	Q3	
	34	1602	480	-.71	.07	.80	-3.1	.76	-3.4 b	.54	.39	60.1	51.6	Q34	
	33	1472	480	-.20	.06	.73	-4.8	.72	-4.7 a	.58	.44	57.4	47.6	Q33	
-----+-----+-----+-----+-----+-----															
	MEAN	1399.4	480.0	.00	.06	1.01	.1	1.01	.3			48.5	46.5		
	S.D.	168.5	.2	.57	.01	.13	2.2	.14	2.2			7.2	4.5		

4.4 Mixed two-way ANOVA

The students come from four schools of which, as mentioned, two are Band One and two Band Three. There is a hypothesis that there is a relationship, or association, between school bands and dimensions of critical thinking, skill and dispositional dimensions. Mixed ANOVA compares several means when there are two or more independent variables.

A 2 x 2 mixed ANOVA was conducted to evaluate the effectiveness of school bands on the dimensions of critical thinking. As shown in Table 4.6, the main effect for school band yielded an F ratio of $F(1, 478) = 1.75, p > .05$, indicating there was no difference between scores in Band 1 and in Band 3. The main effect for dimension yielded an F ratio of $F(1, 478) = 176.5, p < .001$, indicating that the score in skills ($M=60.4, SD=9.0$) significantly differed from that in dispositions ($M=56.3, SD=8.6$). There was significant interaction effect between school band and

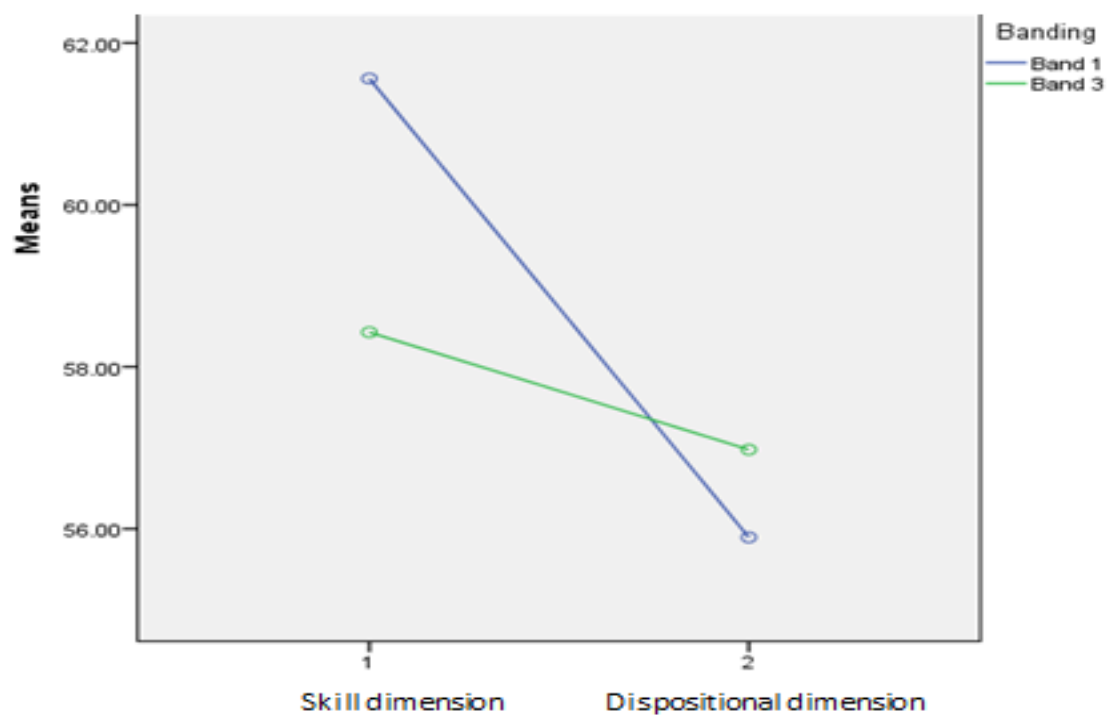
the dimensions of critical thinking with $F(1, 478) = 61.99, p < .001$. The interaction is illustrated in Figure 2. For skills, the score in Band One ($M=61.56, SD=8.3$) was higher than the score in Band Three ($M=58.43, SD=9.74$) whereas for dispositions, the score in Band One ($M=55.9, SD=8.3$) was lower than the score in Band Three ($M=56.98, SD=9.03$).

Table 4.5 Results of ANOVA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^a
Intercept	3082555.927	1	3082555.927	22606.088	.000	.979	22606.088	1.000
Band	238.636	1	238.636	1.750	.187	.004	1.750	.262
Error	65179.863	478	136.360					

a. Computed using alpha = .05

Figure 2 Interaction effect between school band and dimension of critical thinking



As illustrated in Figure 2, there was a relationship between school bands and the dimensions of critical thinking. In skills dimension of critical thinking, the Band One school students got the mean 61.56 while Band Three school students got 58.43. That means the Band One school students were more inclined to the skills dimension of critical thinking comparing to the Band Three school students. There was a different result in dispositional dimension of critical thinking, in which Band Three school students got the mean 56.98, slightly higher than the Band One school students who got mean 55.9. That means the Band Three school students were slightly more inclined to the dispositional dimension. In other words, the more abled students were found more inclined to the skills dimension of critical thinking while the less abled students were slightly inclined to the dispositional dimension.

4.5 Chapter summary

Based on the quantitative data from the teacher and student surveys, the instrument (questionnaire of the list of 40 definers of critical thinking) was reliable, since the Cronbach's alpha was .91. When calculating the student survey, as from the results of Rasch analysis, the values of Outfit MNSQ of 97.5% of the definers were between 0.7 to 1.3, and therefore the instrument was measuring the conceptions of critical thinking. There were two interesting findings. First, the results of PCA revealed that there was a discrepancy between the conceptions of critical thinking between scholars and students. As noted, the scholars conceived critical thinking as two

dimensional, consisting of skills and dispositions. The student respondents, however, regarded critical thinking as one dimensional. That means students had no intention of categorising the definers of critical thinking into dimension. Second, as seen from the mixed two-way ANOVA, it was found that there was a relationship between school bands and the dimensions of critical thinking. The Band One school students were more inclined to the skills dimension of critical thinking and the Band Three school students were slightly more inclined to the dispositional dimension.

In comparing the top ten ranked definers between teachers and students, as shown in Table 4.6, there were common definers which both teachers and students regarded as closely related to critical thinking. They were *rational thinking, thoughtful judgments, reflection, higher-order thinking, analysis, inference, respect for evidence, and multiple perspectives*.

Table 4.6 Comparison between Top 10 ranked definers from teachers and students

Rank	Teachers	S/D*	Students	S/D*
1	Reflection	S	Multiple perspectives	D
2	Higher-order thinking	S	Rational thinking	S
3	Multiple perspectives	D	Analysis	S
4	Rational thinking	S	Thoughtful judgments	S
5	Thoughtful judgments	S	Logic	D
6	Analysis	S	Inference	S
7	Respect for evidence	D	Objectiveness	D
8	Inference	S	Respect for evidence	D
9	Synthesis	S	Higher-order thinking	S
10	Logic	D	Reflection	S

*S=skill, D=disposition

There were differences and similarities in comparing teacher and student conceptions. As revealed from the above data, the high similarity confirms that there is a close relationship between teacher and student conceptions of critical thinking. The quantitative data, however, cannot explain which factors contribute to this relationship, and therefore, it is necessary to investigate this relationship through the qualitative data obtained from interviews, which will be presented in the next section.

Chapter 5 Findings of qualitative data

In addition to the quantitative data from the questionnaires, qualitative data was provided by the semi-structured interviews. At each of the sample schools, one teacher and 8 students were invited to participate in the interviews. The student interviews were conducted in a focus group, each group consisting of four students, in total 32 students. The qualitative data from teacher and student semi-structured interviews was reported respectively. The main purpose of the interviews was to investigate teacher conceptions of critical thinking (research question 1); student conceptions of critical thinking (research question 2); and the relationship between these two conceptions (research question 3).

5.1 Teacher conceptions of critical thinking

In answering the interview question 1 *From your perspective, what is critical thinking?*, and question 8 *Please explain your answers on the questionnaire*, respondent teachers mentioned many terms. Teacher response in interviews was illustrated as Table 5.1. According to the responses, four main themes were addressed which all included these four definers of critical thinking. These four themes were: *higher-order thinking*, *inference*, *analysis*, and *thoughtful judgments*.

Table 5.1 Teacher response in interviews

Definers of Critical Thinking	Owen (Oxford School)	Oliver (Omega School)	Terry (Trinity School)	Tracy (Tiffany School)
1. Self-regulation	y			
2. Open-mindedness		y	y	
3. Reflection			y	
4. Confidence in reasoning	y	y	y	
5. Higher-order thinking	y	y	y	y
6. Persistence	y	y		
7. Interpretation				
8. Respect for evidence	y			y
9. Inference	y	y	y	y
10. Systematicity	y	y	y	
11. Conceptualisation	y	y		
12. Multiple perspectives		y	y	y
13. Synthesis				
14. Responsibility		y		y
15. Drawing conclusions	y	y		y
16. Consensus-seeking			y	
17. Evaluation				
18. Judiciousness	y			
19. Clarity		y		y
20. Consistency			y	
21. Bias detection	y		y	y
22. Truth-seeking	y		y	
23. Rational thinking			y	y
24. Self-correction				
25. Assumptions identification			y	
26. Inquisitiveness		y	y	y
27. Deductive reasoning	y		y	
28. Tolerance towards a wide range of views and values		y		y
29. Problem-solving	y		y	y
30. Acceptance		y		
31. Convergent thinking				

32. Fairness		y		
33. Explanation			y	y
34. Logic		y	y	y
35. Analysis	y	y	y	y
36. Specificity				
37. Thoughtful judgments	y	y	y	y
38. Objectiveness		y		y
39. Application	y	y		
40. Accuracy				

y=teachers noted this definer

Theme 1: Higher-order thinking

Higher-order thinking is always regarded as the foundation of the theory of critical thinking (Duron, Limbach & Waugh, 2006, p. 160). The respondent teachers did not define *higher-order thinking*; however, they all agreed that critical thinking is a kind of higher-order thinking.

“Critical thinking is higher-order....when they (students) are required to make judgments and comparisons, they will find difficulties, so I think this kind of thinking which is required in Liberal Studies belongs to higher-order thinking” (Owen)

Another teacher highlighted the weakness of her students in achieving *higher-order thinking*:

“Our students are Band Three school students, most are weak. If they are required to think on a slightly higher-order, they can’t do so” (Tracy).

Two other teachers thought that *higher-order thinking* is judgment making, based on various factors, not only personal opinions:

“We should understand the practical situation before making judgments, not depend on the personal opinions we mentioned before. I think that this kind of thinking is critical thinking. The conclusion may be the same but it is higher-order. This kind of thinking considers various factors, not just the personal factor” (Oliver)

“As I mentioned, higher-order thinking is not only considers our standpoints, we should also consider the weaknesses of other people, we express our opinions before seeing the whole picture.” (Terry)

In teacher conceptions, critical thinking was recognised as *higher-order thinking* which is required in Liberal Studies; however, Band Three school teachers found that it was difficult for their students to acquire this kind of thinking.

Theme 2: Thoughtful judgments

The term *thoughtful judgments* describes a person who carefully considers things when making judgments, the act of deciding, understanding and having good sense (Paul & Elder, 2006, p. 314).

Teachers clearly explained the process of making *thoughtful judgments*:

“Critical thinking is what you should use before making judgments. For example,

whether we should or should not do something, agree or disagree something, or to analyse pros and cons. That is when you should undergo this process of making judgments.” (Owen)

Owen provided an example from daily life to further explain how to make judgments: waking up late and how to arrive at school on time.

“I think that critical thinking requires a process of information gathering. You should understand the information from every aspect; understand the perspectives of every stakeholder. And then you can think about it thoroughly.....you can request comments from other people....Finally you can take your own standpoint. ” (Terry)

Terry further explained that people should go through the above process because there is too much information in society. Relying on a certain aspect of information leads to misunderstanding.

Teachers provided example of issues when explaining what *thoughtful judgment* is:

“Some of our students are sensitive to political issues. In Occupy Central, they analysed the information they got from the newspaper. Teachers also explained in the lessons. Finally they decided whether to participate or not.” (Tracy)

“Concerning the issue of solid waste, I disagree with the proposal for the enlargement

of landfill in Tuen Mun not because I'm living there.....I am aware that the issue of solid waste in Hong Kong must be managed.....If we don't enlarge the landfill in Tuen Mun, what else can we do? I must consider many real situations before making judgment. This is not based on personal factors.” (Oliver)

Like Owen, Oliver also provided a daily example to illustrate why students need *thoughtful judgments*: what to eat in the class lunch on the last teaching day.

To conclude, teachers emphasised that the procedures for making *thoughtful judgments* that should not be based on personal opinions only. Examples of issues in Liberal Studies were used to elaborate this process.

Theme 3: Analysis

Analysis is a skill “to identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experiences, reasons, information, or opinions” (Facione, 2011, p. 21). Findings showed that *analysis* was found to be another major skill in critical thinking:

“Skills in Liberal Studies? I think there are many kinds of skills. For example, the easiest one is data description. Another example is to analyse information. These

skills are much easier.” (Owen)

Some teachers gave a short sentence when defining critical thinking:

“Critical thinking is a way of thinking which depends on information. It includes analysis and judgment making.” (Tracy)

“Which definers relate to critical thinking? Logic and analysis.” (Oliver)

In teacher conceptions and their classroom practice, *analysis* was an important skill in Liberal Studies that they emphasised in their lessons. They thought that there were some skills in critical thinking and *analysis* was one of them.

Theme 4: Inference

According to Facione (2011), *inference* is a skill “to identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation” (p. 21). Two teachers emphasised the weaknesses of their students in drawing *inferences*:

“In the process, they (students) must think whether this inference is right or wrong, if there is any evidence base. I am worried because they (students) always use affective

words..... They use the language in their daily lives and think that this is inference”

(Owen)

“They can’t draw inferences, not because of lack of knowledge, it’s because they are incapable of drawing inferences.” (Oliver)

Regardless of the weaknesses of students in drawing *inferences*, teachers shared their experiences in helping students to draw *inference*:

“In the process of debate, when other students voice something they don’t agree with, they will point out the weaknesses of other students. Then they raise the evidence to prove the weaknesses of the arguments of other students. So that debate can help them to draw inferences” (Tracy)

“The group discussion lesson can help them in developing multiple perspectives, drawing inferences, logic, and analysis. When students come out to present their arguments, it will not be very clear before Q&A. I will ask them questions. I think this can help them to think thoroughly. (Terry)

The teachers reported that drawing *inferences* was difficult for their students, however, teachers put effort into helping students to make improvements through classroom practice such as debates and group discussions.

To conclude, respondent teachers noted many definers of critical thinking during the interviews as in Table 5.1. Among the 40 definers, four definers were noted by all respondent teachers and were regarded as the four themes generated from the interviews. They were *higher-order thinking*, *thoughtful judgments*, *inference*, and *analysis*. The teachers regarded critical thinking as a kind of *higher-order thinking*, and as a foundation for making *thoughtful judgments*, which consists of the skills of *inference* and *analysis*. The four themes collected from teacher responses, *higher-order thinking*, *thoughtful judgments*, *inference*, and *analysis*, were all in the skills dimension of critical thinking. Teachers neglected dispositions during the interviews in which 8 definers (*consensus-seeking*, *judiciousness*, *consistency*, *acceptance*, *fairness*, *self-correction*, *specificity*, and *accuracy*) were noted by one teacher only and the last three definers were never noted by any teacher. It is clear that the teachers emphasised the skills dimension of critical thinking.

An interesting finding was that some key words had been neglected in the teacher interviews, such as *interpretation*, *synthesis*, and *evaluation* which serve as important terms in the Level 5 Descriptors (HKEAA, 2007). These terms were also noted by the scholars including Elder and Paul (2010); Glaser (1941); Facione (1990, 2011); Fisher and Scriven (1997); Halpern (2014); Scriven and Paul (1987) in the skills dimension of critical thinking. Surprisingly, these terms were not noted by teachers; however, they were reported by students when describing classroom practice.

The importance of the skills dimension of critical thinking demonstrated in the qualitative data was echoed with the quantitative data. As noted, there were seven skills among the top ten ranked definers from teacher responses. The four themes generated from teacher interviews were among these. In the results of the survey, *higher-order thinking* ranked in top second; *thoughtful judgments* ranked fifth; and *analysis* and *inference* were in sixth and seventh. The teachers provided congruent responses in the survey and interviews in which they thought that the skills dimension of critical thinking was very important.

5.2 Student conceptions of critical thinking

In answering interview questions 1 and 8, respondent students addressed four main common themes to which critical thinking is related: *multiple perspectives*, *rational thinking*, *analysis*, and *thoughtful judgments*. The themes were generated from student responses in interviews in which all groups of students had noted these four definers (see Table 5.2).

Table 5.2 Student response in interviews

Definers of Critical Thinking	Oxford School		Omega School		Trinity School		Tiffany School	
	Gp 1	Gp 2	Gp 1	Gp 2	Gp 1	Gp 2	Gp 1	Gp 2
1. Self-regulation	y							
2. Open-mindedness			y		y	y		
3. Reflection		y			y	y	y	y
4. Confidence in reasoning	y	y						
5. Higher-order thinking			y	y				
6. Persistence			y	y				
7. Interpretation			y					
8. Respect for evidence	y	y	y		y	y		y
9. Inference	y	y		y	y		y	y
10. Systematicity			y			y	y	y
11. Conceptualisation			y		y	y	y	
12. Multiple perspectives	y	y	y	y	y	y	y	y
13. Synthesis	y		y		y	y	y	y
14. Responsibility								
15. Drawing conclusions	y	y		y		y	y	y
16. Consensus-seeking					y			y
17. Evaluation		y	y					
18. Judiciousness		y		y			y	y
19. Clarity			y	y	y	y		y
20. Consistency								
21. Bias detection		y		y	y	y		y
22. Truth-seeking		y					y	
23. Rational thinking	y	y	y	y	y	y	y	y
24. Self-correction			y	y	y			y
25. Assumptions identification		y			y	y		
26. Inquisitiveness				y				
27. Deductive						y	y	

reasoning								
28. Tolerance towards a wide range of views and values	y	y	y	y		y	y	y
29. Problem-solving		y			y			y
30. Acceptance	y				y	y	y	
31. Convergent thinking				y				
32. Fairness								y
33. Explanation		y	y			y	y	y
34. Logic	y					y	y	
35. Analysis	y	y	y	y	y	y	y	y
36. Specificity			y					
37. Thoughtful judgments	y	y	y	y	y	y	y	y
38. Objectiveness	y	y	y	y	y	y		y
39. Application	y				y	y		
40. Accuracy	y						y	

y=students noted this definer

Theme 1: Multiple perspectives

Students were familiar with the term *multiple perspectives* that they quoted in numerous responses.

In defining critical thinking, they said:

Student A: We make judgments after looking from multiple perspectives.

Student B: (Critical thinking) means to view a matter from multiple perspectives”.

(Oxford school, Group 1)

“To analyse from different perspectives. The standpoint is not important. The most important thing is to be neutral when you are making judgments.” (Oxford school,

Group 2, Student A)

“To look at an issue from different perspectives, not from one side only.” (Trinity school, Group 1, Student B)

“When we decide to agree or disagree something, we should think about both sides, this is two perspectives. So this is critical thinking.” (Omega School, Group 1, Student A)

“I think multiple perspectives relate to critical thinking.....Because we should consider an issue from every perspective, right or wrong, or different opinions on that matter.” (Omega School, Group 2, Student B)

“When we want to see the whole picture of a matter, we should consider different perspectives from the viewpoints of different stakeholders. The final objective is to make judgments.” (Tiffany School, Group 1, Student B)

Some students argued that *multiple perspectives* means considering the opinions of different stakeholders, while others thought that the standpoints of agreeing and disagreeing were also perspectives. They all thought that *multiple perspectives* were important in making judgments, to decide whether a matter is right or wrong, and a personal standpoint about whether to agree or disagree with something.

Some students used examples from issues to define what *multiple perspectives* are:

“I think that it is to find out right and wrong, from multiple perspectives to look at a matter. For example the news reported that the protesters in Occupy Central blocked the road and created chaos. They neglected the good sides of the protesters. Therefore we should look at a matter from different angles.” (Trinity School, Group 2, Student C)

Students were familiar with the idea that the term *multiple perspectives* include at least two angles from which to consider an issue. They used a controversial issue in a Liberal Studies lessons as an example to illustrate what different perspectives means: for and against Occupy Central. They thought that judging an incident from only one perspective is not appropriate; thus, judging from *multiple perspectives* is important to see the whole picture of an issue.

Theme 2: Rational Thinking

Similar to their teachers, almost every group of students mentioned *rational thinking*. The importance of *rational thinking* was emphasised:

“Rational thinking and multiple perspectives are the prerequisite of critical thinking”
(Oxford School, Group 1, Student B)

Some students tried to give a definition for *rational thinking*:

“(What is rational thinking?) I think that it is no personal feelings. To be objective, no personal opinions.” (Oxford School, Group 2, Student D)

“(What is rational thinking?) It is similar to subjective and objective. Do not take sides, should see an issue in neutral, the advantages and disadvantages of each side.” (Omega School, Group 1, Student B)

A student used examples of issue to explain what *rational thinking* is:

“(What is rational thinking?) Let’s take parallel goods trader as an example. If the discussants hate a parallel goods trader, they will find the parallel goods trader always wrong. Maybe there are some reasons that drive some people to be parallel goods traders. Some people are so radical that they think parallel goods traders are doing wrong things. I think we should judge this issue from a neutral perspective.” (Trinity School, Group 1, Student C)

A student described the role of *rational thinking* in Liberal Studies lessons:

“I think that critical thinking is quite rational. That means to see an issue from a neutral point. No influence from other opinions. Only judge what is good and what is not good. If classmates bring their own standpoints to a debate, this is not rational.” (Tiffany

School, Group 2, Student B)

Most of the students thought that *rational thinking* was embedded in critical thinking. They thought that it was important to be rational and be neutral when making judgments. Students believed that they can make a judgment after considering opinions from *multiple perspectives*.

Theme 3: Analysis

Analysis was a common term noted in student interviews. A student regarded critical thinking as comprising *analysis*:

“I think that both analysis and logic relate to critical thinking.” (Oxford School, Group 1, Student D).

Some students highlighted the importance of *analysis* in Liberal Studies lessons:

“I think that critical thinking is important since we have to analyse the contributing factors and effects of an issue. We should apply critical thinking to consider the contributing factors and effects, so that we can answer correctly in the exams.” (Oxford School, Group 2, Student C).

“To analyse the social or economic effects of a policy or an issue.” (Omega School, Group 2, Student B)

Teachers helped students to analyse information:

“We choose the hot issues to report on the Liberal Studies newspaper cutting assignment, and then we share our findings with our classmates during the lessons.

Teacher and classmates listen, and then we all analyse the news.” (Trinity School, Group 1, Student C)

“After giving us the issue, the teacher leads us to consider the issue from different perspectives. He also gives examples. We then analyse and draw conclusions.”

(Tiffany School, Group 1, Student B)

Students were familiar with the term *analysis* and recognised its importance in Liberal Studies since they were required to demonstrate *analysis* in the examinations. Students also reported that their teachers helped them to analyse information and the issues in daily practice such as through teacher elaboration and newspaper cutting assignments.

Theme 4: Thoughtful judgments

Students shared a similar view to that of their teachers, that the essence of *thoughtful judgments* was frequently noted in interviews. Students explained how to make *thoughtful judgments*:

“I think that we should be neutral first, and then we should examine the issue clearly from pros and cons. Finally we take the side that we agree with....This is a process.”

(Oxford School, Group 2, Student D)

“To understand an issue thoroughly, and then make judgments.” (Trinity School, Group 2, Student C)

“It is a process. We make judgments after listening to various comments from various people.” (Omega School, Group 1, Student A)

“To think in your brain after examining an issue, and then analysing the pros and cons, and the opinions of different stakeholders.” (Omega School, Group 2, Student D)

Some students reported how their teacher helped them to make *thoughtful judgments* in essays:

“Sometimes we have to write two essays, one agreeing and the other disagreeing. Therefore we can look in depth at the reasons I agree and disagree. To understand the question more deeply.” (Tiffany School, Group 1, Student A)

Some students used examples of law making to illustrate how *thoughtful judgments* may be implemented in Liberal Studies lessons:

“(Student A) Just like comparing the pros and cons.....to decide whether to legislate a law or not.

(Student B): And also provide us a direction how to improve the law after legislation.”

(Tiffany School, Group 2)

To the students, the process of *thoughtful judgments* involves judging an issue after examining the pros and cons, and the opinions of different stakeholders. In order to facilitate the skill of making *thoughtful judgments*, teachers designed assignments involving writing two essays, one for the pros and the other for the cons of an issue, with the intention of forcing students to think about an issue from both sides.

To conclude, the respondent students noted many definers of critical thinking during the interviews as in Table 5.2. Among the 40 definers, four definers were noted by all respondent students, regardless of the school bands, and were regarded as the four themes generated from the interviews. They were *multiple perspectives*; *rational thinking*; *analysis* and *thoughtful judgments*. The students regarded critical thinking as a kind of *rational thinking* and *thoughtful judgments*, which consists of the skill of *analysis* and disposition of *multiple perspectives*. Of the four themes collected from student responses, *multiple perspectives* related to the dispositional dimension of critical thinking and *rational thinking*, *thoughtful judgments*, and *analysis*, belonged to the skills dimension. It is evident that the students were emphasised the skills dimension of critical thinking more than the dispositional dimension.

These four themes were the most common student responses in interviews; and they also coincided with the quantitative data. The four themes collected from student interviews were

exactly the same top ranked definers as from the student survey. In the student survey results, *multiple perspectives*, *rational thinking*, *thoughtful judgments*, and *analysis* were ranked first, second, third, and fourth respectively. The students provided responses in the survey and interviews in which they recognised that critical thinking included the above four themes.

The findings from the teacher and student interviews were consistent to the quantitative data. Both respondents tended to emphasise the skills dimension of critical thinking in which *higher-order thinking* and *rational thinking* were quoted by teacher and student interviews respectively. The terms *thoughtful judgments* and *analysis* were recognised as related to critical thinking by both teachers and students. Since these terms are the skills dimension of critical thinking, therefore, it is evident that the respondents strongly emphasised the skills dimension of critical thinking. Students placed *multiple perspectives* as the first ranked chosen definer in the survey and they also noted that *multiple perspectives* very often in the interviews, however, skills dimensional definers were mentioned more often than the dispositional definers. It is clear that both teachers and students conceived of critical thinking as more closely related to the skills dimension. The dispositional definers *consistency* and *responsibility* were not mentioned by students in the interviews. Coincidentally, these two definers were ranked as 39th and 40th respectively in the student survey.

As illustrated from the quantitative and qualitative data, teachers and students were found to

emphasise the skills dimension of critical thinking. The qualitative data was found consistent with the quantitative data. The terms noted by the respondent teachers (i.e. *higher-order thinking, inference, analysis, and thoughtful judgments*) and students (i.e. *multiple perspectives, rational thinking, analysis, and thoughtful judgments*) were also the top ranked definers in the survey. Skills dimensional definers were more strongly emphasised in interviews.

5.3 Relationship between teacher and student conceptions of critical thinking in Liberal Studies

After elaborating on teacher and student conceptions of critical thinking, this section focuses on exploring the relationship between these two conceptions from the findings of interviews. Since the sample size of teachers in the survey was too small to render a quantitative comparison possible between teacher and student conceptions of critical thinking, the qualitative data is very significant in examining the relationship.

As mentioned by the conceptual framework as Figure 1, Liberal Studies teachers are assumed to have their own conceptions of critical thinking, which influence classroom practice since teachers are the significant designers of classroom practice. Situated in this classroom practice, student conceptions of critical thinking were assumed to be influenced. It was assumed that a relationship is existed exists between teacher and student conceptions, with the key element, classroom practice, in between them. The findings from teacher and student interviews confirmed that there

was a relationship, both *explicit* and *implicit*, between teacher and student conceptions of critical thinking. Here, *explicit* means a clear and direct relationship which leaves no room for confusion or doubt while *implicit relationship* means the unexpressed and indirect relationship between teacher and student conceptions of critical thinking. The evidence of this relationship was found in the classroom practice, i.e. teacher content-specific and teacher general instructional approaches. As noted, a teacher's content-specific instructional approach is described as the teaching behaviours or methods in Liberal Studies lessons and a teacher's general instructional approach is the common teaching behaviours or methods in lessons, regardless of subjects. Both teacher content-specific instructional approach and a teacher's general instructional approach were found to have an explicit relationship with teacher and student conceptions of critical thinking.

5.3.1 Explicit relationship in classroom practice

As mentioned, *explicit* means a clear and direct relationship which leaves no room for confusion or doubt. In this study, there was an explicit relationship in the classroom practice that was influenced by teacher conceptions of critical thinking and accordingly influenced student conceptions of critical thinking.

Teacher content-specific instructional approach

As mentioned, *teacher's content-specific instructional approach* describes those teacher behaviours in a specific subject lesson, which means Liberal Studies in this current study. The following teacher content-specific instructional approach played a significant role in shaping student conceptions of critical thinking:

■ *Emphasis on answering techniques*

Liberal Studies teachers emphasised drilling the skills of answering techniques such as *multiple perspectives, analysis, judiciousness, inference, counter argument, objectiveness, and evaluation*, where these terms were significant requirements in the Liberal Studies level descriptors (HKEAA, 2014).

● *Multiple perspectives*

As indicated by the results of the survey, the 480 respondent students regarded critical thinking as more in the skills dimensional than dispositional. However, a dispositional definer, *multiple perspectives*, was seen as an important term from student survey and interviews. According to the curriculum and assessment (C&A) guide, *multiple perspectives* is a term to describe the traits of a person who “evaluates critically and interprets objective information and knowledge by considering the pros and cons of the arguments, and be aware of the limitations in, and

alternatives to, the positions they have chosen” (CDC & HKEAA, 2007, p. 90). It was, however, seen as one of the skills in answering techniques. The term *multiple perspectives* was one of the main themes generated from student interviews. In responding to the question *What wordings does your teacher use in lessons*, students replied:

“Multiple perspectives! Our teacher mentioned it.” (Omega School, Group 1, Student B)

Students reported that their conceptions of critical thinking as involving *multiple perspectives* were influenced by their teachers:

Researcher: Did your teacher do or say something that you think it is about critical thinking?

Student: He taught us the answering framework at the very beginning. For example the social aspect, economic aspect.....we can't think of the economic aspect if he does not tell us. He taught us how to answer from different aspects.....We can understand how to write an essay from different aspects.”

Researcher: So you think that answering from different aspects is related to critical thinking?

Student: Yes. (Oxford School, Group 1, Student B)

A student used an example to elaborate on the importance of using *multiple perspectives* in writing essays:

“The teacher guides us to think about more stakeholders in writing essays. For example ‘citizen’ means different people in Hong Kong, including Choi Yuen Villagers and non-Choi Yuen Villagers. Among the non-Choi Yuen Villagers, there are developers and other people who are running business. He teaches us to widen our thinking, and then we can have critical thinking.” (Oxford School, Group 1, Student A)

The following excerpt illustrated the importance of multiple perspectives as an answering technique:

Researcher: Do you need the skill of multiple perspectives in writing essays?

Student A: Absolutely!

Researcher: Who told you that you must do so?

Student D: Teacher!....He told us to state which perspective we use at the beginning of each paragraph.

Researcher: So you must think from multiple perspectives in writing essays and in examinations, and therefore you think that multiple perspectives are related to critical thinking?

Students: Yes! (Oxford School, second interview, Group 1)

Teachers reported that they did not mention the term *critical thinking*, however, what they did and what they required students to do in the lessons was regarded as critical thinking:

“Our teacher habitually trains us to look at an issue from different perspectives....He won’t stress this is critical thinking but he trains us to think from this way. So I think

that to look at a matter from different perspectives is critical thinking.” (Omega School, Group 1, Student B)

A clear example:

Researcher: Can you think of any incident where the teacher teaches critical thinking in Liberal Studies lessons?

Student B: I did not realise that he has taught us critical thinking, however, when he asks us to think of an issue, we naturally view the issue from different aspects.

Researcher: Did your teacher teach you to do so?

Student B: Yes!

Student A: Yes! He did not emphasis that this is critical thinking, but the way he teaches us to think is critical thinking.

Researcher: So you think that your teacher had taught you critical thinking because to view an issue from different aspects is critical thinking?

Students: Yes! (Omega School, Group 2)

This finding was consistent to the results of the survey that students regarded *multiple perspectives* as an important element in critical thinking. Teachers remind their students to consider an issue from multiple perspectives and write the perspectives clearly in the essays.

● Analysis

In learning answering techniques, students thought that what teachers always do or ask them to do

was very important. In answering the question *What is critical thinking*, a student immediately reported *analysis*:

Researcher: What word was noted by your teacher?

Student C: Analysis. He teaches us to analyse information and then apply it to the topic.

(Omega School, Group 2)

Analysis is the ability to “identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experiences, reasons, information, or opinions” (Facione, 2011, p. 21). *Analysis* was ranked third in the student survey, and was one of the main themes generated from the student interviews.

Another student explicitly stated the relationship between *analysis* and critical thinking:

Student D: I think that analysis and logic relate to critical thinking.....Because the important element of critical thinking is whether there is logic in what one’s saying. If he misses an important point, other people can refute him. We should analyse the logic of speech, this is critical thinking (Oxford School, Group 1).

● *Judiciousness*

Students reported that there were some dispositions required during the process of *analysis*:

Researcher: What words does your teacher teach you in the lesson?

Student C: Judiciousness.

Researcher: When will you need it?

Student A: In searching for and analysing data, in deciding which materials we can use (Omega School, Group 1).

Another group also thought that *judiciousness* was important in writing essays:

Researcher: In addition to multiple perspectives, which term does your teacher recognise as important?

Student C: Judiciousness.

Researcher: How did your teacher say that?

Student D: He told us to carefully analyse each argument from different angles, don't just look at the surface; we should analyse step-by-step, we can't jump to a conclusion without looking at the middle of a matter (Oxford School, second interview, Group 1).

● *Inferences*

In addition to *analysis* and *judiciousness*, among the various answering techniques, teachers strongly emphasised the skill of drawing *inferences*. *Inference* is the ability to “identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to deduce the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation” (Facione, 2011, p. 21). When learning the technique of making *inferences*, students discovered the usefulness of inference in nurturing disposition:

Student B: I think that respect for evidence is important since we use example to infer an incidence. Therefore evidence is the most important element in critical

thinking. In answering questions, we should provide examples, drawing inferences and arguments.

Researcher: This is what your teacher teaches you?

Student D: He said we should provide data in every essay.

Researcher: Data is evidence?

Students: Yes. (Oxford School, second interview, Group 1)

Teachers reminded their students to provide evidence when drawing *inferences* which demonstrated that teachers emphasised the disposition of *respect for evidence*. *Respect for evidence* is used to describe a person who “shows the respect for evidence that consists of facts or conditions that are objectively observable, beliefs or statements generally accepted as true by the recipients, or conclusions previously established” (Inch & Warnick, 2010, p. 25). This term was ranked eighth in the student survey and was recognised as a significant element in critical thinking.

A student reported that his teacher’s conceptions influenced his conception of critical thinking:

Student: Because we always practice drawing inferences in Liberal Studies lessons.

Researcher: Your teacher always mentions inference?

Student: The term inference is always mentioned by our teacher. I think drawing inferences is to find the relationship between cause and effect.... So when you can draw inferences, that means you have critical thinking.

Researcher: Does your teacher teach you to draw inferences?

Student: Yes.

Researcher: You always practice drawing inferences in the lessons, so you think drawing inferences means critical thinking?

Student: Yes. (Oxford School, Group 1, Student A)

A student reported that *inference* relates to critical thinking because of classroom practice:

“Inference is highly related to critical thinking because we always practice drawing inferences in daily lessons.” (Oxford School, Group 1, Student A)

A Band One student further explained the elements of a good *inference*:

Student B: I think that conceptualisation is an important term, because our teacher tells us that we should include some concepts in analysis. I think that examples and concepts are more important than evidence. Concepts are important to improve the conviction of arguments. Concepts are convincing because they are supported by our predecessors. Therefore we add concepts to evidence and make arguments more convincing.

Researcher: Does your teacher tell you that concepts are important in answering questions? ...

Student A: Our teacher required us to use concepts in answering questions, which means to conceptualise a long sentence. To demonstrate to the examiners that we are familiar with Liberal Studies by using more conceptualised terms...To be more clear in presenting arguments. (Oxford School, second interview, Group 1)

Inference was frequently noted in student interviews in which their teachers always stressed the importance of drawing *inferences* in writing essays. This result was in line with results of the

survey, where *inference* was ranked as sixth in order of importance to students in Liberal Studies.

- *Counter argument*

In addition to inference, there were other terms that demonstrated how teachers influenced their students, for example *counter argument*.

Researcher: Does critical thinking appear in Liberal Studies lessons?

Student C: Yes. Counter argument!

Researcher: What do you mean by counter argument?

Student C: First, we should know the opinions from the opposite side...Then we should decide our standpoint...finally we can make counter arguments...

Student A: Just like mathematics, we apply the formula. He (teacher) teaches us which aspects we can apply as counter argument....we just follow what he teaches us.

Student B: He teaches us the direction for making counter arguments.

Researcher: So you think making counter arguments is critical thinking?

Students: Yes! (Oxford School, Group 1)

To make counter arguments was a necessary skill that their teacher emphasised in the lessons for writing essays.

- *Objectiveness*

Objectiveness was also regarded as an important term in Liberal Studies:

Student A: If we do not have evidence, our arguments will become subjective, not

supported by evidence... so objectiveness is important.

Researcher: That means it is not good to be too subjective. So you think that objectiveness is important? You just said it is more objective if we have evidence, how about the data...

Student D: To demonstrate that we are objective.

Researcher: To demonstrate that we are objective. Your teacher told you that you should use evidence to demonstrate objectiveness, for example data, discussion? How does he teach you the importance of objectiveness?

Student D: To consider from every perspective is objective. (Oxford School, second interview, Group 1)

Objectiveness is a disposition that describes a person's tendency to hold a fair and undistorted view on a question or an issue (Inch & Warnick, 2010, p. 144). *Objectiveness* was ranked seventh in the student survey which demonstrated that students strongly emphasised the importance of *objectiveness* in critical thinking.

● *Evaluation*

Evaluation was also noted by teachers:

Researcher: What words does your teacher mention?

Student A: Evaluation. Because when we answer the questions such as “to what extent we agree/disagree”, this is evaluation. (Omega School, Group 1)

Evaluation is a skill to “assess the credibility of statements or other representations that are

accounts or descriptions of a person's perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions, or other forms of representation" (Facione, 2011, p. 21). Teachers drill students in answering different question types, and "to what extent do you agree/disagree" is a typical question type in Paper 2. Students are required to demonstrate their skills in the assessment of their judgment and opinions on an issue.

It was evident that students were influenced by their teachers, who taught them the techniques of answering questions, including *multiple perspectives, analysis, inference, counter argument, objectiveness, and evaluation*. Students regarded these terms as important elements in critical thinking. Some students drew the following conclusions:

Researcher: In the lessons, does your teacher emphasise skills or dispositions?

Student B: Both, but more skills. She reminds us to remember the answering framework.

Researcher: To remember the answering framework. So more emphasis on skills?

All students: Yes. (Trinity school, Group 2)

Another student was aware of the existence of an answering technique in every lesson:

"I think the lessons are divided into two parts. The first part is to understand the issue, and the related information. The second is how to answer, that is the answering technique." (Oxford School, Group 2, Student D)

Another example illustrated that lessons strongly emphasised answering techniques:

Student: Mostly they focus on teaching answering techniques.

Researcher: How about last year? Did you also focus on answering techniques?

Student: Sort of writing arguments and evidence.

Researcher: Also answering techniques?

Student: Yes! (Oxford School, second interview, Group 2)

Teachers emphasised answering techniques, including looking at an issue from *multiple perspectives, analysis, drawing inferences, counter argument, objectiveness, and evaluations*, which were found to be important skills in Liberal Studies. Teachers always noted these terms to teach their students writing essays, which shaped student conceptions of what critical thinking is.

■ *Debate*

The emphasis on answering techniques was reported as an influential factor that shaping student conceptions of critical thinking, and debate was also an important factor in the content-specific instructional approach of teachers. In order to nurture student abilities to view an issue from different aspects or stakeholders, teachers usually used debate with the whole class or among the groups:

Student: In debate, the pro side considers how to argue with the con side and vice versa, but when we are audience we can listen to the arguments of both sides.

Researcher: So you think this is critical thinking? To listen to both sides?

Student: Yes! We can think of all the arguments from both sides. (Omega School, Group 2, Student B)

A student clearly illustrated the process of debate:

“Each group represents one stakeholder, we share our opinions. If the opinion is opposed to other groups, we can raise our arguments. When other groups raise their opposing opinions, we can think about them and argue with them.” (Trinity School, Group 2, Student B)

Students had positive comments about the debate among groups:

Researcher: Is this kind of debate useful in enhancing your critical thinking?

Student B: It is helpful. When we look at the matter only from the viewpoint of the parallel goods trader, we cannot understand the negative influences on the Sheung Shui inhabitants. (Trinity School, Group 1)

Another example illustrating the advantage of debate:

Researcher: Do you like this kind of debate?

Student B: It's good. It helps us to think more...because I may not think of a certain opinion but my classmates can think of that. I can absorb the opinions of others through debate so that I can make improvements....I can synthesize their opinions and write my essays. (Trinity School, Group 2)

Another student reported that group learning nurtured their personal dispositions:

Researcher: What does the teacher do to make you more open-minded and tolerant?

Student: Open-mindedness, that means acceptance and to listen to the opinions that are different from our own. Our teacher asks classmates from two different sides share their ideas. When we listen to different opinions, we become more open-minded and accept the ideas of other people” (Tiffany School, Group 2, Student A).

Teachers also found that this kind of debate was a good teaching method with which to enhance student critical thinking:

Owen: When they argue with me, their brain is working...

Researcher: That means the students who argue with you are better at critical thinking?

Owen: Usually they have better results.

Students appreciated debate, whether in the whole class or among groupmates, since they could listen to the opinions of others, think of the opposite side, and finally enrich the writing content of their essays and examinations. Teacher also reported that debate was a good way to make students think, and usually thoughtful students were found to have better academic performance in Liberal Studies.

To conclude, students reported that they were strongly influenced by the classroom practice that was influenced by teacher conceptions of critical thinking. The teacher content-specific instructional approach, which meant that the teaching behaviours or methods in Liberal Studies

lessons, had a significant impact in shaping student conceptions of critical thinking. In this study, teacher content-specific instructional approach included teacher emphasis on answering techniques and the adoption of debate. As noted, the terms multiple perspectives, analysis, inference, and evaluation were important requirements in Liberal Studies level descriptors (HKEAA, 2014). Accordingly, Liberal Studies teachers put much effort and time into teaching these skills. As reported by a student at Oxford School, the Liberal Studies teachers mostly focused on teaching answering techniques, and this classroom practice was found very influential in shaping student conceptions of critical thinking. In addition to emphasis on teaching answering techniques, Liberal Studies teachers frequently adopted debate, which was significant in nurturing various dispositions of critical thinking. The effectiveness of debate in enhancing student critical thinking will be discussed in Chapter 6.

Teacher general instructional approach of teachers

In addition to a teacher's content-specific instructional approach, another classroom practice, i.e. teacher's general instructional approach of teachers was another significant factor in shaping student conceptions of critical thinking. As mentioned, *teacher's general instructional approach* is defined as common teaching behaviour or methods in lessons, regardless of subjects. As noted, a teacher's general instructional approach involves the common teaching behaviours or methods used in lessons, regardless of subject. In this study, the teacher's general instructional approaches

were found to be significant in influencing student conceptions of critical thinking.

■ *Group learning*

Most of the respondent students reported that their teachers adopted group learning in Liberal Studies lessons. Normally students were assigned into groups of four or five in order to discuss things with their classmates during the lessons. Students explained the usefulness of group learning in Liberal Studies:

Researcher: What do you mean by group learning?

Student D: The teacher gives us news, different pieces of news for different students.

We then share our opinions after synthesizing the materials, this is cooperation.

Student B: We have different opinions in a group. We learn from each other in our sharing. We not only focus on our own minds, it is good to listen to the opinions from others....We won't limit ourselves to our own world and languages, we look at the world of others, so that we can rationally analyse a matter, the advantages and disadvantages of a matter. It's better than when we think on our own.

Researcher: So you think group learning enhances critical thinking?

Students: Yes. (Oxford School, Group 1)

Another student in the same school shared similar opinions:

"We are in group of four; each of us reads one part of the material before the lesson.

Then, in the lesson, we take turns to report to our groupmates, teach them and finally

we discuss the material together.” (Oxford School, Group 2, Student D)

The adoption of group learning was found to have influenced student conceptions of critical thinking since students can share different opinions in the group and, accordingly their knowledge can grow. Students reported that group learning is beneficial to their learning in Liberal Studies:

Researcher: What is the advantage of sitting in a group of four?

Student A: Reciprocal marking.

Researcher: What is it for?

Student B: We can see the differences when reading the essays of classmates. To find out what they did better than mine so that I can improve my essays.

Student D: It can speed up the learning pace and saves our time in the lesson since a teacher must spend much time marking all the essays. (Oxford School, Group 2)

There were similar comments from students in other schools:

Researcher: What is the advantage of reading the same material in pairs?

Student D: I can hear the opinion of my partner, and won't judge from my own standpoint. Then I can filter the information, to see which information to keep or discard. (Trinity School, Group 1)

Students found that group learning was beneficial to their advancement of knowledge; and significant to nurturing their personal dispositions, such as to be *rational*, *open-mindedness*, and

tolerance. The following excerpt was an example of *to be rational*:

Researcher: Does your teacher teach you the appropriate attitudes when discussing in group?

Student A: To be rational.

Researcher: How can you become rational when your classmates challenge you?

Student D: We all know that this is discussion.

Researcher: That means the teacher has reminded you to be rational in discussion?

Students: Yes. (Oxford School, second interview, Group 1)

In the student conceptions, group learning provided an opportunity for them to be rational. Rational thinking is used to describe a disposition of critical thinking: “thinking, speaking, reasoning, making a decision, or acting in way that is generally reliable and efficient for achieving one’s goals” (Evans & Over, 1996, p. 8). No matter whether described as a skill or disposition, rational thinking was ranked second in the student survey and was one of the main themes in student interviews. This indicated that students strongly emphasised rational thinking as an important element in critical thinking, and group learning was found to be a significant classroom practice that shaped students to achieve rational thinking.

Open-mindedness was another disposition that nurtured student critical thinking through group learning. In responding to the question *What are the words your teacher mentions in lessons*, a student replied:

“Open-mindedness. That is to accept those opinions on which I disagree. Our teacher requires classmates from both sides to explain in order to listen to different opinions, so that we can easily accept the opinions of other people.” (Tiffany School, Group 2, Student A)

Open-mindedness describes the disposition of a person who is “tolerant of divergent views and sensitive to the possibility of his/her own possible biases, who respects the right of others to have different opinions” (Facione, 2011, p. 30). Students felt that they were open-minded since they could accept the opposite opinions of others in group learning.

Tolerance was another disposition of critical thinking that was nurtured in group learning. The following is an example:

Researcher: That means you become tolerant of the views of others after Liberal Studies?...

Student: In our daily life, we view an issue from the perspective of others, not only from our own.

Researcher: In group discussions, you can listen to the opinions of others; this makes you become more aware of the perspectives of others, right?

Student: Yes. (Trinity School, Group 1, Student D)

The following excerpt showed another example:

Researcher: What is the usefulness of group learning?

Student A: I think that is to be tolerant of different opinions. We should do so in order to exchange ideas with other people no matter whether the discussion is

right or wrong.

Researcher: Can group learning make you more open-minded and view from multiple perspectives?

Student A: Yes.

Student D: I think it can also help us to accept others more....when the discussion is over, you may not accept their opinions, but.....sometimes we can use the opinions to draw conclusions (Tiffany School, Group 1).

Tolerance towards the views and values of others describes the disposition of a person who ‘fully welcomes and unambiguously endorses alternative ways of feeling, thinking, and acting’ (Von Bergen, 2012, p. 111).

The purpose of using group learning in Liberal Studies was to provide an opportunity for students to take side in an issue. Meeting classmates from different sides nurtured student dispositions of critical thinking. In group learning, students were assigned tasks where they were required to listen to the opinions and ideas of classmates in the group. Group learning shaped students to be more ready and happy to listen, and thus tolerant of the opinions of others.

■ *Teacher feedback*

The following excerpts illustrated how teacher feedback influenced student conceptions of critical thinking. In responding to the question *Which definer relates to critical thinking?* a student

reported:

“Higher-order thinking! Our teacher always complained that we were too superficial.”

(Omega School, Group 2, Student A)

Although the teachers did not explain what higher-order thinking was, students thought that higher-order thinking was related to critical thinking, according to comments from their teachers. This showed that there was an impact of a teacher’s feedback on student conception of critical thinking.

Another example showed how teacher’s comments on student essays influenced student conceptions:

Researcher: What teacher comments appeared on your essays?

Student: Usually no inferences, no evidence...

Researcher: It seems that these two points are so important that teacher always reminds you.

Student: Yes. (Oxford School, second interview, Group 1, Student A)

Students were encouraged to collect data in the IES. It was, therefore, a challenge for students to design questionnaires. Student conceptions of critical thinking were shaped by a teacher’s comments on their student IES:

“After I designed the questionnaire, the teacher pinpointed the weaknesses. He said it was too subjective, we should be objective.” (Tiffany School, Group 2, Student D)

Teachers gave feedback on the design of questionnaires and, therefore, students learnt that they should not be subjective in designing questionnaires since objectiveness was a requirement in Liberal Studies.

To conclude, teacher feedback was found to be influential in shaping student conceptions of critical thinking, whether verbally or in text form, in essays or IES.

■ *Use of instructional media*

Teachers were reported to use instructional media to explain an issue, and to give opinions from multiple perspectives. A student realised that video watching was important in Liberal Studies learning:

Researcher: What is the usefulness of video?

Student: Multiple perspectives.

Researcher: Any examples?

Student: There are usually three or four stakeholders in a video, we can jot down the main points of their opinions, and whether their standpoints agree or disagree.

Researcher: So you think that to view an issue as different stakeholders is critical thinking?

Student: Yes. (Trinity School, Group 2, Student B)

Students thought that they could grasp information or knowledge from the video explaining the opinions of different stakeholders toward the same issues. This helped them to view an issue from

multiple perspectives.

To conclude, teacher's general instructional approach, which was another essential classroom practice, was reported as significant in shaping student conceptions of critical thinking. Group learning was recognised as very important in enhancing student knowledge and, at the same time, nurturing dispositions such as being *rational*, *open-minded*, and *tolerant of the views of others*. Teacher's oral and written feedback, and use of instructional media, such as video, were also regarded as influential in shaping student conceptions of critical thinking.

5.3.2 Implicit relationships in classroom practice

Most students clearly reported that the classroom practice in Liberal Studies lessons had influenced their conceptions of critical thinking. In some cases, however, some students cannot clearly report how their conceptions formed. They stated that they had heard of the terms of critical thinking but not realised that their teachers had mentioned them. These kinds of statements were noted as *implicit relationships* which involves two types of relationship:

- A: teachers explicitly noted the names of the definers of critical thinking though not mentioning the term *critical thinking*;
- B: teachers used examples to teach the skills or dispositions of critical thinking.

Here is an example of a Type A implicit relationship:

Researcher: When your teacher teaches you how to draw conclusion or opinions from others, did he remind you to be tolerant of the views of others?

Student A: He did not say so, but I think it is important to be tolerant of the views of others...

Researcher: ...Any other terms that you think are related to critical thinking?

Student D: Reflection is related to critical thinking...That means we have our opinions on a certain matter, but after discussion with others, we may feel that our opinions are not correct.

Researcher: Reflection, alright. Does your teacher mention this term?

Student D: I don't know. (Oxford School, second interview, Group 1)

This student clearly explained the reasons why some terms are related to critical thinking but they were not clear about why thought think so. Other students described the implicit relationship precisely:

“Some terms have shown up in the lessons...sort of those that appeared in Liberal Studies examination papers...such as interpretation, explanation...so our teacher has mentioned concepts such as multiple perspectives...but not directly telling us that is related to critical thinking...but he has mentioned it in the lessons” (Oxford School, second interview, Group 2, Student D)

Students reported that their teachers had noted some terms but they did not explicitly tell their students that these terms were related to critical thinking. An example:

Researcher: You have just mentioned that your teacher told you to be neutral when designing questionnaire items, so this is critical thinking?

Student B: Yes. (Tiffany School, Group 2)

At the very beginning of the interviews, Band Three school students were silent when they were asked what critical thinking is. When the interviews continued, however, they realised that they had conceptions of critical thinking and those conceptions were influenced by classroom practice:

Researcher: Over the past 1.5 years, has critical thinking existed in your Liberal Studies lessons? Does your teacher mention similar terms as on the questionnaire?
Has your teacher told you that Liberal Studies is related to critical thinking?

Student D: No. I have never heard of the term *critical thinking*.

Researcher: No, why?

Student D: Because our teacher did not tell us.

Student A: He did not directly mention the term critical thinking.

Researcher: So what happened in the lessons?

(Students described classroom practice, for example listening to a teacher's lecture, doing worksheets and watching videos, discussion in groups, writing essays. After chatting for 23 minutes, when the researcher asked again what critical thinking was, a student reported as below:

Student A: I think that critical thinking is making my own judgment after reflection.

(Trinity School, Group 2)

It was clear that Band Three school students were weak in their awareness of the existence of

critical thinking in Liberal Studies lessons. They thought that their teachers had not taught them critical thinking because they did not explicitly use the term. It was not only Band Three school students who reported that they had never heard the term critical thinking in Liberal Studies, Band One school students made the same statement:

Researcher: Does your teacher speak about critical thinking? Any idea?

Student C: No idea.

Researcher: No idea? Okay. Just now you replied that critical thinking was to analyse right or wrong; different perspectives, different stakeholders. Does your teacher help you to analyse the viewpoints of different stakeholders? Do you think that this is a kind of critical thinking?

Student B: It might be. We can discover the different viewpoints of different stakeholders and the reasons behind them.

Researcher: That means your teacher has taught you how to analyse different viewpoints from different stakeholders or perspectives.

Students: Yes. (Oxford School, Group 2)

Regardless of school band, students reported that their teachers did not teach them critical thinking, and therefore critical thinking did not exist in Liberal Studies lessons. When the researcher asked them what happened in the lessons, they clearly described classroom practice such as the teacher's explanation of the issues, video watching and reading materials, group discussions, techniques in writing essays. Finally they understood that their teachers had taught them critical thinking, especially the skills of critical thinking.

In responding to the question Please explain your answers on the questionnaire, students concluded as follows:

Researcher: Do you mean these 40 terms have never or seldom appeared in Liberal Studies?

Student B: The teacher seldom mentions them explicitly. Maybe at this stage we only grasp the technique of analysing the viewpoints of different stakeholders, the reasons behind it and the impacts of their viewpoints. Perhaps our teacher will teach us how to make inferences and to seek consensus at a later stage.

Researcher: What do you mean by “at a later stage”?

Student B: After we reach a concept by synthesis. But it cannot happen in lessons since our teacher only give us assignments about interpretation.

Researcher: That means your teacher seldom mentions these terms in Liberal Studies lessons, right?

Students B and C: Yes.

Student D: He mentions a few of them.

Researcher: He mentions a few of them? What are they? Just what you have said? Inferences? Multiple perspectives? Interpretation?

Student D: Analysis, rational, something like that.

Researcher: That means your teacher teaches you the skills when the wordings appeared in the essay questions?

Student D: Yes.

(Oxford School, second interview, Group 2)

In both Band One and Three schools, students were not aware of the existence of critical thinking

in Liberal Studies lessons. They found the 40 definers on the questionnaire unfamiliar since their teacher seldom mentioned the terms. Only one student recognised that there were a few terms that their teacher had mentioned, at least in teaching the answering techniques.

For the type B implicit relationship, i.e. teachers used examples to teach the skills or dispositions of critical thinking, teachers used examples to teach the skills or dispositions of critical thinking:

Researcher: Which terms did your teacher mention?

Student D: I have no idea whether he has mentioned it or not, but I remember the term *bias detection*. Since some information is just from our own perspectives, for example the tram issue...The advocator proposed getting rid of trams from Hong Kong's Central business district. This is only from an economic perspective; it's a bias, not seeing from perspectives of others. We detect this as a bias, we shouldn't think of only one side.

Researcher: ...Does your teacher teach you how to detect bias?

Student D: In writing essays, we will get low marks if we view a matter from only one side.

Researcher: Does your teacher teach you how to detect bias?

Student D: I have no idea.

Researcher: You watched a video about this issue, right? (Students nodded their heads)

When someone judges an issue from their own perspective, just like the advocator in the tram issue, did your teacher teach you how to detect bias?

Student D: He just told us that the idea of the advocator was from a certain perspective.

Student A: Everyone has their own viewpoints in the video, we should clarify each of

the viewpoints, and then distinguish the differences among them, and evaluate which one is better. To compare the pros and cons since there maybe bias.

Researcher: That means your teacher taught you how to detect bias?

Student A: Yes, through different perspectives.

Researcher: To detect the bias through multiple perspectives, right?

Students: Yes. (Oxford School, second interview, Group 1)

Students admitted that they were not aware of the existence of critical thinking in Liberal Studies lessons, but during the interview, they understood that their teachers had taught them critical thinking implicitly:

Researcher: So, in general, critical thinking has not existed in Liberal Studies lessons from Form 4 until now, right?

Student A: Not really, it may exist but we aren't aware of its existence.

Researcher: Maybe your teacher had done something about critical thinking but you aren't aware?

Student B: We have talked about group learning, I am just aware that it is related to critical thinking! (Tiffany School, Group 2)

When asking about the sources of their conceptions of critical thinking, students tended to answer *I don't know* or *no idea*. In fact, students have their own conceptions but were not aware of what, or how to formulate their conceptions. They reported that their teachers had not clearly and explicitly taught them critical thinking in the lessons, however, teachers told other stories. When

answering the interview question *Do you think that critical thinking takes place in your classroom?*

Liberal Studies teachers gave positive answers. For example, a Band One school teacher, Owen, said:

“I often.....teach how to write arguments, just like I did in semester one. I teach students to judge an issue from different perspectives such as the good side and bad side; to assess the effectiveness of a policy. That means the aspects we should judge when we make comparisons. For example the depth and scope of an impact, how to revamp the disadvantages of an issue. These are the aspects I teach students to consider.”

Owen taught students to write arguments by considering an issue from various perspectives. In his opinion, it was a classroom practice that enhanced critical thinking. It showed that teachers used examples to demonstrate the relationship between definers and critical thinking. A student of Owen’s said:

Researcher: You think that multiple perspectives are related to critical thinking. Okay, how did you know this term?

Student: In explaining how to answer different types of questions, our teacher reminded us not to view and judge an issue from only one perspective....we should consider it from different aspects....

Researcher: So your teacher says that is multiple perspectives, right?

Student: He did not explicitly say that, he shows us examples to demonstrate how to think from different aspects, for example social, economic or environmental. We should not draw conclusions from only one perspective.

Researcher: That means your teacher told you that you should analyse from multiple

perspectives such as social, economic or environmental, and this is called multiple perspectives. This is critical thinking, right?

Student: He did not tell us that this is multiple perspectives. He gives us examples and directions to consider the influences of an issue from different angles.

Researcher: That means he use examples to show you what multiple perspectives is?

Student: I think so. (Oxford School, second interview, Group 2, Student B)

Owen intentionally designed assignments for writing arguments in which students should consider multiple perspectives. He demonstrated how to do so by providing the issues that students should consider. This behaviour shaped student conceptions that considering an issue from multiple perspectives was using critical thinking. Students therefore conceived that multiple perspectives were an element of critical thinking. The excerpts from Owen and his students demonstrated that there was an implicit relationship between teacher and student conceptions of critical thinking.

Band Three school teachers also claimed that they had taught critical thinking in Liberal Studies lessons.

Researcher: Do you think that critical thinking takes place in your classroom?

Tracy: Yes! Just now I mentioned that we discuss current and constant issues in the lessons. Debate is one of the activities we adopt. Students are required to take sides and either agree or disagree. They cannot follow other classmates in deciding which side they should take. Although there is much information on the online world, we cannot get definitive answers. In deciding which side they

should take, students need to make inferences, and provide evidence.

Tracy adopted debate to force students to make inferences with evidence before taking sides. She thought that this procedure in debate enhanced the student's critical thinking. In answering the question *What does your teacher do to make you realise that this is critical thinking?*, one student of Tracy reported that debate promoted their critical thinking:

“Debate among groups. Each group represents a stakeholder of an issue and raises our opinions. We can refute the arguments of other groups if there are different opinions. We can consider the issue more thoroughly if we are refuted by other groups. We can also refute them when we find that there is something wrong with their opinions.....Refutation makes us think more. Sometimes we do not consider an opinion raised by other classmates. We can absorb their opinions by refutation, and then we can make improvements... We can also synthesize their opinions and write them in the essays.” (Trinity School, Group 2, Student B)

The classroom practice of arguing with classmates who had different opinions was found beneficial to enhancing student critical thinking. Both teachers and students conceived that refutation enriched student understanding and their opinions on an issue; by synthesizing their own opinions and those from classmates, students could make a reasoned judgment and their essays were improved. Those behaviours enacted in the process of debate were regarded as elements of critical thinking. It was demonstrated that teachers deliberately adopted debate as a classroom practice that aimed to enhance student critical thinking. Students reported that critical

thinking took place in Liberal Studies lessons. Teacher conceptions of critical thinking had influenced classroom practice, and classroom practice had an impact on shaping student conceptions of critical thinking.

Another Band Three school teacher thought that spontaneous questioning by students was the use of critical thinking:

Researcher: Do you think that critical thinking takes place in your classroom?

Terry: I notice that my students seldom ask critical thinking questions in the lessons.

Instead, when I have explained an issue, or gave them think time, they come and ask me. For example, the One Child Policy in Mainland China. I have mentioned that some officials took the second babies away from parents. Some students asked me after the lesson who did it, the local government or the central government. They had thought of this question.

Researcher: Do you think that student questioning during or after lessons is critical thinking?

Terry: Yes, because they have thought of the questions very seriously. They want to get more information in order to judge a policy. This is a process of thinking...Although they cannot immediately draw a conclusion since it is a complex process. But I do think it is a process of thinking...

In Terry's experience, when students think about an issue thoroughly, they will ask questions spontaneously. It was, therefore, the role of teachers to provide more information for students:

Researcher: What have you do to get your students to think critically?

Terry: I provide much information. I give them many videos, many activities; show them the viewpoints of different stakeholders. I will elaborate after they read the materials. They can ask me if they have problems.

Researcher: You think that all these things can enhance their critical thinking? (Terry nodded). You just mentioned that every cycle there is a double lesson for discussion, do you think that discussion enhances student critical thinking?

Terry: Absolutely! They are forced to think about the standpoints of the stakeholders. This can help them to think. They can consider their standpoints on, and viewpoints toward an issue.....I provide them with more input. I think that the prerequisite of critical thinking is to understand an issue very clearly. Otherwise students cannot reach higher level thinking such as critical thinking.....

Researcher: That means you think that you should provide Form 4 and Form 5 students with more input and they will be a critical thinker in Form 6?

Terry: Yes.

Terry believed that his students could not achieve critical thinking unless he provided them with more information. When students absorbed the information, they were able to discuss it. Evidence from Terry's students:

Researcher: Does critical thinking take place in your lessons?

Student B: Yes. Our teacher asks us to consider the impact of an issue and then we share our opinions. We should use critical thinking to answer...After giving us the issue topic, our teacher guides us to think from various perspectives, and then he gives examples to illustrate it. Then we can analyse and think, lastly we can draw conclusions...

Student C: During discussion, we share our own opinions of different stakeholders, then

we discuss who gains most or is most affected by the issue...

Student A: The main part is discussion. During discussion, four groupmates may have different standpoints. We should decide for or against a policy after discussion, and provide evidence...

Researcher: Good, that means critical thinking has taken place in your lessons?

Students: Yes. (Trinity School, Group 1)

Terry provided more information for students before group discussion. Students were required to, first, read the information carefully; second, analyse the opinions of different stakeholders; third, discuss and try to draw conclusions, such as who gained most or was most affected by the issue, and whether they were for or against a policy; fourth, share the results of their discussion with evidence. Terry believed that during this process of discussion, student critical thinking could be promoted. Accordingly, students conceived that this kind of behaviour (analysing, drawing conclusions, providing evidence for their arguments) were elements of critical thinking. Although the teacher did not explicitly mention any terms of critical thinking, the students learnt that the behaviours required by their teachers were related to critical thinking. It was evident that teachers intentionally designed classroom practices in order to promote student critical thinking, and that finally these classroom practices influenced student conceptions of critical thinking. The excerpts from Terry and his students demonstrated that there was an implicit relationship between teacher and student conceptions of critical thinking.

5.4 Chapter summary

Before proceeding to the Discussion chapter, it is useful to revisit the qualitative findings of this study. In order to answer the third research question *What is the relationship between teacher and student conceptions of critical thinking?* semi-structured interviews were conducted. Student responses were very focused, and the aim was to find out how their conceptions of critical thinking were shaped. The findings showed that there are explicit and implicit relationships between teacher and student conceptions of critical thinking.

Explicit relationship in classroom practice

There was an explicit relationship between teacher conceptions of critical thinking and student conceptions of critical thinking. As mentioned, *explicit* means a clear and direct relationship which leaves no room for confusion or doubt. In this study, students were strongly influenced by classroom practices: the teacher content-specific approach and general instructional approach. In the teacher content-specific instructional approach, Liberal Studies teachers were found to be very focussed on teaching answering techniques. Teachers usually provided a framework for writing essays that students were expected to follow strictly. These techniques included writing essays from multiple perspectives and clearly stating which perspective students were using at the beginning of each paragraph. The skill of analysis was also stressed by teachers who directly told students to analyse information. In the process of analysing, students were reminded to be judicious, and that step-by-step analysis is important. Teachers also emphasised drawing

inferences in order to show the cause-effect relationship in essays. Teachers explicitly taught students to include evidence, inferences, and arguments in each paragraph. Students were reminded to respect evidence. Drawing counter-arguments, evaluation, and being objective were also regarded as significant elements of critical thinking. Debate was also an important element in the content-specific instructional approach. Teachers usually used debate to force students to think more thoughtfully in order to argue with classmates. In this classroom practice, students tended to appreciate the usefulness of group learning in widening knowledge and nurturing dispositions such as open-mindedness.

In addition to a teacher content-specific instructional approach, the general instructional approach was also found to be significant in shaping student conceptions of critical thinking. Of the four secondary schools, three reported that group learning was adopted in Liberal Studies lessons. Most respondent students contended that group learning was related to critical thinking because they were more ready to listen to the opinions of classmates. It provided the opportunity for them to absorb knowledge from others, and meanwhile, to nurture dispositions such as being rational, open-minded, and tolerant towards the different views of others. Teacher feedback during the lessons and written on student assignments were also found to influence student conceptions of critical thinking. Watching video with multiple perspectives was another significant element in the general instructional approach, which allowed students to view an issue from multiple

perspectives.

Implicit relationship in classroom practice

In this study, *implicit relationship* means the unexpressed and indirect relationship between teacher and student conceptions of critical thinking. There are two types of implicit relationship. First, teachers explicitly noted the names of the definers of critical thinking but implicitly demonstrated the relationships between definers and critical thinking; second, teachers used examples to demonstrate the relationship between definers and critical thinking. Both Band One and three students commented that they did not recognise the existence of critical thinking in Liberal Studies. They had their own conceptions of critical thinking; however, they did not know the sources of these conceptions. This might be because their teachers had implicitly taught them critical thinking. The teachers either explicitly noted the names of the definers of critical thinking but implicitly demonstrated the relationship between the definers and critical thinking; or they used examples to demonstrate the relationship between definers and critical thinking.

Teachers were clear about what critical thinking was and had the intention to make critical thinking happen in the classroom. They deliberately designed and implemented those classroom practices that promoted critical thinking but they intended to do implicitly. This might be because of issues between student's low ability in critical thinking and high-stake examinations. On one

hand, as a Band One teacher, Owen thought that their students would find difficulties with the higher-order thinking which was required in Liberal Studies. Another teacher from a Band Three school clearly admitted that her students were not able to demonstrate higher-order thinking. It was evident that both Band One and three school teachers were not confident in student ability in learning critical thinking. This was similar to the study of Tsui (2001) where teacher confidence in their student ability in higher-order thinking has an impact on the expectations of students, which limited teacher willingness, interest and efforts to enhance student critical thinking.

On the other hand, critical thinking was a significant element in the curriculum and assessment of Liberal Studies (HKEAA, 2007). Teachers were obliged to teach critical thinking in the lessons in order to help their students get high grades in the examinations. Teachers therefore emphasised teaching answering techniques such as “conceptualisation”, “evidence”, “a wide range of views and values”, “evaluating various viewpoints”, “synthesising”, “logical arguments”, “interpret and analysing” as expected in the Level 5 Descriptors (HKEAA, 2009). When facing this dilemma, teachers might adopt a more feasible way in their classroom practice: to implicitly teach critical thinking. This was why the teachers either explicitly noted the names of the definers of critical thinking but implicitly demonstrated the relationship between definers and critical thinking, or they used examples to demonstrate the relationship between definers and critical thinking. As Jones (2005) concluded, student conceptions of critical thinking were greatly influenced by the

teaching context in which the subject and assessment task was situated. As revealed by this study, there was an explicit and implicit relationship between teacher and student conceptions of critical thinking in Liberal Studies.

An interesting finding should be reported here. There might be other sources of student conceptions of critical thinking. Students reported that they had heard the term *critical thinking* from internet and TV news, but not from their teachers (Omega School, Group 1). When was asked how she learnt the term *synthesis*, the student answered *every normal people know* (Oxford school, second interview, Group 2, student D). The student might learn the term in her daily life that she did not aware of how she learnt it. It indicated that besides teacher conceptions and the classroom practice, there might be other sources of the formation of conceptions of critical thinking but students might not know how the conceptions formed.

Chapter 6 Discussion

The purpose of this study was to investigate the relationship between teacher and student conceptions of critical thinking in Liberal Studies. The research questions were:

1. What are teacher conceptions of critical thinking in Liberal Studies?
2. What are student conceptions of critical thinking in Liberal Studies?
3. What is the relationship between teacher and student conceptions of critical thinking in Liberal Studies?

The above research questions will be discussed separately.

6.1 Teacher conceptions of critical thinking in Liberal Studies

In this study, fourteen teachers completed questionnaire and four participated in semi-structured interviews in order to contribute their conceptions of critical thinking in Liberal Studies.

6.1.1 Teachers emphasised the skills dimension of critical thinking

There was congruence between this study and the studies reviewed in which respondent teachers regarded critical thinking as combining skills and dispositions. In the skills dimension, teachers noted, for example, higher order thinking and problem solving (Howe, 2000, 2004); analysis, explanation, evaluation, inference, and self-regulation (Gordon, 2000); analysis and problem

solving (Walthew, 2004); synthesis and evaluation (Jenkins, 2011); being reasonable and logical (Stapleton, 2011); synthesis and analysis (Krupat et al., 2011); decision making, evaluating, analysing, and problem solving (Steffen, 2011); analysis and evaluation (Rowles et al., 2013). In the dispositional dimension, fairness and being objective (Howe, 2000, 2004); being sensitive to others (Gordon, 2000); curiosity (Walthew, 2004); being flexible and creative (Jenkins, 2011); having diverse perspectives (Stapleton, 2011); flexibility (Krupat et al., 2011); multiple perspectives and open-mindedness (Steffen, 2011, Rowles et al., 2013) were all noted. In the study of Lawrence et al. (2008), teachers concluded that critical thinking involves skills and dispositions. The respondent teachers in this study shared similar views to their counterparts in other studies who conceived of critical thinking as having skills and dispositional dimensions.

The teachers in this study conceived of critical thinking as being two dimensions, however, they thought that critical thinking was more inclined to the skills dimension than the dispositional. Of the top 30 ranked definers of critical thinking (mean over 3), 17 or 57% were related to the skills dimension. Four themes were found, from teacher survey and the semi-structured interviews, all of which were in the skills dimension and had been given a high ranking in the teacher survey. These themes were *higher-order thinking* (ranked 1), *thoughtful judgments* (ranked 5), *analysis* (ranked 6), and *inference* (ranked 7). This is consistent to the study by Krupat et al. (2013) which found a majority of responses in the skills dimension, and with Rowles et al. (2013) who concluded that

75% of teachers conceived of critical thinking as being in the skills dimension.

The findings in this study were opposite to those of Howe (2000, 2004). In his study, the Canadian respondent teachers emphasised the skills dimension and the Japanese teachers emphasised the dispositional dimension, which Howe concluded was because of cultural differences (p. 63). The respondent teachers in this study, however, did not share the views of their Japanese counterparts who are also influenced by the Asian culture. Rather, they tended to incline to the Western conception which emphasised the skills dimension of critical thinking.

The respondent teachers in this study shared a similar view with their counterparts in the study of Rowles et al. (2013) that teachers saw the skills dimension of critical thinking as more important than the dispositional. In the study of Rowles et al. (2013), approximately 75% of the respondent teachers conceived critical thinking as (1) ability that included process, skill set and action; (2) cognitive processing of information or evidence included analysis and evaluation; (3) decision making or problem solving (p. 25). In this study, the quantitative data indicated that skills dimensional definers such as *reflection*; *higher-order thinking*; *rational thinking*; *thoughtful judgments*; *analysis*; and *inference* were ranked high. On the other hand, the qualitative data showed that teachers regarded critical thinking as *higher-order thinking*, *inference*, *analysis*, and *thoughtful judgments* which were also belonged to the skills dimension. Even though the scholars

contended that critical thinking consisted of both skills and dispositions (Elder & Paul, 2008; Ennis, 1996; Facione, 1990, 2011; Halpern, 2014; Norris & Ennis, 1989; Scriven & Paul, 1987), the respondent teachers emphasized more on skills dimension of critical thinking.

6.1.2 Teachers had clear conceptions of critical thinking

In this study, respondent teachers were clear about what critical thinking was. In the survey, every teacher answered every item. Of the 40 definers of critical thinking, 30 definers from teacher survey got mean over 3. As mentioned, there was great *consumer validity* (Coniam, 2013, p. 120). Therefore, it was evident that respondent teachers *buy* the idea that the majority of the definers were related to critical thinking.

More evidence from the semi-structured interviews demonstrated that teachers had a clear conception of critical thinking. When the teachers were asked *From your perspective, what is critical thinking?* and *Please explain your answers on the questionnaire*, they provided answers without any hesitation. For example, Owen provided his own definition of critical thinking as “what you should think before making judgments”. He also provided an example to illustrate more clearly “whether we should or should not do something, agree or disagree something, or analyse pros and cons. At that time you should undergo this process of making judgments”. Tracy also contributed her own conception and elements of critical thinking: “critical thinking is a way of

thinking which depends on information. It includes analysis and judgment making.” The teachers stated very clearly their conceptions of critical thinking, with detailed elements. Teachers were expected to effectively assist students in the construction of their conceptions of critical thinking if the teachers themselves have an accurate or complete understanding of critical thinking.

The teachers may have had a clear understanding of what critical thinking is because of their teaching experience in Liberal Studies. Of the 14 respondent teachers in the survey, eleven had 5 to 6 years of teaching experience in NSS Liberal Studies. Before the commencement of the NSS in 2009, twelve had taught AS LS from 1 to 5 years. That means they were experienced in Liberal Studies. It is believed that these experienced Liberal Studies teachers were familiar with the curriculum aims that student critical thinking should be developed through Liberal Studies (CDC & HKEAA, 2007, p. 5). As mentioned, Liberal Studies is a core subject in NSS, therefore teachers were necessary to be familiar with the assessment requirements which covered the elements of critical thinking such as *interpretation; analysis; evaluation; synthesis; logic; conceptualization; multiple perspectives; respect for evidence; open-mindedness; and tolerance towards a wide range of views and values* (HKEAA, 2014). In other words, the terms of critical thinking was clearly stated in the documents. Accordingly, from the documents, teachers were clear about what critical thinking was.

In this study, the respondent teachers had clear conceptions of critical thinking. However, it was different with the findings from the studies by Alazzi and Khawaldeh (2008) and Innabi and Sheikh (2006) in Jordan; and Stedman and Adams (2012) in the United States. These three studies all revealed that teachers were not familiar with the definition and teaching strategies of critical thinking. Unlike their counterparts in Jordan and the United States, the respondent teachers in this study showed a clear understanding of what critical thinking is. Why did Hong Kong teachers have a clear conception of critical thinking when their counterparts in different countries had vague conceptions? This is worth discussion and further research.

6.1.3 Teachers shared similar views with scholars

As shown by the data, teacher conceptions of critical thinking were found similar with those of scholars. First, as noted, respondent teachers regarded critical thinking as higher-order thinking. *Higher-order thinking* and reflection were ranked as the first definer of critical thinking. This was consistent with Ennis's (1985) view, that "critical thinking incorporates a good deal of the directly practical side of higher order thinking" (p. 47). Critical thinking is seen as an "operative example of higher-order thinking" (Miri, David & Uri, 2007, p. 355), however, the interchangeable use of the terms 'critical thinking' and 'higher-order thinking' was evident in teacher interviews. Higher-order thinking was one of the major themes generated from teacher interviews. In the higher-order thinking level in the revised Bloom's Taxonomy (Anderson & Krathwohl, 2001), the

terms *evaluation*, *synthesis*, and *analysis* were regarded as the top three levels in the hierarchy. These three terms were also ranked highly in the teacher survey: *evaluation* was ranked 12th; *synthesis* was ranked 7th; and *analysis* was 6th. It was found that both respondent teachers and scholar regarded critical thinking as *higher-order thinking*.

Teacher conceptions of critical thinking were similar with those of scholars, where critical thinking was seen as two dimensional. The list of 40 definers of critical thinking was generated from a synthesis of reviewed literature (Birnbacher, 2001; Bloom, 1956; HKEAA, 2007; APA Dictionary of Psychology, 2007; Elder & Paul, 2008, 2010; Ennis, 1962, 1987, 1996; Evans & Over, 1996; Facione, 1990, 2011; Fisher & Scriven, 1997; Glaser, 1941, 1980; Halpern, 1989, 1996, 2014; HKEAA, 2007; Howe, 2000, 2004; Inch & Warnick, 2010; Lewis & Smith, 1993; Lipman, 2003; Norris & Ennis, 1989; Paul & Elder, 2006; Polya, 1981; Scriven & Paul, 1987; Shaw, Montinari, Piovesan, Olson, Gino, & Norton, 2014; Siegel, 1988; Von Bergen, Von Bergen, Stubblefield, & Bandow, 2012). As shown in Table 6.1, of the 40 ranked definers from the teacher survey, 30 (75%) were seen as closely related to critical thinking. These 30 definers comprised both skills and dispositions, in which 17 (57%) were skills and 13 (47%) were dispositions. This result was in accordance with Elder and Paul (2008); Ennis (1996); Facione (1990, 2011); Halpern (2014); Norris and Ennis (1989); and Scriven and Paul (1987) who argued that critical thinking was two dimensional. These scholars thought that critical thinking included the skills of, for

example, analysis and inference, and the dispositions of logic and open-mindedness. It was clear that teacher conceptions of critical thinking as two dimensional were consistent with the terms given by scholars in describing critical thinking.

Table 6.1 Comparison of the rankings, means and sources of the definers.

Ranking	Definers	Mean	Dimension (S/D)	Scholars
1	Reflection	3.93	S	Scriven & Paul (1987)
1	Higher-order thinking	3.93	S	Howe (2000, 2004); Lewis & Smith (1993)
3	Multiple perspectives	3.86	D	HKEAA (2007)
3	Rational thinking	3.86	S	Evans & Over (1996); Howe (2000, 2004)
5	Thoughtful judgments	3.79	S	Howe (2000, 2004); Paul & Elder (2006)
6	Analysis	3.71	S	Ennis (1989); Facione (1990); Norris & Ennis (1989); Scriven & Paul (1987)
7	Respect for evidence	3.64	D	Glaser (1941); HKEAA (2007); Inch & Warnick (2010)
7	Inference	3.64	S	Elder & Paul (2008); Ennis (1996); Facione (1990); Norris & Ennis (1989)
7	Synthesis	3.64	S	Halpern (2014); Scriven & Paul (1987)
7	Logic	3.64	D	Elder & Paul (2008); Halpern (2014)
7	Tolerance towards a wide range of views and values	3.64	D	HKEAA (2007); Von Bergen et al. (2012)
12	Open-mindedness	3.50	D	Elder & Paul (2010); Facione (1990); Norris (1989)
12	Evaluation	3.50	S	Facione (1990); Fisher & Scriven (1997); Scriven & Paul (1987)
12	Bias detection	3.50	S	HKEAA (2007); Inch & Warnick (2010)

12	Assumptions identification	3.50	S	Ennis (1989); Halpern (2014); Norris & Ennis (1989)
12	Objectiveness	3.50	D	Howe (2000, 2004); Inch & Warnick (2010)
17	Confidence in reasoning	3.43	D	Facione (1990)
17	Clarity	3.43	S	Elder & Paul (2008); Ennis (1996); Norris & Ennis (1989); Scriven & Paul (1987)
17	Inquisitiveness	3.43	D	Facione (1990)
17	Deductive reasoning	3.43	S	Halpern (2014)
17	Explanation	3.43	S	Facione (1990); Halpern (2014)
22	Systematicity	3.36	D	Facione (1990)
22	Judiciousness	3.36	D	Facione (1990)
24	Interpretation	3.21	S	Elder & Paul (2010); Facione (1990); Fisher & Scriven (1997)
24	Truth-seeking	3.21	D	Facione (1990)
24	Self-correction	3.21	D	Halpern (2014); Lipman (2003)
24	Problem-solving	3.21	S	Howe (2000, 2004); Polya (1981)
24	Acceptance	3.21	D	Glaser (1980)
29	Convergent thinking	3.14	S	Halpern (2014)
30	Drawing conclusions	3.07	S	Elder & Paul (2008); Halpern (2014)
31	Conceptualization	2.86	S	HKEAA (2007); Lipman (2003); Scriven & Paul (1987)
32	Fairness	2.71	D	Elder & Paul (2008); Scriven & Paul (1987); Shaw et al. (2014); Siegel (1988)
33	Application	2.64	S	Bloom (1956); Ennis (1962); Scriven & Paul (1987)

34	Self-regulation	2.36	S	Facione (1990)
34	Responsibility	2.36	D	Birnbacher (2001); Howe (2000, 2004)
36	Accuracy	2.50	D	Paul & Elder (2006); Howe (2000, 2004); Scriven & Paul (1987)
36	Specificity	2.50	D	Howe (2000, 2004)
38	Consensus-seeking	2.20	D	Halpern (2014)
39	Persistence	2.07	D	Halpern (2014)
40	Consistency	1.57	D	Halpern (2014); Scriven & Paul (1987); Siegel (1988)

6.1.4 Teachers shared similar views with educational authorities

As discussed earlier, the respondent teachers were experienced in NSS and AS LS, so that they were clear about what critical thinking is. Their conceptions of critical thinking were thus also similar, to a certain extent, to those of educational authorities. As noted, in the teacher briefing sessions in 2008, the HKEAA presented the level descriptors in which Level 5 was categorised in three broad dimensions: (1) multiple perspectives and importance of context; (2) critical thinking; (3) mastering the enquiry process and reflection. Of the seven level descriptors in Level 5, four are concerned with critical thinking.

- interprets and analyses different and complex information from a variety of perspectives;
- evaluates various viewpoints and synthesizes own opinions and suggestions with well-supported arguments and sufficient examples;
- communicate ideas in a concise, logical, balanced and systematic way;

- conceptualises evidence, consistently shows respect for evidence, open-mindedness and tolerance towards a wide range of views and values (HKEAA, 2008, p. 22).

The terms from the critical thinking dimension in the level descriptors were adopted as definers for the survey, they were *multiple perspectives; analysis; synthesis; respect for evidence; tolerance towards a wide range of views and values; evaluation; open-mindedness; interpretation; conceptualisation; and consistency*. From the results of teacher survey, seven terms were ranked very high (see Table 6.2). That means the terms of critical thinking that HKEAA mentioned were also regarded by the respondent teachers that highly related to critical thinking. It was clear that the respondent teachers held a similar view to that of the CDC and HKEAA that critical thinking consisted of skills such as conceptualising evidence; evaluating various viewpoints and synthesising one's own opinions and suggestions with well-supported arguments and sufficient examples; and interpreting and analysing different and complex information from a variety of perspectives. Critical thinking also consisted of dispositions such as consistently showing respect for evidence, open-mindedness and tolerance towards a wide range of views and values. It is necessary for teachers to follow the HKEAA since they have to help their students to prepare for public examinations. It is therefore, understandable that teacher conceptions of critical thinking should be congruent with those the educational authorities.

Table 6.2 Comparison of the results of the teacher survey and the level descriptors.

Ranking of Definers	Definers in the survey	Level Descriptors (HKEAA, 2014)
3	Multiple perspectives	variety of perspectives
6	Analysis	analyses
7	Synthesis	synthesizes
7	Respect for evidence	respect for evidence
7	Tolerance towards a wide range of views and values	tolerance towards a wide range of views and values
12	Evaluation	evaluates
12	Open-mindedness	open-mindedness

6.1.5 Teachers recognised the importance of critical thinking

Although it was not the focus of this study, the examples from the teacher semi-structured interviews demonstrated the importance of critical thinking in individual dimension. As a teacher, Owen found that he needed critical thinking when he woke up late in the morning and wanted to arrive at school in time. Oliver thought that students needed critical thinking to decide what foods to choose for class lunch on the last teaching day. This echoes Facione's (2011) comment that "all of us encounter opportunities in our daily lives to engage problems and decisions using strong critical thinking" (p. 4). On the other hand, Terry regarded critical thinking as a process of information gathering. People should gather information from every aspect to avoid misunderstanding. Critical thinking enables people to "consider alternative views to arrive at sound judgments" (Ku & Ho, 2010, p. 54). Through attending Liberal Studies classes, students develop the skill of critical thinking and problem solving (CDC & HKEAA, 2007, p. 5) and can

apply critical thinking in “making decisions and judgments on issues and problems at both personal and social levels” (CDC & HKEAA, 2007, p. 6). The importance of critical thinking in the individual dimension was recognised by the respondent Liberal Studies teachers as a survival skill (Johanson, 2010; Wagner, 2008, p.15) and a 21st century skill (Rosefsky & Opfer, 2012). However, the respondent teachers did not recognize the importance of critical thinking in the workplace and in the society. Future study could be more focus on investigating teacher conceptions of the importance of critical thinking.

To conclude, the first research question *What are teacher conceptions of critical thinking in Liberal Studies?* was discussed above. The respondent teachers held a clear conception of critical thinking, with which they could clearly and precisely describe critical thinking during the interviews. Although they shared similar views with the scholars, who conceived of critical thinking as two dimensional, teachers were found to emphasise the skills dimension. The experienced LS teachers might have attended the teacher briefing sessions arranged by HKEAA in 2008, and they were assumed had read the C&A Guide to understand the curriculum and assessment before teaching this new subject in 2009. Teachers were then clear about the requirements for the examinations. Since critical thinking skills were strongly emphasised in the level descriptors of LS (HKEAA, 2014), teachers were clear that they were obliged to teach students those skills in order to help them achieve a higher level in the examinations. Having

taught LS since 2009, teachers had become clear about what critical thinking is. As Stapleton (2011) noted, teachers can capture the essence of teaching critical thinking in their classrooms when they have an understanding of critical thinking (p. 21). It was hoped that the respondent teachers who had clear conceptions of critical thinking could teach critical thinking in their Liberal Studies lessons. The description of how teacher conceptions of critical thinking influenced their classroom practice and how student conceptions of critical thinking influenced by the classroom practice will be discussed in section 6.3.

6.2 Student conceptions of critical thinking in Liberal Studies

After examining teacher conceptions of critical thinking, the second research question *What are student conceptions of critical thinking in Liberal Studies* is discussed here.

6.2.1 Students conceived critical thinking as being one dimension

One of the most intriguing findings of this study is that students perceived critical thinking as being one dimension. As mentioned, the items on the questionnaire were adopted from scholars and were categorised into the skills and dispositional dimensions according to the literature reviewed. The findings from students, however, did not conform to the intentions of the researcher. As shown in Table 4.3, the result of PCA illustrated that the 40 definers cannot be neatly categorised into two components. Each component consisted of both skills and dispositions. In

other words, the student conceptions of critical thinking were different to those of scholars, who contended that critical thinking has skill and dispositional dimensions. The respondent students conceived critical thinking as one dimension only.

In student conceptions, critical thinking is a concept without any dimensions at all. This may because they were unfamiliar with the term *critical thinking*. Students from Trinity School reported in the semi-structured interviews that teachers did not directly mention the term *critical thinking*, and students have never heard of the term *critical thinking*. A student from a Band One school also noted that she had no idea whether her teacher had said something about critical thinking. Students were quite unfamiliar with the term *critical thinking*, since their teachers taught critical thinking implicitly, and explicitly mentioned the names of the definers of critical thinking but did not mention the term critical thinking, and because teachers used examples to teach the skills or dispositions of critical thinking. Students could not clearly understand what critical thinking was and they did not realise that critical thinking could be understood as different dimensions. This conception of critical thinking as one dimensional was reported by Howe (2000, p. 60) as early as 2000. Howe illustrated the connection of the definers by example, such as *thoughtful judgments* as a part of *analysis*, and *reasoning* as including *logic*. For the respondent students in this study, these concepts may be a part of critical thinking. As noted earlier, there are various interpretations of the term *critical thinking* because of the richness and the ambiguity of

its meaning (Johnson, 2009, p. 61). Because we perceive the world through our own conceptions and thus create our own meaning for certain phenomena, and words or phrases (Pratt, 1992; Paul, 1993), there are different conceptions of critical thinking among different people. In this study, the findings revealed that there were different conceptions of critical thinking between scholar and Hong Kong Form 5 students.

6.2.2 Students emphasised the skills dimension of critical thinking

From the results of PCA, the respondent students conceived critical thinking as one dimensional. From the results of student interviews and survey, students were found emphasizing skills dimension of critical thinking. As mentioned, there were four themes collected from the responses in student interviews: *multiple perspectives* related to the dispositional dimension of critical thinking while *rational thinking*, *thoughtful judgments*, and *analysis*, belonged to the skills dimension. It is evident that the students shared similar views with their teachers, who emphasised the skills dimension more than the dispositional dimension of critical thinking.

As reported as Table 4.2, 17 out of 40 definers had a mean higher than 3. That means students thought that 43% of the definers were closely related to critical thinking. Of these 17 definers, only six were dispositions (*multiple perspectives*; *logic*; *objectiveness*; *respect for evidence*;

judiciousness; and *tolerance towards a wide range of views and values*). In the top ten ranked definers in the student survey, there were six skills dimensional definers: *rational thinking*; *analysis*; *thoughtful judgments*; *inference*, *higher-order thinking*, and *reflection*. This finding coincided with the study by Wong (2007). The respondent students in her study reported that *critical thinking is an action facilitated by cognitive skills* which included analysis, synthesis and evaluation (p. 72), and *critical thinking is a reflective thinking* (p. 80). There was a difference between the sample in Wong's study and that of this study, where Wong's study involved ten girls studying AS LS in an EMI school, and in this study there were 480 Form 5 students learning NSS LS through CMI in four schools. In spite of this difference, there was common ground between these two studies in that the respondent students were senior high school students. In this study, the respondent students provided similar answers. These terms were ranked high in the student survey in this study in which *analysis* was ranked 3rd; *higher-order thinking* ranked 9th; and *synthesis* ranked 17th and all these terms were skills dimensional. Students studying Liberal Studies in Hong Kong share similar conceptions of critical thinking in which the skills dimension of critical thinking was more important than the dispositional.

6.2.3 A correlation of school band and the dimensions of critical thinking

Previous research has examined the relationship between critical thinking and academic performance, such as the relationship between critical thinking skills and language learning

(Klimoviene et al., 2006); critical thinking disposition and student academic achievement in different grade levels (Dehghani et al., 2011; Giancarlo & Facione, 2001; Stupnisky et al., 2008; White et al., 2015); and even in the conceptions of teacher candidates (Karagol & Bekmezci, 2015). There was a different finding shown in this study. As shown in Figure 2 (see section 4.4), there was a significant interaction effect between school band and the dimensions of critical thinking. Band One school students were found more inclined to the skills dimension of critical thinking and Band Three school students were more inclined to the dispositional.

The reason Band One school students were more inclined to the skills dimension of critical thinking might have been due to the pressure of the high-stakes examination. Under the highly selective education system in Hong Kong (Lau, 2005, p. 196), Band One school students are generally anxious about their academic performance, since only students who achieve high grades can enter university, and therefore, students as well as their schools put much effort into obtaining high grades in public examinations so as to strive for the opportunity to enter university (Lau, 2005, p. 195). In an Asian learning context such as Hong Kong, the student concept of learning is adjusted to pass examinations, and use certain kinds of learning and study strategies to enhance their performance in high school study (Yip, 2013, p. 824). Accordingly, students emphasised the skills required in the Liberal Studies examinations. As noted, 80% of Liberal Studies marks come from a public examination that consists of two written papers. In 2014, the level descriptors

(Level 5) for the skills of identifying, organising, analysing, interpreting, evaluating, and synthesising are going to be evaluated in the written examinations (HKEAA, 2009). This might explain why Band One school students were more inclined to the skills dimension of critical thinking. It was, however, insufficient to verify the discovery of the relationship between school band and the dimensions of critical thinking since Band One and Band Three school students were taking the same examinations and both of them should emphasized skills dimension of critical thinking. Why the Band One school students were more inclined to skills dimension of critical thinking than Band Three school students? A more in-depth study is recommended to be conducted.

The second research question *What are student conceptions of critical thinking in Liberal Studies?* was discussed as above. The next section discusses the third research question, *What is the relationship between teacher and student conceptions of critical thinking in Liberal Studies?*

6.3 Relationship between teacher and student conceptions of critical thinking in Liberal Studies

Respondent teachers and students held similar views in the surveys, where they regarded critical thinking as inclined to the skills dimensions rather than the dispositional. On the other hand, in the semi-structured interviews, both respondents reported that they recognised critical thinking as

being related to *analysis* and *thoughtful judgments*. The similar views will be discussed below.

6.3.1 Students were influenced by the explicit content-specific and general instructional approaches of teachers

As noted, a teacher's content-specific instructional approach was found significant in influencing student conceptions of critical thinking. Firstly, the respondent teachers, according to student reports in the semi-structured interviews, placed emphasis on answering techniques such as using multiple perspectives, analysis, inference, counter argument, and evaluation. Band One school students, for example, reported that their teacher explicitly noted the term *multiple perspectives* in lessons and taught students to view an issue from multiple perspectives in writing essays, and all these practices influenced them in that they saw multiple perspectives as related to critical thinking (Omega School and Oxford School). Teachers also taught students to analyse information and then apply it in writing essays (Omega School); and to be judicious during writing (Oxford School). Students also conceived of critical thinking as making inferences, since their teachers often used the term *inference* and taught students to draw inferences. It is clear that "teachers' ordinary language in the presentation of subject matter was found to have significant impact on students' conceptions" (Zeidler & Lederman, 1989, p. 771).

In teaching answering techniques, teachers always mentioned the terms such as multiple

perspectives; analysis; inferences; objectiveness; and evaluation. Accordingly, students recognised that these terms were important elements in critical thinking. This drilling in answering techniques had an impact in shaping student conceptions of critical thinking.

The respondent teachers might have emphasised the drilling of answering techniques because of the pressure of the high-stake examinations. As mentioned, NSS Liberal Studies is one of the core subjects, in which every senior high school student in Hong Kong takes the DSE examination. Being experienced teachers, the respondents have been acutely aware of the consequences of high-stakes examinations, such as public reporting of examination results, and for Band Three schools, the closure of a school if student academic performance is continually at a low level (Vogler & Carnes, 2014, p. 38). As a result teachers tended to design their instructions in order to fit the requirements of the examinations. In other words, classroom practice is influenced by the pressure of high-stakes examinations (Firestone, Monfils, Camilli, Schorr, Hicks & Mayrowetz, 2002, p. 1516; Vogler & Carnes, 2014, p. 54). Accordingly, teachers were anxious to adopt those practices they believed best suited the requirements of the examinations. Teachers were thus eager to design classroom practices that could help their students attain grades that would allow them to graduate and help their school improve examination grades (Vogler & Carnes, 2014, p. 56).

The respondent Liberal Studies teachers were also keen on using debate in their lessons. Owen, a

teacher from a Band One school, reported that students who argued with him in lessons generally had better academic performance because their brains were working. A Band Three school teacher, Tracy, also reported that debate helped students to draw inferences. Students also recognised that debate was helpful in Liberal Studies because they could listen to all the arguments from both pros and cons sides before making a reasoned decision, which in turn they can use as opinions in writing essays. In accordance with the study by Tous, Tahriri, and Haghighi (2015), students found that debate provided them with an opportunity to analyse the data and evaluate the arguments (p. 33). The respondent students in this study shared a similar view, recognising that one of the benefits of debate participation was their improvement of analytical and critical skills (Williams, McGee & Worth, 2001, p. 200). Debate was also found to encourage student dispositions of critical thinking such as open-mindedness and tolerance for other views and values. During the process of debate, students were required to “search for evidence and proofs to support their arguments, look for reasons, and see the issues from different angles and take multiple perspectives into consideration” in which critical thinking skills and dispositions were developed (Zare & Othman, 2015, p. 167).

To conclude, debate was one of the significant content-specific instructional approaches that Liberal Studies teachers often used in their lessons, and was found to be significant in developing student critical thinking (Camp & Schnader, 2010, p. 656; Doody & Condon, 2012, p. 232;

Goodwin, 2003, p. 161; Yang & Rusli, 2012, p. 142). When preparing and during debate, students need to think more carefully in order to argue with classmates. Accordingly, students learn the skills of viewing an issue from different perspectives and as different stakeholders, and to synthesize the opinions of classmates and enrich the arguments made in essays; whereas in the dispositional dimension, students learnt to be open-minded and tolerant. Student conceptions of critical thinking were shaped by the adoption of debate in the classroom practice.

Teacher general instructional approach was also had an impact in shaping student conceptions of critical thinking. First, group learning were adopted by three out of the four sample schools in Liberal Studies lessons. Group learning was found to be useful in promoting skills such as synthesizing materials and opinions; analysing advantages and disadvantages of a matter (Oxford School); filtering information (Trinity School); and improving writing skills through reciprocal marking in pairs (Oxford School). Similar comments were made in studies by Fung and Howe (2014, p. 260); Kaddoura (2013, p. 18) and Nazari and Mahmoodi (2015, p. 143) in which group learning was found to have a positive impact on the development of student critical thinking. Group learning was also beneficial for nurturing student dispositions such as rational thinking (Oxford School); open-mindedness (Tiffany School); and tolerance of the views of others (Trinity School and Tiffany School). In short, group learning was a general instructional approach that most respondent Liberal Studies teachers adopted in their lessons in order to promote student

critical thinking, which, in turn, shaped student conceptions of critical thinking.

Teacher feedback was another influential factor in shaping student conceptions of critical thinking.

Although students did not understand what higher-order thinking was, they learned this word from teacher complaints and, finally, it shaped their understanding that higher-order thinking means critical thinking (Omega School). Students also learned some words that may be regarded as critical thinking, such as inference and evidence, as noted by Oxford School students and objective as noted by Tiffany School students.

The instructional media used in Liberal Studies lessons was recognised as influencing student conceptions of critical thinking. Watching videos was reported as teaching multiple perspectives and, therefore, students thought that to look at an issue as different stakeholders was critical thinking (Trinity School).

Teacher actions influence the way that students learn (Brickhouse, 1990, p. 61). Liberal Studies teachers had clear conceptions of critical thinking, and they intentionally used various methods to improve the skills and nurture the dispositions of students. As a result, student conceptions of critical thinking were influenced by classroom practice. It was clear that teacher conceptions of critical thinking influenced classroom practice, and, classroom practice was found significant in

shaping student conceptions of critical thinking.

6.3.2 Students were affected by the implicit messages of teachers

Students reported that teacher's explicit content-specific and general instructional approaches had a great impact on their conceptions of critical thinking as noted above. The implicit messages embedded in a teacher's languages were also found to have a significant influence.

When asked how they recognised the words on the questionnaire, students always answered “can't remember” or “I don't know”. It is clear that they could not trace the source of their ideas. They confessed that their teachers did not say anything about the term critical thinking (Oxford School). Implicit messages embedded in teacher language provided for varied conceptions, however (Zeidler & Lederman, 1989, p. 777). They noticed that some words had been heard in the lessons. Sometimes their teachers taught the words via writing essays, for example that students should be careful to detect bias (Oxford School); and in answering examination papers (Oxford School); and sometimes the teachers used examples to teach the different aspects of a matter from multiple perspectives (Oxford School). This is a Type B implicit relationship, in which teachers use examples to teach the skills or dispositions of critical thinking. In addition to the skills used in answering, dispositions such as being tolerant of different opinions were also learned implicitly in the lessons (Oxford School). These Band One school students could understand the intention and

importance of the teacher's actions, and at least they found that these actions were important to their learning and examinations. Even though they did not remember whether their teachers had mentioned the words or not, they thought that the words were related to critical thinking.

Students from Band Three schools held a similar view to Band One school students. They were not aware of the existence of critical thinking in Liberal Studies lessons (Tiffany School) because their teachers had not mentioned any of the words that appeared on the questionnaire (Trinity School). Neither Band One nor Band Three school Liberal Studies teachers had clearly and explicitly introduced the terms of critical thinking in the lessons. It is doubtful that students can conceptualise critical thinking if their teachers do not explicitly teach or mention the term. A Band One school student from Oxford School reported that some terms had been used in the Liberal Studies lessons but that the teacher did not explicitly say that these were related to critical thinking. In other words, teachers had the intention to teach critical thinking through techniques such as analysis, inference, and multiple perspectives, but did not explicitly tell their students that these terms were related to critical thinking. As a result, students attached meaning to these phenomena, understanding that these words were related to critical thinking.

When they were asked the source of their conceptions of critical thinking, students recalled their Liberal Studies lessons and realised that their teachers, through the classroom practice, had

implicitly taught critical thinking. Students were not aware of teacher intentions of teaching critical thinking. A Band Three student from Tiffany School concluded that “we have talked of group learning, I am just aware that it is related to critical thinking”. Many students admitted not having thought about the issue raised by the questionnaire (what critical thinking is) until they were asked to complete it. During the process of thinking about whether the definers are related to critical thinking, the students were stimulated to clarify their conceptions of critical thinking. It demonstrated that the inability of most students to identify the sources of their conceptions of critical thinking was because the conceptions of critical thinking were taught and learned implicitly.

The lack of awareness of the existence of critical thinking in Liberal Studies lessons might due to the teacher frustration with poor academic performance by students, and their low confidence in student potential to learn critical thinking (Tsui, 2001). As reported by Owen, a Band One school teacher, students had difficulties when they were required to learn higher-order thinking. A Band Three school teacher, Tracy, confessed that her students were so weak that they could not demonstrate higher-order thinking because of their school band. Both Band One and Band Three school teachers in this study had low confidence in nurturing student critical thinking, however, they were obliged to teach critical thinking since it is a requirement of the Liberal Studies examinations. Facing this dilemma, teachers tended to teach critical thinking implicitly. They did

not mention the term *critical thinking*, therefore, as Student C of Trinity School reported that they never heard of the term *critical thinking*. Instead, teachers tended to explicitly mention the names of the definers of critical thinking such as analysis and multiple perspectives; and used examples to teach the skills or dispositions of critical thinking.

In conclusion, student conceptions of critical thinking were found to be significantly affected by their teacher's implicit messages, which lead to varied conceptions. Although teachers did not explicitly mention the term *critical thinking*, they intentionally designed classroom practice to enhance student critical thinking skills and dispositions. For the Band Three school students, teachers were a principal source for shaping their conceptions of critical thinking. They thought that critical thinking did not exist in their lessons simply because their teachers did not mention the term explicitly. This means that if the teachers did not mention the terms of critical thinking directly, the students thought that they did not teach critical thinking. They could not understand that teachers had taught them critical thinking through classroom practice such as debate. Although their teachers also did not mention the terms *critical thinking* explicitly, the Band One school students tried to attach meanings from the teacher's actions to their conceptions of critical thinking. Classroom practice was regarded as pedagogy to enhance their critical thinking. They realised that their teachers had the intention to teach them critical thinking, and so they could easily recognise the existence of critical thinking in Liberal Studies lessons.

6.4 Chapter summary

The purpose of this study was to investigate the relationship between teacher and student conceptions of critical thinking in Liberal Studies. To achieve this main purpose, teacher and student conceptions of critical thinking were examined. Teachers were found to have clear conceptions of critical thinking. This might be because they were experienced in teaching Liberal Studies, whether the previous AS level or existing NSS curriculum. They understood very well that Liberal Studies consists of the elements of critical thinking in curriculum and assessment. Respondent teachers also recognised the importance of critical thinking, especially in the individual dimension, where an individual should possess this kind of survival skill in order to face the challenges in the 21st century. Teacher conceptions of critical thinking were also similar to those of scholars and the Hong Kong educational authorities in which critical thinking was two dimensional. Both quantitative and qualitative data revealed that teachers emphasised, for example, analysis, inference, synthesis, multiple perspectives, open-mindedness which the renowned scholars and CDC and HKEAA that critical thinking composes of these elements. Concerning the two dimensional nature of critical thinking, teachers were found more inclined to the skills dimension. The findings of this study are consistent with those in related literature about the conceptions of critical thinking.

Student conceptions of critical thinking were also examined. Like their teachers, students were found more inclined to the skills dimension of critical thinking. Consistent with their counterparts

in Wong's study (2007), respondent students recognised that the skills dimension of critical thinking was more important than the dispositional. There was also a significant interaction effect between school band and dimensions of critical thinking, in which Band One school students were more inclined to the skills dimension of critical thinking and Band Three school students were more inclined to the dispositional. With the pressure of the high-stakes examinations, students, especially those studying in Band One schools, were more concerned about their academic performance in order to enter university. The only way to do this is to meet the requirements of public examinations and, therefore, they were more focused on the skills dimension of critical thinking that was required in the level descriptors. Contrary to the literature reviewed, students did not possess a negative image of critical thinking. Ip (2007) and some students in Chan's study (2013) felt that critical thinking was to criticise others, and the Asian students in Sng's study (2011) reported that critical thinking was not encouraged or accepted in their countries. Students in this study did not share these viewpoints. Instead, the students in this study were encouraged to criticise the viewpoints of classmates during debate, and they appreciated this practice for enhancing their skills in making reasoned arguments and nurturing their dispositions, such as open-mindedness and tolerance for other views and values. Critical thinking was encouraged in Hong Kong, at least in Liberal Studies lessons. Lastly, contrary to the scholars, students conceived of critical thinking as being one dimensional, that critical thinking was not categorised into two dimensions, and instead was a holistic thing. This might due to the ambiguity of the meaning of

critical thinking. Students were unfamiliar with this term, and they defined it through their vague conceptions. The reason for their vague understanding was explained through the research question *What is the relationship between teacher and student conceptions of critical thinking in Liberal Studies?*

The relationship between teacher and student conceptions of critical thinking was investigated. As Moore (2013) argued, it is more meaningful to see how the conceptions of critical thinking are used as an educational practice. More attention should therefore be paid to the classroom practice of nurturing critical thinking. According to the qualitative data, students were strongly influenced by a teacher's explicit content-specific approach. Teachers emphasised answering techniques, for instance, by mentioning the important terms that students needed to demonstrate in essays. The adoption of debate was found to significantly influence student conceptions of critical thinking. No matter the debate between teachers and students or among groups, students reported that debate improved their skills of analysis and evaluation, and also the dispositions of multiple perspectives and open-mindedness.

The general instructional approach also proved influential in shaping student conceptions of critical thinking. According to the literature in similar fields and the responses of students, group learning was found beneficial in developing student critical thinking skills and dispositions.

Teacher feedback and their adoption of instructional media also had a positive impact in influencing student conceptions of critical thinking.

Teachers influenced their students' conceptions explicitly in Liberal Studies through content-specific and general instructional approaches, moreover, their implicit messages were also found to have significant influence. Both Band One and Band Three school students confessed that they had never heard of the term critical thinking in Liberal Studies lessons; however, they understood the implicit meanings of their teacher's words and actions. In the process of teaching answering techniques, student conceptions of critical thinking were affected by ideas such as detecting bias and being tolerant of different opinions. Students were not aware of the existence of critical thinking in Liberal Studies lessons unless they were required to participate in this study. When completing the questionnaire and during the process of semi-structured interviews, they were stimulated to clarify their conceptions of critical thinking. This demonstrated that student conceptions of critical thinking are taught and learned implicitly.

In conclusion, teacher conceptions of critical thinking were found influential in shaping student conceptions through classroom practice that including explicit content-specific and general instructional approaches; and their implicit messages.

Chapter 7 Implications and limitations

The findings in this study have generated important practical implications for the relationship between teacher and student conceptions of critical thinking in Liberal Studies.

7.1 Implications

This study confirmed the hypothesis that there a relationship exists between teacher and student conceptions of critical thinking in Liberal Studies, with the key element, classroom practice, in between them. In this study, the respondent teachers were found to have a clear conception of critical thinking. As Stedman and Adams (2012) noted that, “without the correct concepts and perceptions of critical thinking, the teacher may believe they are encouraging or teaching critical thinking when they are not” (p. 9). It implies that the investigation of Liberal Studies teacher conceptions of critical thinking is the first step to teach critical thinking. It was also demonstrated that much work is required regarding the improvement of the conceptual understanding of critical thinking in teachers, and thus serves as a reminder for educators of the professional development of Liberal Studies teachers.

Moreover, the importance of dispositional dimension of critical thinking should be re-recognized.

In this study, the respondent teachers emphasized the skills dimension such as *higher-order thinking*; *thoughtful judgments*; and *inference* with students also inclined to the skills dimension

including *rational thinking*; *analysis*, and *thoughtful judgments*. However, the dispositional dimension of critical thinking was found important as some studies showed the positive relationship between dispositions and academic achievement (Bers, McGowan, & Rubin, 1996; Dehghani, Mirdoraghib & Pakmehr, 2011; Giancarlo & Facione, 2001; Karagol, Bekmezci, 2015; Stupnisky, Renaud, Daniels, Haynes & Perry, 2008; White, Beck, Birrenkott, Skewes & Layfield, 2015). As Perkins, Jay, and Tishman (1993) noted, “abilities alone do not suffice for intelligent behave” (p. 2). Also, *open-mindedness* and *tolerance* are descriptors of the Level Descriptors in Level 5 (HKEAA, 2014). It implies that the dispositional dimension of critical thinking is also an important element which Liberal Studies teachers should re-recognize. As Ku (2008) suggested regarding the notion that critical thinking should be nurtured at the secondary school level (p. 117), the implementation of Liberal Studies provides an appropriate opportunity to develop students dispositional critical thinking in their secondary level.

Furthermore, the existence of critical thinking in Liberal Studies should be emphasized. In this study, respondent students reported that they were not aware of the existence of critical thinking in the Liberal Studies lessons since their teachers did not explicitly teach critical thinking. It showed that classroom practice influences students’ conceptions of critical thinking. Since critical thinking is an important element in the Liberal Studies curriculum and assessment, it implies that teachers should intentionally teach critical thinking in Liberal Studies lessons.

Last but not least, this study implied that the relationship between teachers' conceptions of critical thinking and classroom practice is complex. As discussed, the respondent teachers had clear conceptions of critical thinking. However, the translation of these conceptions into classroom practice is mediated by a complex set of situational variables since possessing clear conceptions of critical thinking does not necessarily result in classroom practice which is related to improved student conceptions (Lederman, 1992, p. 348). This implies that there might be other factors that, besides teachers' conceptions of critical thinking, influence classroom practice such as textbooks, curriculum constraints, administrative policies, and teachers attitudes about teaching and learning.

7.2 Limitations

Regardless of the implications described above, some limitations of this study warrant note.

First, the sample size should be increased. In this study, only 14 teachers participated in the survey, and four teachers in the semi-structured interviews. In fact, the main purpose of this study was to investigate the relationship between teacher and student conceptions of critical thinking, and the sampling of teachers and students from same school must be strictly adhered to, otherwise the relationship cannot be observed. Since the average teacher-student ratio in Hong Kong secondary schools is 1:18.5 (Education Bureau, 2001), the number of teachers is definitely smaller than those

of students. The four sample schools had a larger teacher-student ration: Oxford School: 1:83; Omega School: 1:54.3; Trinity School: 1:31; Tiffany School: 1:25.6. Therefore the sample size of teachers in this study is small. Since this study aimed to find out the relationship between teachers and students conceptions of critical thinking, enlarging the teacher sample would mean enlarging the student sample at the same time. In spite of this fact, it is still worth enlarging the sample size in order to increase the impact of the study.

Second, the complexity of classroom practice was under-mentioned. As discussed, teachers possessing clear conceptions of critical thinking do not necessarily shown in the classroom practice. That means the relationship between teachers conceptions of critical thinking and the classroom practice was not investigated. There might be other factors that influence this relationship, e.g. administrative policies, curriculum constraints, textbooks, and teachers' attitudes about teaching and learning.

Third, the complexity of the formation of students conceptions of critical thinking was not addressed in detail. As Pratt (1992) contends, conception is the meaning attached to a phenomenon. How students form their conceptions of critical thinking is rather complex. On the one hand, as Ip noted, the translation of the term *critical thinking* into Chinese as “批判性思考” misled students to be under the impression that they are encouraged to criticize (Ip, 2007). A similar finding was

concluded from Chan's study (2013) that there was a debate about whether critical thinking was criticising others. On the other hand, students were familiar with some definers of critical thinking. As a student from Oxford School reported, all normal people know the term *synthesis* while the Omega School students heard the term *critical thinking* from the internet and TV news. It revealed that students form their conceptions of critical thinking not necessarily from classroom practice, rather these conceptions were generated from common sense and their daily lives. However, this study only investigated how classroom practice influenced students' conceptions of critical thinking but did not investigate other factors.

The fourth limitation of this study is the methodology. Other methods of collecting qualitative data are recommended. As described, this study adopted a mixed methods approach in which qualitative and quantitative data are collected. The respondents had to recall what happened in their Liberal Studies lessons, especially the students who did not aware of the intentions of their teachers in classroom practice. To tackle this weakness, lesson observation is recommended. If there is an opportunity to record the behaviours, events and teacher-student interactions in the classroom, researchers can also gain deeper insights by observing the process in the lesson, such as teacher and student verbal and non-verbal messages and blackboard notes (Richie, 2003, p. 35). Document analysis is another research method that is recommended. As mentioned in section 3.32, the latest assignment with teacher comments were examined but did not adopted as an instrument

since it did not provide any useful data. However, other documents are recommended. Lesson plans, teacher handouts and Powerpoint presentations during lessons, student assignments and test/examination papers with teacher feedback are examples of documents. Did teachers shape student conceptions of critical thinking? Clues and evidence can be seen by analysing the written communication between teachers and students (Richie, 2003, p. 35).

The last limitation is the design of the questionnaire. As mentioned, the term *definer* was adopted from Howe (2000), to describe the conceptions of critical thinking, e.g. *evaluation*, *analysis*, etc. However, the terms were not defining critical thinking. Definers may help to include related concepts about critical thinking, but not necessarily help to define the term. In other words, *evaluation* and *fairness* may not actually define critical thinking. Another term, such as *descriptors*, could possibly replace *definers*. In the questionnaire, respondents were required to choose which scale best described their conceptions of critical thinking, with 1 being not related to critical thinking and 4 strongly related to critical thinking. In this sense, respondents might have thought that both *analysis* and *fairness* could be used to describe critical thinking. Accordingly, *descriptors* might be better than *definers* where the terms are used to describe critical thinking but are not actually defining critical thinking.

7.3 Chapter summary

To conclude, this study shed light on the existing scope of studies investigating the relationship

between teacher and student conceptions of critical thinking, especially in the context of Hong Kong that Liberal Studies classroom practice, including teacher explicit content-specific and general instructional approaches; and teacher implicit messages, and had significant impact in shaping student conceptions of critical thinking. The improvement of the conceptual understanding of critical thinking by teachers is recommended, by providing a comprehensive and systematic pre-service or in-service teacher training for Liberal Studies teachers. The findings from this study cannot be generalised to the larger local context, or other similar contexts outside Hong Kong since the sample size only represented very small numbers of Liberal Studies teachers and students in Hong Kong; however, one of the contributions of the findings of this study is that it aroused the necessity of revisiting the meaning of critical thinking. It is meaningful for teachers to explore their conceptions of critical thinking, and to find out how these conceptions are reflected in their classrooms (Moore, 2013, p. 508). The classroom practices that nurture student critical thinking were examined and then recommended for other Liberal Studies teachers. The voice of students is equally significant for curriculum enhancement (Chan, 2013, p. 561). As noted, many students in this study admitted that they had not thought about what critical thinking was until they were asked in the questionnaire and during the interviews. During the process of thinking about whether the definers are related to critical thinking, students were stimulated to clarify their conceptions of critical thinking. When students are clear about what critical thinking is, they can assess the usefulness of critical thinking instruction, since they are the crucial

stakeholders in the learning process. This study added to the limited body of studies investigating the relationship between teacher and student conceptions of critical thinking. As noted, there is literature exploring the relationship between teacher and student conceptions (Abd-El-Khalick et al., 1998; Bartos & Lederman, 2014; Lederman, 1985, 1987, 1992; Sarieddine & BouJaoude, 2014; Zeidler & Lederman, 1989), however it concerns the nature of science, which is not the focus of this study. This study revealed that student conceptions of critical thinking were strongly influenced by the explicit content-specific and general instructional approaches of teachers, and also their implicit messages. Teachers seem to be the significant source of student conceptions of critical thinking. Since existing research investigating the relationship between teacher and student conceptions of critical thinking was rare, especially in Hong Kong context, it is hoped that the results of this study will contribute to the current literature.

This study also found that the relationship between school band and dimensions of critical thinking, in which the pressure from high-stake examinations was demonstrated, was an important factor. Further studies may enlarge the sample size of respondents, especially of teachers, in order to make the study more reliable. Finally, additional research methods such as classroom observation and document analysis are recommended so as to provide deeper insights for researchers.

Chapter 8 Conclusions

This study aimed to investigate the relationship between teachers and students' conceptions of critical thinking in Liberal Studies. Regardless of its importance in individual, workplace, and social dimensions, and its inclusion in the worldwide educational reforms, the term *critical thinking* is conceived as vague and unclear. A new compulsory subject, Liberal Studies, was introduced to the NSS curriculum in 2009, with the aim of nurturing student critical thinking. In spite of this intention, the way teachers and students conceived of critical thinking was not clear. Inspired by the literature regarding science, it was hypothesised that teacher conceptions of critical thinking influenced Liberal Studies classroom practices, and that classroom practices influence student conceptions of critical thinking. In other words, it assumes that there is a relationship between teacher and student conceptions of critical thinking in Liberal Studies.

This mixed-approach study was conducted with a sample of 14 Liberal Studies teachers and their 480 Form 5 students in four secondary schools in Hong Kong. This study found that both teachers and students emphasised the skills dimension of critical thinking. Teachers had a clear understanding of what critical thinking was, but students had not. Teachers held similar views as scholars and educational authorities. As opposed to the conceptions of scholars, students conceived of critical thinking as one dimensional. A relationship was found between school band and dimensions of critical thinking in which Band One school students were more inclined to the

skills dimension of critical thinking. The assumption that the Liberal Studies classroom practices greatly influenced student conceptions of critical thinking through explicit teacher's content-specific instructional and general instructional approaches, and teacher implicit messages was confirmed. In spite of this finding, the relationship between teacher and student conceptions of critical thinking still requires much more empirical investigation, for example adopting lesson observation for collecting data or enlarging sample size.

Although there are limitations, this study has made conceptual contributions for Liberal Studies teachers and educational practitioners. First, it confirmed the conceptual framework that classroom practice, which was influenced by teachers' conceptions of critical thinking, had an impact on students' conceptions of critical thinking. In the studies about the nature of science, for example, Lederman (1985, 1999), this conceptual framework was confirmed. From the findings of this study, this conceptual framework was proved to be applicable in the area of critical thinking. As mentioned, *critical thinking* is a term regarded as rich in meaning and ambiguous (Johnson, 2009, p. 61); accordingly, it is suggested that the framework be applied to other areas of study where the focus is also rich and ambiguous. In this conceptual framework, classroom practice is the key concept mediating teachers' and students' conceptions. In future research, therefore, the area of study should be related to a discipline or subject which situated in a classroom context. It is believed that this conceptual framework will provide contributions to different areas of study

which are embedded in different disciplines or subjects.

Moreover, this study added value to the existing research about investigating both teachers' and students' conceptions of critical thinking. There have been studies examining teachers' conceptions of critical thinking along with some studies into students' conceptions of critical thinking. Few studies, however, have investigated both conceptions at the same time. Besides the contribution already accounted for by the skills and dispositional dimension of critical thinking, students' conceptions of critical thinking was found to be discrepant with those of scholars. In addition, the findings of the relationship between school band and dimension of critical thinking should be fully utilised to improve future studies. These results also indicate the need to expand the current study on the conceptions of the skills and dispositional dimensions of critical thinking in order to derive more comprehensive investigation of conceptions of critical thinking.

Furthermore, this study filled a research gap in terms of demonstrating the empirical evidence of the influence of classroom practice on students' conceptions of critical thinking. The hypothesis was confirmed that teachers' conceptions of critical thinking influenced the classroom practice which had an impact on students' conceptions of critical thinking. However, classroom observation is strongly recommended for comprehensive investigation of how the classroom practice influences students' conceptions of critical thinking. Further research with various

approaches of methodology is greatly needed in order to further investigate the effects of classroom practice on students' conceptions of critical thinking.

Regarding the research methodology, the existing instrument for investigating conceptions of critical thinking should be fine-tuned if it is to be used in future research. Instead of using the term *definers*, the term *descriptors* might be adopted with elaboration and examples. A larger sample of teachers in the survey and interviews is also suggested so as to obtain more reliable data. All of these issues point to the need for further research if investigating teachers' and students' conceptions of critical thinking.

Since classroom practice is a complex milieu while critical thinking is a vague term, the relationship among teachers' conceptions of critical thinking, students' conceptions of critical thinking, and classroom practice is still unclear and requires considerably more empirical investigation. Other factors that have potential impact on this relationship may be unaccounted for in the current studies. Although there has been continuous discussion and extensive studies about teachers' and students' conceptions of critical thinking, the empirical basis for understanding the relationship between these two conceptions is far from complete. In order to provide insights about examining this relationship, this study has developed an initial investigation that will allow for more systematic and comprehensive research into the conceptions of critical thinking and the

role of classroom practice in influencing students' conceptions of critical thinking.

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Appendix 1 Classroom variables (Lederman, 1985)

Teacher's general instructional approach	
1	Anecdotal
2	Dynamic
3	Emphasis on rote memory/recall
4	Extended lecturing
5	Frequent questioning
6	Fragmented
7	Higher cognitive level questions
8	Instructional digression
9	Pacing
10	Periodic review
11	Predictable
12	Problem solving
13	Receptive to unsolicited questions
14	Rushing
15	Seat work
16	Sequential probing
17	Supportive
18	Use of humour
19	Variety of instructional media
Teacher's content-specific characteristics	
20	Amoral
21	Anthropomorphic language
22	Arbitrary constructed
23	Creativity
24	Developmental
25	Fallibility
26	Language accuracy
27	Misinformation
28	Moral and ethical implications
29	Parsimony
30	Quantity of materials
31	Relevancy
32	Superficiality

33	Testable
34	Unified
Teacher non-instructional characteristics	
35	Demeanour
36	Impersonal
37	Non-instructional digression
Student characteristics	
38	Active engagement
39	Attentive
40	Unsolicited questioning
41	Discipline
Classroom atmosphere	
42	Down time (wait time)
43	Low anxiety
44	Rapport

Appendix 2 The list of 30 classroom variables of critical thinking

Teacher's general instructional approach	
1	Frequent questioning
2	Higher cognitive level questions
3	Periodic review
4	Problem solving
5	Receptive to unsolicited questions
6	Group learning
7	Sequential probing
8	Variety of instructional media
9	Appropriate materials
10	Systematic
Teacher's content-specific instructional approach	
11	Emphasis on answering techniques
12	Mind map
13	Debate
14	Extended lecturing
15	Emphasis on inference
16	Debate with students
17	Drawing conclusions
18	Brainstorming
19	Explanation
20	Sharing of/ inviting personal opinions
Teacher non-instructional characteristics/ attitudes	
21	Demeanour
22	Supportive
23	Use of humour
24	Respect for diversities
25	Impartial
Classroom atmosphere	
26	Discipline
27	Wait time (for student's answers)
28	Low anxiety
29	Rapport
30	Friendly (among group members)

Appendix 3 Description of definers of critical thinking

Definers of Critical Thinking	Description
1. Self-regulation	The process that self-consciously monitors one's cognitive activities, the elements used in those activities, and the results educed, particularly by applying skills in analysis, and evaluation of one's own inferential judgments with a view toward questioning, confirming, validating, or correcting either one's reasoning or one's results. (Facione, 2011, p. 21)
2. Open-mindedness	A person who is tolerant of divergent views and sensitive to the possibility of their own possible biases, who respects the right of others to have different opinions. (Facione, 2011, p. 30)
3. Reflection	Being "aware of its own assumptions and implications as well as being conscious of the reasons and evidence that supports this or that conclusion" (Lipman, 2003, p. 26).
4. Confidence in reasoning	A person who is confident that their own reasoning skills will yield good judgment, who is confident in their own critical thinking (Facione, 2011, p. 30)
5. Higher-order thinking	A person who takes new information and information stored in memory and interrelates and/or rearranges and extends this information to achieve a purpose or find possible answers in perplexing situations (Lewis & Smith, 1993, p. 136)
6. Persistence	A person whose attitude involves working on a task and not stopping before its completion. (Halpern, 1989, p. 30)
7. Interpretation	To comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria. (Facione, 2011, p. 21)
8. Respect for evidence	A person who shows the respect for evidence that consists of facts or conditions that are objectively observable, beliefs or statements generally accepted as true by the recipients, or conclusions previously established. (Inch & Warnick, 2010, p. 25)

9. Inference	To identify and secure elements needed to draw reasonable conclusions; to form conjectures and hypotheses; to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions, or other forms of representation. (Facione, 2011, p. 21)
10. Systematicity	A person who consistently endeavours to take an organised and thorough approach to identifying and resolving problems, who is orderly, focused, persistent, and diligent in their approach to problem solving, learning, and inquiry. (Facione, 2011, p. 30)
11. Conceptualisation	The process of clustering things in terms of their similarities. (Lipman, 2003, p. 181)
12. Multiple perspectives	A person who evaluates critically and interprets objective information and knowledge by considering the pros and cons of the arguments, and is aware of the limitations in, and alternatives to, the positions they have chosen (CDC & HKEAA, 2007, p. 90)
13. Synthesis	The process of putting together elements and parts so as to form a whole (Bloom, 1956, p. 192)
14. Responsibility	To have an obligation of some sort to act in the interest of another person, an animal, a thing, or a non-personal cause (Birnbacher, 2001, p. 10)
15. Drawing conclusions	The process of reaching an inferential belief that is derived from premises. (Halpern, 1989, p. 168)
16. Consensus-seeking	A person who find ways to compromise and to achieve agreement (Halpern, 1996, p. 27)
17. Evaluation	To assess the credibility of statements or other representation that are accounts or descriptions of a person's perception, experience, situation, judgment, belief, or opinion; and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions, or other forms of representation. (Facione, 2011, p. 21)
18. Judiciousness	A person who approaches problems with a sense that some are ill-structured and some can have more than one plausible solution, who has the cognitive maturity to

	realise that many questions and issues are not black and white and that, at times, judgments must be made in contexts of uncertainty. (Facione, 2011, p. 30)
19. Clarity	To make sure the meaning of the terms and the way of presentation in speaking and writing are clear and understandable. (Ennis, 1996, p. 4)
20. Consistency	A standard for assessing the quality of an argument. When the premises that support a conclusion are not contradictory, they are consistent. (Halpern, 1989, p. 216)
21. Bias detection	A person who detects unreasoned distortion of judgment or a prejudice on a topic (Inch & Warnick, 2010, p. 143)
22. Truth-seeking	To describe a person who has intellectual integrity and a courageous desire to actively strive for the best possible knowledge in any given situation, who asks probing questions and follows reasons and evidence wherever they lead, even if the results go against their cherished beliefs. (Facione, 2011, p. 30)
23. Rational thinking	Thinking, speaking, reasoning, making a decision, or acting in way that is generally reliable and efficient for achieving one's goals (Evans & Over, 1996, p. 8)
24. Self-correction	A person who utilises feedback, tries to determine what went wrong and to recognise the factors that led to the error. (Halpern, 1989, p. 30)
25. Assumptions identification	The process of identifying assumptions that are statements for which no proof or evidence is offered. They may be stated or implied. (Halpern, 1989, p. 215)
26. Inquisitiveness	A person who is habitually strives to be well-informed, wants to know how things work, and seeks to learn new things about a wide range of topics, even if the immediate utility of knowing those things is not directly evident, who has a strong sense of intellectual curiosity. (Facione, 2011, p. 30)
27. Deductive reasoning	The use of stated premises to formulate conclusions that can logically be inferred from them. (Halpern, 1989, p. 168)
28. Tolerance towards a wide range of views and values	A person who fully welcomes and unambiguously endorses alternative ways of feeling, thinking, and

	acting (Von Bergen, 2012, p. 111)
29. Problem-solving	A process when a person consciously searches for some action appropriate to attaining a clearly conceived, but not immediately attainable, aim. (Polya, 1981, p. 117)
30. Acceptance	To refer to behavioural willingness and psychological acceptance (Hayes, Strosahl, & Wilson, 2012, p. 77)
31. Convergent thinking	To describe the kind of thinking you engage in when you are required to come up with a single correct answer to a question or a problem. (Halpern, 1989, p. 434)
32. Fairness	To avoid showing favouritism toward oneself or toward another individual (Shaw et al., 2014, p. 364)
33. Explanation	To state and to justify reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments. (Facione, 2011, p. 21)
34. Logic	To describe a branch of philosophy that explicitly states the rules for deriving valid conclusions. (Halpern, 1989, p. 168)
35. Analysis	To identify the intended and actual inferential relationships among statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experiences, reasons, information, or opinions (Facione, 2011, p. 21)
36. Specificity	To describe the quality of being unique (APA Dictionary of Psychology, p. 880)
37. Thoughtful judgments	To describe a person who carefully considers when making judgments, i.e. the act of deciding, understanding and good sense (Paul & Elder, 2006, p. 314)
38. Objectiveness	To describe a source's tendency to hold a fair and undistorted view on a question or an issue (Inch & Warnick, 2010, p. 144)
39. Application	To describe the use of abstractions in particular and also concrete situations. (Bloom, 1956, p. 191)
40. Accuracy	To describe a person who is care to obtain conformity with fact or truth (Paul & Elder, 2006, p. 313)

Appendix 4 The list of 40 definers and their sources

Definers of critical thinking	Source
1. Self-regulation	Facione (1990)
2. Open-minded	Elder & Paul (2010); Facione (1990); HKEAA (2007); Norris & Ennis (1989)
3. Reflection	Scriven & Paul (1987)
4. Confident in reasoning	Facione (1990)
5. Higher-order thinking	Howe (2000, 2004); Lewis & Smith (1993)
6. Persistence	Halpern (2014)
7. Interpretation	Elder & Paul (2010); Facione (1990); Fisher & Scriven (1997)
8. Respect for evidence	Glaser (1941); HKEAA (2007); Inch & Warnick (2010)
9. Inference	Elder & Paul (2008); Ennis (1996); Glaser (1980); Facione (1990); Norris & Ennis (1989)
10. Systematicity	Facione (1990)
11. Conceptualisation	HKEAA (2007); Scriven & Paul (1987)
12. Multiple perspectives	HKEAA (2007)
13. Synthesis	Bloom (1956); Halpern (2014); HKEAA (2007); Scriven & Paul (1987)
14. Responsibility	Birnbacher (2001); Howe (2000, 2004)
15. Drawing conclusions	Elder & Paul (2010); Halpern (2014); Howe (2000, 2004)
16. Consensus-seeking	Halpern (2014)
17. Evaluation	Bloom (1956), Ennis (1987); Facione (1990); Fisher & Scriven (1997); HKEAA (2007); Scriven & Paul (1987)
18. Judiciousness	Facione (1990)
19. Clarity	Elder & Paul (2008); Ennis (1996);

	Norris & Ennis (1989); Scriven & Paul (1987)
20. Consistency	Halpern (2014); Scriven & Paul (1987); Siegel (1988)
21. Bias detection	HKEAA (2007); Inch & Warnick (2010)
22. Truth-seeking	Facione (1990)
23. Rational thinking	Evans & Over (1996); Howe (2000, 2004)
24. Self-correction	Halpern (2014); Lipman (2003)
25. Assumptions identification	HKEAA (2007); Ennis (1962); Halpern (2014); Norris & Ennis (1989)
26. Inquisitiveness	Facione (1990)
27. Deductive reasoning	Halpern (2014); Howe (2000, 2004)
28. Tolerance of a wide range of views and values	HKEAA (2007); Von Bergen et al. (2012)
29. Problem-solving	Howe (2000, 2004); Polya (1981)
30. Acceptance	Glaser (1980)
31. Convergent thinking	Halpern (2014); Howe (2000)
32. Fairness	Elder & Paul (2008); Scriven & Paul (1987); Shaw et al. (2014); Siegel (1988)
33. Explanation	Facione (1990); Halpern (2014)
34. Logic	Elder & Paul (2008); Halpern (2014); Glaser (1980)
35. Analysis	Bloom (1956); Ennis (1987); Facione (1990); Howe (2000, 2004); Norris & Ennis (1989); Scriven & Paul (1987)
36. Specificity	Howe (2000, 2004)
37. Thoughtful judgments	Howe (2000, 2004); Paul & Elder (2006)
38. Objectiveness	Howe (2000, 2004); Inch & Warnick (2010)
39. Application	Bloom (1956); Ennis (1962); Scriven & Paul (1987)
40. Accuracy	Paul & Elder (2006); Howe (2000, 2004); Scriven & Paul (1987)

Appendix 5 Questionnaire (English version)

A list of 40 definers of critical thinking

Use the scale below, and for each item, put a tick in the box that best describes your conceptions of critical thinking.

1	2	3	4
not related to critical thinking at all			strongly related to critical thinking

Definers of Critical Thinking	1	2	3	4
1. Self-regulation				
2. Open-mindedness				
3. Reflection				
4. Confidence in reasoning				
5. Higher-order thinking				
6. Persistence				
7. Interpretation				
8. Respect for evidence				
9. Inference				
10. Systematicity				
11. Conceptualisation				
12. Multiple perspectives				
13. Synthesis				
14. Responsibility				
15. Drawing conclusions				
16. Consensus-seeking				
17. Evaluation				
18. Judiciousness				
19. Clarity				
20. Consistency				
21. Bias detection				
22. Truth-seeking				
23. Rational thinking				
24. Self-correction				
25. Assumptions identification				
26. Inquisitiveness				

27. Deductive reasoning				
28. Tolerance of a wide range of views and values				
29. Problem-solving				
30. Acceptance				
31. Convergent thinking				
32. Fairness				
33. Explanation				
34. Logic				
35. Analysis				
36. Specificity				
37. Thoughtful judgments				
38. Objectiveness				
39. Application				
40. Accuracy				

Appendix 6 Teacher Questionnaire (Chinese version)

A. Personal information: Tick the appropriate boxes

1. Gender F ☐ M ☐
2. Age 20-29 ☐ 30-39 ☐ 40-49 ☐ 50+ ☐
3. LS Teaching experience 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5 ☐
4. AS LS Teaching experience <5 ☐ 5-9 ☐ 10-14 ☐ 15-20 ☐

通識科批判性思考概念詞表

請利用下表, √ 出你對批判性思考的概念

- 1 2 3 4
- 與批判性思考 與批判性思考
沒有關係 非常有關係

批判性思考概念詞	1	2	3	4
1. 自我調節				
2. 開放				
3. 反思				
4. 有信心地作出推理				
5. 高階思考				
6. 堅持				
7. 詮釋/解釋				
8. 重視證據				
9. 推論				
10. 有系統的				
11. 概念化				
12. 多角度思考				
13. 綜合				
14. 負責任				
15. 得出結論				
16. 追求共識				
17. 評價				

18. 審慎,明智				
19. 清晰				
20. 一致				
21. 察覺偏見				
22. 追求真理				
23. 理性思考				
24. 自我改正				
25. 辨認假定				
26. 喜好探究				
27. 演繹推理				
28. 容忍不同的意見及價值				
29. 解決難題				
30. 接納				
31. 聚合/求同思考				
32. 公正				
33. 解釋				
34. 邏輯				
35. 分析				
36. 特性				
37. 深思熟慮的判斷				
38. 客觀				
39. 應用				
40. 準確				

Appendix 7 Student Questionnaire (Chinese version)

通識科批判性思考概念詞表

請利用下表, √ 出你對批判性思考的概念

1	2	3	4
與批判性思考 沒有關係			與批判性思考 非常有關係

批判性思考概念詞	1	2	3	4
1. 自我調節				
2. 開放				
3. 反思				
4. 有信心地作出推理				
5. 高階思考				
6. 堅持				
7. 詮釋/解釋				
8. 重視證據				
9. 推論				
10. 有系統的				
11. 概念化				
12. 多角度思考				
13. 綜合				
14. 負責任				
15. 得出結論				
16. 追求共識				
17. 評價				
18. 審慎,明智				
19. 清晰				
20. 一致				
21. 察覺偏見				
22. 追求真理				
23. 理性思考				
24. 自我改正				
25. 辨認假定				
26. 喜好探究				
27. 演繹推理				

28. 容忍不同的意見及價值				
29. 解決難題				
30. 接納				
31. 聚合/求同思考				
32. 公正				
33. 解釋				
34. 邏輯				
35. 分析				
36. 特性				
37. 深思熟慮的判斷				
38. 客觀				
39. 應用				
40. 準確				

Appendix 8 Interview Guide (Choy & Cheah, 2009)

1. From your perspective, what is critical thinking?
2. What role, in your opinion, does critical thinking play in LS lessons?
3. Do you think that critical thinking takes place in your classroom when you are teaching your students? If so, how do you know?
4. How do you think you could bring about critical thinking among students? Specifically what are some things you do or could do to get them to think critically?
5. Do students face problems when you are trying to teach them critical thinking? If so, identify them.
6. Do you think your lessons are enjoyable for students? Why or why not?
7. Do you think you need to give all the information to your students in order for them to learn your subject? Why or why not?
8. Do you think you would be able to implement critical thinking into your lessons if you are required to do so? Why or why not?

Appendix 9.1 Interview Guide for Teachers (English version)

1. From your perspective, what is critical thinking?
2. What role, in your opinion, does critical thinking play in LS lessons?
3. Do you think that critical thinking takes place in your classroom when you are teaching your students? If so, how do you know?
4. What can you do to get your students to think critically?
5. Do the students have problems when you are trying to teach them critical thinking? If so, please identify.
6. Do you think you need to give all the information to your students in order to foster their learning in Liberal Studies? Why or why not?
7. Do you think you would be able to implement critical thinking in your lessons? Why or why not?
8. Please explain your answers on the questionnaire.

Appendix 9.2 Interview Guide for Teachers (Chinese version)

1. 你認為什麼是批判性思考?
2. 你認為批判性思考在通識科中扮演什麼角色?
3. 你認為批判性思考有在你的教學中出現嗎? 如有,你如何得知?
4. 你認為你做了什麼或者應該做什麼令學生有批判性思考?
5. 當你嘗試教批判性思考時,你的學生有遇到什麼問題嗎? 如有,請指出.
6. 為了學習通識,你認為你的學生需要得到所有的知識嗎? 為什麼?
7. 你認為你的課堂有運用批判性思考嗎? 為什麼?
8. 請說明你在問卷上的答案

Appendix 10.1 Interview Guide for Students (English version)

1. From your perspective, what is critical thinking?
2. What role, in your opinion, does critical thinking play in LS lessons?
3. Do you think that critical thinking takes place in your Liberal Studies lessons? If so, how do you know?
4. What are some things you do, or could do, to think critically?
5. Do you face problems when you are trying to learn critical thinking? If so, identify them.
6. Do you think you need to get all the information in order to learn Liberal Studies? Why or why not?
7. Do you think you would be able to implement critical thinking in your lessons if you were required to do so? Why or why not?
8. Please explain your answers on the questionnaire.

Appendix 10.2 Interview Guide for Students (Chinese version)

1. 你認為什麼是批判性思考?
2. 你認為批判性思考在通識科中扮演什麼角色?
3. 你認為批判性思考有在通識科中出現嗎? 如有,你如何得知?
4. 你認為你做了什麼或者應該做什麼令你有批判性思考?
5. 當老師嘗試教批判性思考時,你及你的同學有遇到什麼問題嗎? 如有,請指出.
6. 為了學習通識,你認為你需要得到所有的知識嗎? 為什麼?
7. 如情況需要,你認為你可以在通識科中運用批判性思考嗎? 為什麼?
8. 請說明你在問卷上的答案

Appendix 11 List of codes

Nodes in Set: All Nodes

Created: 26/02/2015 12:25:58

Modified: 09/03/2015 10:57:59

Number of Nodes: 78

- 1 (1) /Definers
- 2 (1 1) /Definers/Skill/
- 3 (1 1 1) /Definers/Skill/Self-regulation
- 4 (1 1 2) /Definers/Skill//Reflection
- 5 (1 1 3) /Definers/Skill/Higher-order thinking
- 6 (1 1 4) /Definers/Skill/Interpretation
- 7 (1 1 5) /Definers/Skill/Inference
- 8 (1 1 6) /Definers/Skill/Conceptualisation
- 9 (1 1 7) /Definers/Skill/Synthesis
- 10 (1 1 8) /Definers/Skill/Drawing conclusions
- 11 (1 1 9) /Definers/Skill/Evaluation
- 12 (1 1 10) /Definers/Skill/Clarity
- 13 (1 1 11) /Definers/Skill/Bias detection
- 14 (1 1 12) /Definers/Skill/Rational thinking
- 15 (1 1 13) /Definers/Skill/Assumptions identification
- 16 (1 1 14) /Definers/Skill/Deductive reasoning
- 17 (1 1 15) /Definers/Skill/Problem-solving
- 18 (1 1 16) /Definers/Skill/Convergent thinking
- 19 (1 1 17) /Definers/Skill/Explanation
- 20 (1 1 18) /Definers/Skill/Analysis
- 21 (1 1 19) /Definers/Skill/Thoughtful judgments
- 22 (1 1 20) /Definers/Skill/Application
- 23 (1 2) /Definers/Disposition
- 24 (1 2 1) /Definers/Disposition/Open-mindedness
- 25 (1 2 2) /Definers/Disposition/Confidence in reasoning
- 26 (1 2 3) /Definers/Disposition/Persistence
- 27 (1 2 4) /Definers/Disposition/Respect for evidence
- 28 (1 2 5) /Definers/Disposition/Systematicity
- 29 (1 2 6) /Definers/Disposition/Multiple perspectives
- 30 (1 2 7) /Definers/Disposition/Responsibility
- 31 (1 2 8) /Definers/Disposition/Consensus-seeking
- 32 (1 2 9) /Definers/Disposition/Judiciousness

- 33 (1 2 10) /Definers/Disposition/Consistency
- 34 (1 2 11) /Definers/Disposition//Truth-seeking
- 35 (1 2 12) /Definers/Disposition/Self-correction
- 36 (1 2 13) /Definers/Disposition/Inquisitiveness
- 37 (1 2 14) /Definers/Disposition/Tolerance towards a wide range of views and values
- 38 (1 2 15) /Definers/Disposition/Acceptance
- 39 (1 2 16) /Definers/Disposition/Fairness
- 40 (1 2 17) /Definers/Disposition/Logic
- 41 (1 2 18) /Definers/Disposition/Specificity
- 42 (1 2 19) /Definers/Disposition/Objectiveness
- 43 (1 2 20) /Definers/Disposition/Accuracy
- 44 (2) /Classroom variables
- 45 (2 1) /Classroom variables/TeacherTeacher's general instructional approach
- 46 (2 1 1) /Classroom variables/TeacherTeacher's general instructional approach/Frequent questioning
- 47 (2 1 2) /Classroom variables/TeacherTeacher's general instructional approach/Higher cognitive level questions
- 48 (2 1 3) /Classroom variables/TeacherTeacher's general instructional approach/Provide feedback
- 49 (2 1 4) /Classroom variables/TeacherTeacher's general instructional approach/Problem solving
- 50 (2 1 5) /Classroom variables/TeacherTeacher's general instructional approach/Receptive to unsolicited questions
- 51 (2 1 6) /Classroom variables/TeacherTeacher's general instructional approach/Group learning
- 52 (2 1 7) /Classroom variables/TeacherTeacher's general instructional approach/Sequential probing
- 53 (2 1 8) /Classroom variables/TeacherTeacher's general instructional approach/Variety of instructional media
- 54 (2 1 9) /Classroom variables/TeacherTeacher's general instructional approach/Appropriate materials
- 55 (2 1 10) /Classroom variables/TeacherTeacher's general instructional approach/Systematic
- 56 (2 2) /Classroom variables/TeacherTeacher's content-specific instructional approach
- 57 (2 2 1) /Classroom variables/TeacherTeacher's content-specific instructional approach/Emphasis on answering technique
- 58 (2 2 2) /Classroom variables/TeacherTeacher's content-specific instructional approach/Mind map
- 59 (2 2 3) /Classroom variables/TeacherTeacher's content-specific instructional approach/Debate
- 60 (2 2 4) /Classroom variables/TeacherTeacher's content-specific instructional approach/Extended lecturing
- 61 (2 2 5) /Classroom variables/TeacherTeacher's content-specific instructional approach/Emphasis on inference
- 62 (2 2 6) /Classroom variables/TeacherTeacher's content-specific instructional approach/Argue with students
- 63 (2 2 7) /Classroom variables/TeacherTeacher's content-specific instructional approach/Drawing conclusions
- 64 (2 2 8) /Classroom variables/TeacherTeacher's content-specific instructional approach/Brainstorming
- 65 (2 2 9) /Classroom variables/TeacherTeacher's content-specific instructional approach/Explanation
- 66 (2 2 10) /Classroom variables/TeacherTeacher's content-specific instructional approach/Sharing of or inviting personal opinions
- 67 (2 3) /Classroom variables/TeacherTeacher's non-instructional characteristics
- 68 (2 3 1) /Classroom variables/TeacherTeacher's non-instructional characteristics/Demeanour
- 69 (2 3 2) /Classroom variables/TeacherTeacher's non-instructional characteristics /Support

- 70 (2 3 3) /Classroom variables/TeacherTeacher's non-instructional characteristics/Use of humour
- 71 (2 3 4) /Classroom variable/TeacherTeacher's non-instructional characteristics/Respect for diversities
- 72 (2 3 5) /Classroom variable/TeacherTeacher's non-instructional characteristics/Impartial
- 73 (2 4) /Classroom variables/Classroom atmosphere
- 74 (2 4 1) /Classroom variables/Classroom atmosphere/Discipline
- 75 (2 4 2) /Classroom variables/Classroom atmosphere/Waiting time
- 76 (2 4 3) /Classroom variables/Classroom atmosphere/Low anxiety
- 77 (2 4 4) /Classroom variables/Classroom atmosphere/Rapport
- 78 (2 4 5) /Classroom variables/Classroom atmosphere/Friendly (among group members)