CORE COMPETENCIES FOR THE TWENTY-FIRST CENTURY UNIVERSITY EDUCATION: AN INVESTIGATION INTO STUDENTS' PERCEPTIONS IN TWO CHINESE SOCIETIES

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by

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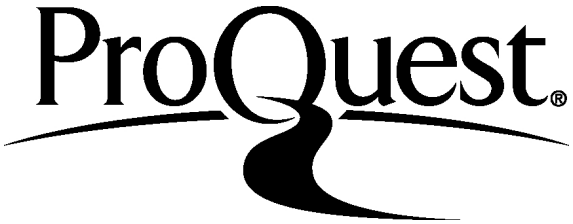

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ABSTRACT

Core Competencies for the Twenty-first Century University Education: An Investigation into Students' Perceptions in Two Chinese Societies

by YAO Jingjing

for the degree of Doctor of Philosophy

The Hong Kong Institute of Education

The rapid expansion of university education in China brings unprecedented challenges for preparing a huge graduate population in the ever-changing society of the twenty-first century. In order to prepare university students with competencies for the twenty-first century, a holistic and deep understanding of the development of students' competencies in university education is imperative to enable more appropriate and effective university education.

This study aimed to explore university students' perceptions on core competencies for the twenty-first century, including their perceptions on the importance of the core competencies, the self-assessment of owning the core competencies, and the perceived adequacy of university education in preparing them with core competencies. A mixed methods research design was adopted with both quantitative and qualitative approaches. The quantitative design was the dominant method used, in

which a cross-sectional survey using a self-report questionnaire of 40 Likert-type items was used to collect data from 5,042 university students from Macau and Zhejiang Province in China. Since these two locations are under the different education system and Higher Education Act (Macau is a Special Administrative Region in China), this study called them as 'two Chinese societies'. The questionnaire comprised three subscales, namely, Importance, Possession, and Adequacy. The qualitative approach was purposively set as supplements to the quantitative results, in which four focus-group interviews with university students and eight face-to-face interviews with university teachers were conducted. All the participants are public university students and teachers from Zhejiang Province and Macau. Analysis with the Rasch rating scale model found that in each subscale, the data fit the Rasch model well, the reliability of the scale was good, and substantial differential item functioning was detected by gender and location respectively.

The analysis gave a profile of university students' perceptions on the importance of competencies for the twenty-first century, self-ratings on these competencies, the perceived adequacy of university education in cultivating these competencies, and the relationships between these three aspects of students' perceptions. The results found that students attached great importance to almost all core competencies listed in the questionnaire, perceived themselves as having acquired many of these competencies to some extent, and considered their universities to be effective in developing most of the competencies explored in this study. The qualitative interviews with university students and teachers supported the quantitative survey. Students' perceptions on the importance of core competencies have moderate correlations with self-assessments

and the perceived adequacy of university education (0.76 and 0.62, respectively), while self-assessments and the perceived adequacy of university education have low associations (0.24). No substantial differences in gender, grade and location were found in the students' perceptions on these three aspects. Based on these findings, some discussions were conducted in which the importance of the students' role was emphasised in determining the development of core competencies in the students themselves, and implications of how to select and develop core competencies for twenty-first century university education in Chinese university students were suggested.

Keywords: core competence, university students, twenty-first century, Chinese society, Rasch model

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LIST OF ABBREVIATIONS

21CCCUE	21st Century Core Competencies for University Education
AHELO	The Assessment of Higher Education Learning Outcomes
APASO	The Affective and Social Outcomes
APEC	The Asia-Pacific Economic Cooperation
ATC21S	The Assessment and Teaching of Twenty-first Century Skills
BK	Basic and Professional Knowledge
CC	Character and Civic Literacy
DeSeCo	The Definition and Selection of Competencies
df	Degree of freedom
DIF	Differential Item Functioning
EU	The European Union
GI	Global and International Perspective
HKIEd	The Hong Kong Institute of Education
IC	Interpersonal Communication
IT	Information Technology
ICT	Information and CommunicationTechnologies
KSAVE	Knowledge, Skills, Attitudes, Values and Ethics
MCEETYA	The Melbourne Declaration on Educational Goals for Young Australians
MNSQ	The Mean Square Error
MOE	The Ministry of Education
NPC	National People's Congress
OECD	The Organization for Economic Cooperation and Development
PS	Creativity and Problem Solving

SD	Standard Deviation
SE	Standard Error
SL	Self-directed Learning
RQ	Research Question
UNESCO	the United Nations Educational Scientific, and Cultural Organization
US	The United States
ZSTD	Standardized as a Z-score

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CHAPTER 1

RESEARCH BACKGROUND

In an age of uncertainty and complexity (Barnett, 2006; Barth, 2015), a fixed set of specialised skills transferred from generations can no longer satisfy the demand of modern society (Koeppen, Hartig, Klieme, & Leutner, 2008). The rapid worldwide expansion of university education (Schofer & Meyer, 2005) motivated studies concerning the quality of university education and graduate attributes (Lin, Yu, & Lin, 2014; Mandelson, 2009; Neubauer, 2012; O'Connor, Lynch, & Owen, 2011; Organization for Economic Cooperation and Development [OECD], 2010), showing a trend that moves away from the traditional emphasis of academic outcomes to the development of the "whole person" (Best, 2008) with skills and competencies for the twenty-first century. Graduates' competencies play an important role for individuals striving for their current academic success and personal excellence, as well as their future social contributions. A holistic and deep understanding of university students' perceptions on core competencies for the twenty-first century will enable more appropriate and effective university education to bridge the gap between the present and the future.

1.1 Introduction

The expansion of university education has been observed in most developed and developing countries over the last few decades. The fast-rising enrolment in university education has led to concern over university graduates' competencies, which are not only determinants of individual life quality but also the foundation of national development and social welfare. Since 2006, China has surpassed the United States (US) in having the largest higher

education system in the world (Chan & Ngok, 2011; Gu, 2012). It is thus a significant time for the development of the Chinese university education system and brings unprecedented challenges for preparing and managing a huge graduate population in an ever-more globalised and competitive environment. A number of core issues in university education need to be rethought: What kind of talent should be cultivated? What key competencies should be valued? How should students be provided with the most suitable skills and competencies?

Attention has been paid to core competencies for the twenty-first century by many countries and organisations (Bok, 2006; Delors et al., 1996; European Association for the Education of Adults, 2011; Lyz, 2012; Miles & Wilson, 2004; Rychen & Salganik, 2002; Stein, 2000). According to Weinert (2001, p53), a core competence refers to "multifunctional and transdisciplinary competencies that are useful for achieving many important goals, mastering different tasks, and acting in unfamiliar situations". In a world in which everything is going to be different with each passing day, young people in particular should be provided with the most substantial competencies to cope with new challenges and opportunities. In view of this situation, ministries of education and international organisations, such as the United Nations Educational Scientific, and Cultural Organization (UNESCO) and the OECD, have proposed competence frameworks for university education directly or indirectly, according to respective considerations with regard to economic, educational, political and cultural issues (OECD, 2010; UNESCO, 1996). Competencies are defined and selected with different priorities and contents, and some are regarded as more important in some countries and regions than others. Nonetheless, on the basis of the consensus of the importance of core competencies, it is possible to construct theoretical

frameworks of core competencies for future citizens regionally and trans-regionally (Rychen & Salganik, 2003).

The accumulated literature facilitates related research on core competencies for the twenty-first century. Theoretical frameworks and models of core competencies (Lin et al., 2014; OECD, 2010; Rychen & Salganik, 2003; Stein, 2000; Wiek, Withycombe, & Redman, 2011) have been presented for various purposes within different domains, not only enriching the theoretical research, but also casting light on the corresponding innovative practices in university education. Far fewer studies are found in Eastern countries than in Western cultures. Since the cultural differences that have existed between the West and the East are significant and remarkable (Heine, 2010; King & McInerney, 2014; Tabellini, 2008), the existing findings in core competencies for the twenty-first century can provide valuable experiences for reference purposes, but cannot be directly put into practice in Eastern cultures. Therefore, local research is imperative, and it is urgent and necessary to inspect the core competencies of Chinese undergraduate students to get a holistic and precise perspective.

This study focuses on the core competencies of university undergraduates in the twenty-first century. Data from Macau and Zhejiang Province have been collected. The main research objective is to explore the perceptions of core competencies of university undergraduates for the twenty-first century from the university students' perspectives. A mixed methods research design is employed, incorporating both quantitative and qualitative approaches. The study investigates university students by using the 21st Century Core Competencies for University Education (21CCCUE) scale to detect the overall perspective of students, including how important the students think the competencies are for themselves; the extent

to which, in their opinion, they have these competencies; and the extent to which, in their view, their university education helps in developing these competencies. The qualitative inquiry is focused on the importance of core competencies for twenty-first century university students and the perceived adequacy of university education in developing these competencies in students, using semi-structured interviews with teachers and students from selected universities. The qualitative approach aims to provide important complementary explanations to the quantitative research, in order to generate a holistic and in-depth profile of the subject investigated.

This study employed a self-report questionnaire named 21CCCUE involving 40 Likert-type items. Descriptive statistics and Rasch measurements were used in the data analysis. The descriptive statistics provided a relatively easy way to visualize the data distribution, especially the frequency and the percentage, which is intuitive and able to maintain the information of raw score. The distance between percentages is ordinal, however, it is treated as interval. Fortunately, by using Rasch measurements, ordinal scales can be converted to interval scale with logit units (Bond & Fox, 2007; Fisher, 1999; Rasch, 1960). Since this major beauty of objectivity (Fisher, 1999), Rasch measurements have been widely used in education, psychology, health sciences and other areas recently. In order to provide a better understanding of Rasch measurements, this study created a separate section (Section 2.9) to introduce more details about Rasch model.

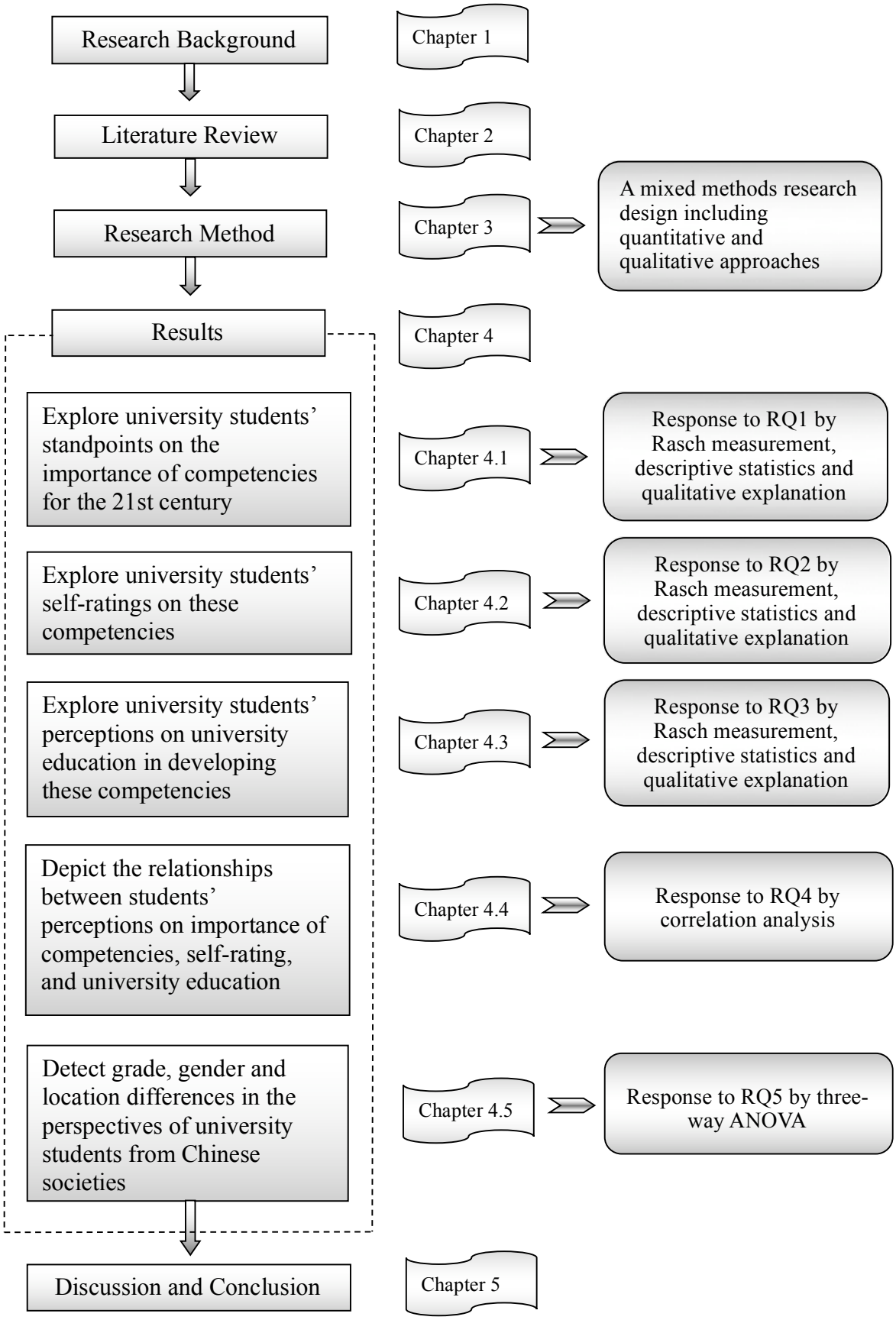


Figure 1. Flowchart of the research framework.

1.2 Background to the Study

This section aims to give a brief introduction on the development of Chinese university education from the founding of the People's Republic of China. The development did not take a long time, however, the scale of the expansion in the twenty-first century was phenomenal. One of the major internal reasons for university reform has been the unsatisfactory quality of university education.

Since the founding of China in 1949, Chinese university education has experienced several stages of development. In the initial stage, the Soviet model was employed and a nationally unified instruction system was established. All university education was under government leadership and the theory of Marxism-Leninism became the foundation of the curriculum system (Wang & Fan, 2008). As relations with the Soviet Union deteriorated after 1957, Chinese university education struggled to develop further under an increasingly hostile political environment. Then, the Cultural Revolution (1966–1976) almost completely devastated the Chinese university education system.

The year 1977 saw a major milestone in the development of university education in China. In this year, Deng Xiaoping decided to resume the National Higher Education Entrance Examination (Gaokao), meaning that Chinese university education entered a new period of development. During the period of reform and China’s opening-up policy, university education stepped into a steady period of development. In this stage, the Chinese government formulated and promulgated a series of laws and regulations to ensure the steady and healthy development of university education (Li & Wang, 2012). For example, the Ministry of Education (MOE) issued the *Decision on the Reform of the Education*

System (1985) and the *Provisional Regulations Concerning the Management of Institutions of Higher Learning* (1986), acknowledged as the most important educational documents in China's early educational reform and which empowered university education to fulfil its potential. The structural reforms provided more autonomy and flexibility to colleges and universities to meet the needs of the students and society, and involved reforms of education provision, management, recruitment, job placement and other aspects (MOE, 1986).

With the rapid development of the social economy and people's growing demands for university education, Chinese university education has flourished and gradually succeeded in turning elite education into universal education since 1999 (Li & Wang, 2012; Pan & Xie, 2001). According to the National Bureau of Statistics of China, there were 1.6 million students enrolled in higher education in 1999, and the figure rose to 6.3 million in a decade, a fourfold increase. On June 2012, there were 9.15 million students taking the Gaokao and 6.85 million of them gained admission, showing a sustainable and steady growth. From 1998 to 2006, students in higher education increased from 6.4 million to 25 million, representing a 290% growth (Li & Wang, 2012). There are over 2,000 colleges and universities in China – open to foreign students as well as Chinese – with a complete degree system, including bachelor's, master's and doctoral degrees. Since 2006, China has had the largest higher education system in the world (Gu, 2012). As the key component of the higher education system, Chinese university education has also experienced a rapid expansion meanwhile.

With the marked increase in the nunber and scale of university education, the quality of education becomes a widespread concern for the government and the public (Li, 2004). The Chinese government has made efforts to strengthen university education and to build first-

rate universities. For example, Project 211 is an important endeavour that the Chinese government initiated in 1995 to strengthen about 100 institutions of higher education and to make a number of key construction disciplines a national priority for the twenty-first century (MOE, 2008). Project 985 is another constructive project aimed to found world-class universities in the new era, which former Chinese President Jiang Zemin announced at the 100th anniversary of Peking University on May 4, 1998 (MOE, 2011). Recently, the MOE issued the *National Medium and Long-Term Education Reform and Development Plan* (2010) and *Some Opinions from the Ministry of Education on Comprehensive Enhancement of the Quality of Higher Education* (2012), which serve as political guidance for the healthy development of university education.

With the development of technology and society, people have naturally come to expect increased quality from university graduates. According to the *National Medium and Long-Term Education Reform and Development Plan* (MOE, 2010), the Chinese government wants universities to focus on talent development and to cultivate professional and creative elites with unshakable faith, good moral character, rich knowledge and high expertise. Each university has its own educational goals for the undergraduates. For example, Tsinghua University aims to cultivate students with innovative thinking skills, sound personalities, broad foundations, global visions, and feelings of social responsibility in order to prepare students become "high-quality, high-level, diversified, and creative" people (http://www.tsinghua.edu.cn/publish/newthu/newthu_cnt/education/edu-1.html). According to Fudan University's website, it "insists on placing undergraduate education at the forefront of development," and proposes developing undergraduates with "broad requirements, a wide base, strong capabilities, and a pursuit of innovation" (http://www.fudan.edu.cn/en/channels/view/49/). It seems that the definition of high-quality

undergraduates covers a wide range of characteristics related to physical attributes, morals, mentalities, ethics and citizenship. A qualified university student should have good physical health and mental development, high ideological and ethical standards, a concrete foundation of professional knowledge and skills and sustainable competencies for learning and practice (Yang, 2013; Zhang, Zhang, & Yao, 2012).

However, the talent-cultivating objectives in Chinese university education seem somewhat vague and general. Compared to overseas universities, domestic university education institutions focus more on the comprehensive development of students while neglecting specific targets for cultivating talents (F. Zhang, 2013). Except for academic achievements, there are few evaluations to measure students' qualities such as moral development, mentalities, ethics and citizenship. A serious disconnect exists between the evaluation structure and social needs (Zheng, 2013). It seems that current Chinese university education does not comprehensively guarantee the quality of talent cultivation (F. Zhang, 2013).

The quality of university students has been doubted and has received mixed reviews from experts and the public. University education has been criticised as excessive emphasis on academic achievement while ignoring personality development, concentrating on teacher's leading role while paying insufficient attention to the role of students, and giving low priority on students' humanistic qualities, psychological and social skills (Zheng, 2013). More and more negative comments on the moral values of university students, as well as the increasingly frequent outbreaks of psychological crisis events among student groups, can be seen in the domestic media. Not so long ago, an article titled "China's new round of debate on 'studying is useless'" (Z. Zhang, 2013) reported that a Chinese father considered the university would be a bad investment for his daughter, which triggered heated remarks on

the Internet and more than 70 per cent of Internet users among a million supported this father's opinion. Similar news in recent years, such as "Beijing University graduate sells pork" (H. Zhang, 2013) and "millions of students give up the college entrance examination" (Li, 2013), have reflected people's disappointment on the quality of university education. In the latest National People's Congress (NPC), an NPC representative and academician of the Chinese Academy of Science, Cui Xiangqun, claimed that the quality of contemporary postgraduates is equivalent to that of former secondary school students and college students (Yang & Lin, 2014). The remark aroused opposition, especially by presidents of universities, but also gained support from some other NPC representatives at the same time (Yang & Lin, 2014).

For a long time university education has embodied a society's ideals and expectations. It is a key agent in cultivating new generations for the present and the future. In the diverse and heterogeneous society of the twenty-first century, Chinese university education is facing unprecedented challenges and impacts for its adaptation, innovation and creation. Changes in the educational model with determined core competencies for all graduates are imperative and urgently needed for universities to reach automatic innovation and sustainable development. To hasten the implementation of these changes, investigating university students' perceptions of core competencies for the twenty-first century may be the first and the most important step.

1.3 Purpose of the Study

The main purpose of this study is to explore the perceptions of core competencies of university graduates for the twenty-first century from the perspectives of university students. Specifically, the perceptions include three main aspects, which are the importance of core competencies, the self-assessment of owning these core competencies, and the perceived adequacy of university education in developing these core competencies. In order to get a holistic and precise understanding of university students' perspectives, a mixed methods research design is adopted. The quantitative approach aims to investigate university students' perceptions on core competencies with the use of the 21CCCUE scale, and the qualitative approach aims to obtain descriptions and interpretations of the research questions with face-to-face interviews.

1.4 Significance of the Study

First, the current study focuses on a theoretically and practically important topic which meets the realistic needs. Core competencies play an important role for university students currently striving for academic success and personal excellence, as well as their future social contributions. It is a trend that moves away from the traditional emphasis of academic outcomes to the development of the whole person with skills and competencies for the twenty-first century. As mentioned earlier, the rapid expansion of university education in China brings both opportunities and challenges. To achieve their mission of cultivating new generations with capability, ethics, autonomy, and responsibility, universities should take steps to implement reforms and innovations, especially in the educational model. The core competencies for all graduate students should be determined as well as the definition of

standards of the corresponding behaviours. Therefore, it is important to conduct local research on core competencies of university graduates.

Second, the emphasis on the students' perspectives in this study supplements the system-based approach in determining what competencies should be developed in students, and enables students to engage in their own development. In the process of policy making and instruction implementation, it is of great importance to take students' perspectives of their own development into account since they are one of the key stakeholders of education. However, students' perspectives have become the "missing perspective" (Tymon, 2013, p. 849). It would be unreasonable to cultivate competencies, such as autonomy and self-directed learning in students, without letting students know. Moreover, under the situation that most of the performance and outcomes of expected competencies are mapped by academic experts, researchers argue that students should have more engagement and perform as "active agents" (Chang & Strauss, 2010; McKenzie, 2003). The person-based approach, whereby the students' agency is involved in determining what competencies should be developed in them, supplements the traditional approach which takes the academic experts' decisions in such policy-making (Su, 2014).

Third, this study adopted an ecological and developmental perspective in conceptualizing the core competencies and their development for twenty-first century university graduates. The ecological theory of human development (Bronfenbrenner, 1994) provided holistic considerations on the authentic development of core competencies of university students. Selecting, conceptualizing and developing students' core competencies under the joint consideration of the students' perspective and ecological and developmental perspective

could be a constructive theoretical effort and facilitate the person-centred development of graduate competencies.

In addition, this study also contributes to theoretical and practical work in related domains, such as policy decisions and education references on university education. For example, it helps for universities to get an overall understanding of students' perceptions of core competencies for the twenty-first century, which could serve as the basis for teaching and learning and ensure the development of desired competencies. Moreover, it may strengthen the responsibility, self-awareness and reflection of participating students for their further development, and encourage teacher participants to reflect on their teaching and research.

1.5 Organisation of the Thesis

This thesis consists of five chapters. This chapter presented the background to the study. Chapter 2 gives a summary of the literature on competence and indicators of core competencies for the twenty-first century and for twenty-first century university education. Chapter 3 introduces the research method of the study, in which a mixed methods research design including quantitative and qualitative approaches was adopted. Chapter 4 presents the research findings and results according to each research question. In the last chapter, discussions on the implications of the results are reported as well as the conclusions.

CHAPTER 2

LITERATURE REVIEW

This chapter mainly deals with the literature review of competence and core competencies for the twenty-first century and twenty-first century university education. The notion of competence, indicators of core competencies for the twenty-first century and core competencies for twenty-first century university education are discussed. Since Rasch logit scores are used to calibrate the results of this study, discussions on the Rasch model (Rasch, 1960) are also introduced in this chapter. After discussing the limitations of the current literature, the conceptual framework of this study is presented at the end of the chapter.

2.1 Competence and Core Competence: Developing Concepts

The notion of competence has been widely used in the social sciences since the middle of the last century (Mulder, 2007). The definitions of competence are diverse in its professional use in different domains (Miller, 1990; Parry 1996; Spencer & Spencer, 1993; Tillema, Kessels, & Meijers, 2000). Numerous synonyms such as “ability”, “capacity”, “skill”, “aptitude”, “capability”, to name a few, reflect the complexity and versatility of the concept. A trend has been observed that the term competence is being used extensively to refer to educational and developmental processes and outcomes in university education, replacing the traditional use of ability and skill (Boni & Lozano, 2007; Mulder, Gulikers, Biemans, & Wesselink, 2009; Weinert et al., 2011). Correspondingly, core competencies are used as cluster indicators of competencies for different educational purposes. With the increasing concern and research focused on the development of human resources and the productivity

of education, the concept of competence (as well as core competence) continues to develop and deepen.

2.2 Competence

In early psychological practices and research, the concept of competence was perceived as an alternative to intelligence, which was generalised and context-independent (Koeppen, Hartig, Klieme, & Leutner, 2008). For example, White (1959) depicted competence as an innate attribute to deal with the environment. McClelland (1973) also argued that the traditional intelligence tests should turn to testing competence for better predictive validity and justification. Competence was also related to a person's effective behaviour, such as Gilbert (1978), who linked competence with performance by a function that worthy performance is proportional to valuable accomplishment. Therefore, it was also called "realized ability" (Connel, Sheridan, & Gardner, 2003, p. 142).

Competence was once regarded specified and concrete skills since a competence movement known as the competence-based education was raised in the US in the 1990s (Hobart & Lundberg, 1995). At that time, competence was used to denote a person's characteristics in fulfilling a particular occupation, or a person's ability to demonstrate performance according to given working standards (Mansfield & Mitchell, 1996; McLagan, 1989; Miller, 1991). Influenced by behaviourism theories, these competencies were often analysed by specific knowledge and skills, with which people developed the enhanced competence profiles for teacher education as well as other vocational training (Fletcher, 1991; McLagan, 1989; Turner, 1973; Zemke, 1982).

Recently, the concept of competence has been developed and has intensified in Europe. In 1997, the OECD launched the Definition and Selection of Competencies (DeSeCo) project, which was chaired by the Swiss Federal Statistical Office and involved more than 12 countries. DeSeCo aimed to provide "solid theoretical and conceptual foundations" for a wide variety of competencies to meet the challenges of the twenty-first century (Rychen & Salganik, 2003, p. 42). According to the DeSeCo, competence is "the ability to successfully meet complex demands in a particular context through the mobilisation of psychosocial prerequisites (including both cognitive and non-cognitive aspects)" (Rychen & Salganik, 2003, p. 43). Not confined to European organisations, this definition provided by the DeSeCo was also accepted in Asia's educational research. Kim et al. (2007) refined four essential characteristics of competence based on the DeSeCo definition, including wholeness (holistically involving cognitive, affective and behavioural aspects), mobilisation (emphasizing the interconnected operation of those cognitive and noncognitive aspects), context-dependency (indicating a specific context necessary to demonstrate the competence), and learnability (competence which is learnable).

On the basis of the DeSeCo, Mulder et al. (2009) illuminated a "new competence concept" for university education, indicating competence is "a series of integrated capabilities consisting of clusters of knowledge, skills, and attitudes necessarily conditional for task performance and problem solving and for being able to function effectively in a certain profession, organisation, job, role, and situation"(p. 757). Although the concept of competence remains elusive, competence has become increasingly important worldwide, as indicated in documents of international organisations such as the International Labour

Organization (ILO), the OECD, the European Union (EU), and the Asia-Pacific Economic Cooperation (APEC) (Winterton, 2009).

In this study, the definition of competence developed by Mulder and his colleagues (2009) was adapted to address the issues of competence in a context of university education. Combined with DeSeCo's definition of competence, the author narrow down the concept of competence as the ability to perform successfully in a particular context through intentional cognitive and/or non-cognitive interactions, which often shows the application of an integrated set of knowledge, skills and attitudes to meet complex demands.

In addition, based on the discussion of characteristics of competence, such as Kim et al.'s (2007), the author consider that the concept of competence should also include characteristics such as integration, intentionality, situationality and learnability. Here integration means that competence always appears as an integrated set of knowledge, skills and attitudes (including both cognitive and non-cognitive aspects). Intentionality denotes that individuals take effective measures purposively, instead of achieving success by chance or as the result of rote learning. Situationality indicates that no competencies can be demonstrated without a specific context, similar to context-dependency mentioned by Kim et al. (2007). As to learnability, it is very important to our educational context. Although competent individuals function effectively with their innate ability, such natural or unteachable ability is beyond our concerns.

2.3 Core Competence

Literally, a core competence means a competency which is very important or crucial. Originally, core competence had been intensively discussed in business domains. The classical work of Prahalad and Hamel (1990) viewed core competencies as "the collective learning in the organization" (p. 81) and "the roots of competitive advantage" (p. 80). Since core competencies were directly related to core products in business domains, three criteria were provided to identify core competencies of a corporation: (1) core competencies should be capable of building market share; (2) core competencies should offer great value to customers by the end products; and (3) core competencies in one company should be hard to copy by others (Prahalad & Hamel, 1990). The interpretation of core competencies in the business area gives insight to the corresponding research in the university education.

In the education field, people show great interest in competence for the purpose of facilitating vocational-technical education and the Credit Transfer System in university education (Mulder, 2007; Mulder et al., 2009). Thus, key/core competencies are used as cluster indicators for various educational purposes. In the DeSeCo definition (Rychen & Salganik, 2003), the term key/core competence refers to "multifunctional and transdisciplinary competencies that are useful for achieving many important goals, mastering different tasks, and acting in unfamiliar situations" (Weinert, 2001, p. 52). Each core competency is a combination of interrelated cognitive skills, attitudes, motivation and emotion, and other social components (Rychen & Salganik, 2003, p. 54).

Identification criteria of core competencies are seldom presented in university education. Discussions focused on identifying and developing core competencies in the context of

corporate education and human resource development may provide significant reference. For example, the three criteria above proposed by Prahalad and Hamel (1990) can be adapted into university cultivation, which means that graduate students with core competencies should: (1) have good survivability and sustainability; (2) be capable of making significant contributions to human society; and (3) have their own characteristics and unique values. Core competencies in business life are much easier to construct and evaluate through increased turnover and market share; however, it is more complicated and difficult to assess in university education because of multiple educational objectives and considerations.

In this study, when discussing core competencies for twenty-first century university education, core competencies were considered crucial to achieving multiple goals, mastering different tasks, and meeting complex demands in our present learning activities and for future sustainability. The characteristics of competence discussed earlier, namely, integration, intentionality, situationality and learnability, are applicable to core competence. In addition, as Weinert (2001, p. 52) suggested, core competencies are generally multifunctional and transdisciplinary. Here, transdisciplinary competencies refer to transferable competencies involving more than one discipline and beyond a certain situation. It is a special characteristic in the education context that target skills and knowledge have been abstracted from their uses in the real world. Only when students are prepared with transferable competencies can they successfully apply these skills and knowledge to practise or different situations. Transdisciplinary does not contradict the characteristic of situationality, while the latter emphasises that competencies should be demonstrated within a specific context, whether in the process of teaching, learning, or applying. Indeed, the

more practices across situations students do, the more functional and transferable their competencies will be.

2.4 Indicators of Core Competencies for the Twenty-first Century

To prepare future citizens to survive and develop in the challenging society of the twenty-first century, many countries and organisations have been searching for competency frameworks for educational systems. Among them are UNESCO, OECD, the DeSeCo symposium hosted by OECD, and major projects, such as the 21st Century Learning Outcomes Project and the Assessment and Teaching of Twenty-first Century Skills Project. In addition, there are other explorations on core competencies for the twenty-first century, such as Bok and his educational goals for future college students in his famous book, *Our Underachieving Colleges* (2006), and the Feasibility Study for the Assessment of Higher Education Learning Outcomes (AHELO, OECD, 2010). Many indicators of core competencies were set up, reflecting the requirements and expectations for future ideal citizens by individuals and communities from all walks of life.

2.4.1 UNESCO and the "Delors Report"

As early as 1996, UNESCO published the "Delors Report" (Delors et al., 1996). The report described the main tensions the society have to confront in the twenty-first century, which exist between the global and the local levels, the universal and the individual contexts, tradition and modernity, long-term and short-term considerations, competition and equality of opportunities, the phenomenal expansion of knowledge and human beings' assimilation capacity, and the spiritual and the material. In the report, education is firmly recommended

as the key role in relieving the tensions and promoting personal and community development, while universities are expected to be establishments and centres of life-long learning and research for students and adults, providing knowledge and skills for diverse tastes and purposes, offering high-level vocational qualifications, and facilitating best teaching by international cooperation and exchanges.

Delors and his colleagues (1996) proposed four pillars of education, namely, learning to know, to be, to do and to live together. The concept of learning throughout life has come up as “the heartbeat of society” (Delors et al., 1996, p. 22), with which an individual could acquire knowledge and skills throughout life, seize learning opportunities, and adapt to changing and complex situations. Many competencies were listed in the report according to fulfilment of the four pillars (see Table 2.1).

Table 2.1

Competencies Suggested by the Delors Report

Four pillars	Competencies
learning to live together	collaboration citizenship and mutual respect communication skills respect for diversity
learning to know	problem-solving skills critical thinking self-management skills intellectual curiosity
learning to be	character development personal responsibility aesthetic sense and spiritual values imagination
learning to do	communication skills manage and resolve conflicts work with others leadership skills

Note. Adapted from *Learning: The treasure within - Report to UNESCO of the International Commission on Education for the Twenty-first Century* (pp. 22–24), by J. Delors et al., 1996, Paris, France: United Nations Educational Science, and Cultural Organization.

2.4.2 DeSeCo and Three Core Qualities Required for a Healthy Society and Successful Life

The DeSeCo described its mission as "to contribute to broadening indicators by including competencies that are not directly related to economic productivity and competitiveness" (Rychen & Salganik, 2002, p. 3). That is to say, competencies such as participation in civic society and self-management were valued and emphasised, which students were more likely to acquire by means other than formal schooling. After two international symposia on key competencies involving more than 12 countries, a final report

suggested three core qualities required for a successful life and a well-functioning society (Rychen & Salganik, 2002): acting autonomously, using tools interactively, and joining and functioning in socially heterogeneous groups. These three core qualities are constructs for organizing and mapping key competencies in different domains (Rychen & Salganik, 2002). As the authors illustrated (Rychen & Salganik, 2002), acting autonomously requires competencies such as identifying one's resources, evaluating one's needs and limits, developing strategies, and analysing situations and relationships, which enable an individual to lead a successful and initiative life as a citizen, a worker, a family member and so on. Using tools interactively means interacting with the environment effectively, which requires competencies such as gathering and analysing information, literacy and numeracy. Joining and functioning in socially heterogeneous groups focuses on the individual's relationships and interactions with others, including competencies such as managing and resolving conflict, acting in synergy and cooperating in a work team.

2.4.3 The 21st Century Learning Outcomes Project and "21st Century Skills"

A three-year project hosted by the League for Innovation in the Community Colleges in America, the 21st Century Learning Outcomes Project, developed a set of "21st century skills" based on research on 16 pioneering community and technical colleges (Miles & Wilson, 2004). The "21st century skills" encompassed hard skills such as literacy, numeracy and technical ability, and soft skills such as teamwork, communication, problem solving and the ability to interact with diverse groups (see Table 2.2).

Table 2.2

Competencies Suggested by the 21st Century Learning Outcomes Project

Competencies	Components
communication skills	reading, writing, speaking and listening
computation skills	understanding and applying mathematical concepts and reasoning, analysing and using numerical data
community skills	citizenship, appreciation of diversity and pluralism, local, community, global, and environmental awareness
critical thinking and problem-solving skills	analysis, synthesis, evaluation, decision making, creative thinking
information management skills	collecting, analysing, and organizing information from a variety of sources
interpersonal skills	teamwork, relationship management, conflict resolution, workplace skills
personal skills	ability to understand and manage self, management of change, learning to learn, personal responsibility, aesthetic responsiveness, wellness
technology skills	computer literacy, Internet skills, retrieving and managing information via technology

Note. Adapted from "Learning outcomes for the twenty-first century: Cultivating student success for college and the knowledge economy," by C. L. Miles & C. Wilson, 2004, *New Directions for Community Colleges, 126*, pp. 89–90.

2.4.4 The Melbourne Declaration on Educational Goals for Young Australians (MCEETYA)

The Melbourne Declaration aimed to provide a high quality of life for all Australians in the twenty-first century through innovating education and improving educational outcomes. In the declaration on educational goals for young Australians, the explicit goal was set and

expressed as “all young Australians become successful learners, confident and creative individuals, and active and informed citizens” (MCEETYA, 2008, p. 8). Concrete demands and expectations were also elaborated around these three targets, which are illustrated in Table 2.3.

Table 2.3

Competencies Suggested by the MCEETYA

Educational goals	**Competencies**
successful learners	capacity to learn, skills in literacy, numeracy, and information technology, ability to think deeply and logically, ability to be creative, innovative, resourceful , and solve problems, ability to plan, collaborate, communicate, and work in teams, ability to make sense of the world, and ability to self-develop and self-motivate.
confident and creative individuals	ability to manage one’s emotional, mental, spiritual and physical wellbeing, have a sense of optimism, be enterprising, take initiative and be creative, develop personal values and character, ability to pursue education and employment, ability to relate well with others, be ready and responsible for one’s life roles.
active and informed citizens	moral and ethical integrity, ability to practise democracy and justice, ability to understand and appreciate indigenous and non-indigenous cultures, ability to work for the common good, be responsible global and local citizens

Note. Adapted from *Melbourne Declaration on Educational Goals for Young Australians,* 2008, pp. 8–9.

2.4.5 The Assessment and Teaching of Twenty-first Century Skills Project (ATC21S) and the KSAVE Model

The Assessment and Teaching of Twenty-first Century Skills Project (ATC21S) is a public private partnership project launched in 2009, involving six countries (Australia, Finland, Portugal, Singapore, England, and the US) and three founding corporations (Cisco, Intel and

Microsoft). Aimed to offer insight into assessment and teaching for the future, scholars of ATC21S have tried to define twenty-first century skills. Binkley and his colleagues (2012) proposed the KSAVE model based on the analysis of 12 relevant frameworks by countries and organisations including the EU, OECD, the US, Japan, Australia, Scotland, and England. Ten skills are grouped into four categories constituting the KSAVE model which stands for knowledge, skills, attitudes, values and ethics (Binkley et al., 2012, see Table 2.4).

Table 2.4
The Twenty-First Century Skills Framework of the KSAVE Model

Categories	**Competencies**
ways of thinking	creativity and innovation critical thinking, problem solving, decision making learning to learn, metacognition
ways of working	communication collaboration (teamwork)
tools for working	information literacy ICT literacy
living in the world	citizenship (local and global) life and career personal and social responsibility (including cultural awareness and competence)

Note. Adapted from *Assessment and Teaching of 21st Century Skills* (pp. 18–19), by M. Binkley et al., 2012, Dordrecht: Springer.

2.4.6 The Lifespan Competencies Framework of the German National Educational Panel Study (NEPS)

The German NEPS selects and conceptualises competencies for major educational-stage-comprehensive assessments using multi-cohort large-scale approaches (Artelt et al., 2013;

Weinert et al., 2011). The target competencies are functional educational relevant competencies acquired and developed over different educational stages across the lifespan, and are thought to be especially relevant for future educational and professional careers, general life satisfaction and well-functioning societies (Artelt et al., 2013). Four areas of individual abilities and competencies are selected and conceptualised. Among these areas, B and C are about relevant educational competencies, while A and D are about general abilities and capacities and educational stage-specific outcomes (see Table 2.5).

Table 2.5
The Lifespan Competencies Framework of NEPS

Areas	Abilities and Competencies
A	Domain-general cognitive abilities and capacities, such as indicators of nonverbal reasoning and information-processing speed
B	Domain-specific cognitive competencies, including German language competencies, mathematical competence and scientific literacy
C	Meta-competencies and social competencies, including indicators of procedural and declarative metacognition and self-regulation, information and communication technologies (ICT) literacy, and social competencies
D	Educational stage-specific (curriculum- or job-related) attainments, skills and outcome measures

Note. Adapted from "Assessing competencies across the lifespan within the German National Educational Panel Study (NEPS) - Editorial," by C. Artelt, S. Weinert & C. H. Carstensen, 2013, *Journal for Educational Research Online, 2*, pp. 5–14.

2.4.7 Other Explorations on Core Competencies for the Twenty-first Century

Derek Bok criticised the teaching quality of American universities and proposed eight education goals for twenty-first century universities (Bok, 2006). He advocated cultivating graduates with multiple capacities, including competencies of communicating, thinking,

building character, citizenship, living with diversity, preparing for a global society, acquiring broader interests and preparing for a career. To improve the quality of undergraduate education, Bok also advised that reforms should take place in university curricula, teaching methods and research. Bok's work had a deep influence worldwide, with university education given more attention to satisfy their stakeholders (Lyz, 2012; McClung & Werner, 2008).

In 2008, the Second APEC Education Reform Symposium held in Xi'an emphasised important knowledge, skills and attitudes as twenty-first century competencies lay in four priority areas, including learning each other's languages, stimulating learning in math and science, career and technical education (CTE), and information communications technology (ICT) and systemic reform (APEC Education Reform Symposium, 2008).

OECD (2010) had carried out a feasibility study for the Assessment of University Education Learning Outcomes (AHELO). The purpose of AHELO was to assess whether what students in higher education learn upon graduation is practically and scientifically feasible. The learning outcomes encompass generic skills such as critical thinking, analytical reasoning, problem-solving, and written communication which are considered common abilities to all students, and discipline-specific skills in economics and engineering. Three volumes of the AHELO feasibility study report were recently published describing the design, implementation, data analysis and future insights about the project (Tremblay, Lalancette, & Roseveare, 2012, 2013a, 2013b).

2.5 Core Competencies for Twenty-first Century University Education

In university education, core competencies are crucial and fundamental for every student and are beneficial to their life-long well-being, reflect the ideas and values held by the university, and should not be limited by short-sighted economic benefits and temporary sensation. Based on the indicators of core competencies documented in the literature (Delors et al., 1996; OECD, 2010; Rychen & Salganik, 2003; Stein, 2000; Wiek et al., 2011), Mok and her colleagues proposed six domains of core competencies as the most important for twenty-first century university education in the studies of Chinese graduates (Cheng, Yeh, Liu, & Mok, 2011; Mok, Lee, Yao, Cheng, &Liu, 2010; Mok et al., 2011). They are basic and professional knowledge, creativity and problem solving, interpersonal communication, character and civic literacy, global and international perspective, and self-directed learning. Table 2.6 presents these indicators and related literature in which they are widely proposed.

Table 2.6

Six Domains of Core Competencies and Their References in the Literature

Indicators	UNESCO The Four Pillars of Education (Delors et al., 1996)	OECD DeSeCo Key competencies for a successful life (Rychen & Salganik, 2003)	Derek Bok (2006) The purpose for undergraduate education	OECD The key competencies for lifelong learning (European Communities, 2007)	OECD The Assessment of Higher Education Learning Outcomes (OECD, 2010)	MCEETYA (2008) The Melbourne Declaration on Educational Goals for Young Australians	ATC21S KSAVE Model (Binkley et al., 2012)
1. Professional and Basic Knowledge	✓	✓	✓	✓	✓	✓	✓
2. Creativity & Problem Solving	✓	✓	✓	✓	✓	✓	✓
3. Interpersonal Communication	✓	✓	✓	✓	✓	✓	✓
4. Character & Civic Literacy	✓	✓	✓	✓	×	✓	✓
5. Global & International Perspective	✓	✓	✓	✓	×	✓	×
6. Self-directed Learning	✓	✓	✓	✓	✓	✓	✓

Note. Adapted from "The development of indicators for the basic competencies of university students," by Y. Y. Chen, L. J. Yeh, K. S. Liu, & M. M. C. Mok, 2011, *Psychological Testing*, *58*(3), p. 558.

2.5.1 Basic and Professional Knowledge

In the education context, knowledge means important information which may be justified as the primary, sometimes almost the sole kind of, educational objective in a curriculum (Bloom, 1956). Through teaching and learning activities, students learn facts, information, skills, and values directly and indirectly, explicitly and implicitly, consciously and unconsciously. A positive relationship between the increase in knowledge and the increase in maturity is assumed, and knowledge is also frequently regarded as an important criterion of intelligence or performance (Neumann & Tomé, 2011; Vanini & Bochert, 2014). For university students, acquiring knowledge is a bounden duty in their collegiate careers, and it becomes more important than ever before in such a modern society characterised with knowledge economy. Although it is widely accepted that knowledge is the core of students' engagement with university education, there is remarkably little discussion of knowledge itself (Ashwin, 2014).

Knowledge is highly valued by many societies for the sake of knowledge, as knowledge was considered wealth ((Tilak, 2006). With modern society in the information era, disciplinary and interdisciplinary knowledge is constantly enriched and updated, and the demand of mastering knowledge and skills for university students is becoming increasingly higher. The requirement of basic and professional knowledge includes not only traditional skills, such as expression in writing, logical analysis, and empirical deduction, but also contemporary skills such as IT application, critical thinking, and decision making (Ananiadou & Claro, 2009; Binkley et al., 2012). Even though knowledge itself does not constitute a competence, basic and professional knowledge is the basis of all kinds of competence. Since numerous studies aimed to prepare undergraduate students with a solid basic knowledge and appropriate

professional knowledge by various approaches and technologies (Ashwin, Abbas, & McLean, 2012; Hicklin, Alberktsson, & Hammerle, 2009; Robinson & Bradley, 1997; Yuen & Majid, 2007), it is imperative to incorporate basic and professional knowledge into core competencies for university students.

2.5.2 Creativity and Problem Solving

Creativity may be one of the most widely discussed and highly valued issues involving many disciplines such as psychology, education, philosophy, technology, sociology and economics. Creativity can be defined in many ways, but no one definition is broadly accepted for the well-known reason that it is very difficult to identify the valid criteria. Creativity has long been deemed an ambiguous and vague concept with loose meanings in many contexts. Generally speaking, creativity is viewed as the ability to produce "something" which is novel, appropriate and valuable (Amabile, 2012; Sternberg, 1999, 2006). It is widely related to an individual's intellectual skills, knowledge, thinking styles, personality, motivation and environment, and to some extent formed by the confluence of these components (Sternberg, 2006). Creativity was previously considered indispensable for giftedness and first-class work (Blumen-Pardo, 2002; Cropley, 1995). Nowadays, creativity is widely accepted as an essential competency for modern society (Ananiadou & Claro, 2009; Pellegrino & Hilton, 2012). Although evidence shows that creative and unconventional ideas are often rejected in schooling and vocation (Cropley & Cropley, 2000; Sternberg & Lubart, 1995), no educators, researchers or employers would deny the importance of creativity.

The ability to problem solve is too important to be underestimated and compromised (Chaudhry & Rasool, 2012). As one of the higher-order thinking skills, problem solving is the

major purpose and desirability of student's development in university education. Evidence abounds that problem solving is beneficial to increase efficiency and productivity of students and employees (Chaudhry & Rasool, 2012; Macpherson, 2002; Puvanasvaran, Megat, Tang, Muhamad, & Hamouda, 2008). In addition, the same amount of studies are focused on evaluating and improving the problem-solving skills of undergraduate students (Celik, 2008; Seechaliao, Natakuatoong, & Wannasuphoprasit, 2011; Yunus et al., 2006). Problem solving is often bracketed with creativity and equally stressed within many academic situations (Cropley & Cropley, 2000; Cropley & Urban, 2000; Dehaan, 2009; Friedman & Forster, 2005; Reiter-Palmon & Illies, 2004; Sternberg, 2006). The term "creative problem-solving" makes them more inextricably involved. Therefore, they should be put together as an indispensable indicator of core competencies.

2.5.3 Interpersonal Communication

The ability to listen, talk, interact with others, respect and tolerate differences, handle one's emotions, manage and function within a team, are key components of efficient and appropriate interpersonal communication skills. Interpersonal communication competence is extensively regarded as a necessary and essential factor to succeed in school and career (Chen, Donahue, & Klimoski, 2004; Koponen, Pyörälä, & Isotalus, 2010; Troth, Jordan, & Lawrence, 2012), and is positively related to the individual's emotional intelligence, collaborative conflict resolution, and social cohesion (Jordan & Troth, 2004; Troth, Jordan, & Lawrence, 2012). College students also strongly perceive communication competence as a crucial performance, both physically and intellectually, and robustly associated with sociality (Almeida, 2004).

Interpersonal communication competence is emphasised by individuals and organisations not only because efficient interpersonal communication contributes to success across a variety of academic and professional contexts (Worley, Worley, & Soldner, 2008), but communication difficulties will take their toll on undergraduate students in a wide range of settings, even affecting their daily lives, one of the main causes of the "lone wolf" phenomenon in school (Barr, Dixon, & Gassenheimer, 2005). Interpersonal communication is one of the most basic and significant functions of human sociality and directly related to the individual's existence and development. Any university that does not cultivate this competence in its students should certainly be viewed as a failure.

2.5.4 Character and Civic Literacy

Character development and civic socialisation are considered major goals of education as well as learning and academic achievement (Berkowitz, 2012). Character is generally recognised as being "good" or "bad", which is related to morals, virtues, values, beliefs, ethics and citizenship (Lickona, 2001; Martinson, 2003). Character is related not only to the individual's moral judgment and moral action (Lickona, 2001), but also to other merits such as positive personality, humanity, empathy, honesty, respect and justice, or vices such as dishonesty, injustice, selfishness and recklessness (Sessink, Toon, & Wesley, 2010). The concern for civic and character development has been advocated by educators and maintained in educational legislation in many societies. For example, U. S. Department of Education (2005) aims to promote strong character and citizenship among their nation's youth. Quotes like "Nothing is of more importance for the public weal, than to form and train up youth in wisdom and virtue" (Benjamin Franklin) and "Education at its best should expand the mind and build character" (the former US Secretary of Education, Margaret Spellings) are

highlighted in their brochures (U. S. Department of Education, 2005). Many studies have focussed on character education in the school context (Annette, 2005; Berkowitz & Bier, 2005; Brooks, & Kann, 1993; Bulach, 2002; Lickona, 1993, 2001). In China, Confucianism advocated that virtue is more important than wisdom to a gentleman, and cultivation of morality has been a tradition at all levels of the Chinese education system.

Under the school background, character and citizenship are always combined (Althof & Berkowitz, 2006; Berkowitz & Bustamante, 2013). According to the Partnership for 21st Century Skills (p. 21), civic literacy includes "participating effectively in civic life through knowing how to stay informed and understanding governmental processes", "exercising the rights and obligations of citizenship at local, state, national and global levels", and "understanding the local and global implications of civic decisions". It is foundational for understanding and practicing democratic citizenship, social participation and human rights, which determines the democratisation and civilisation degree of a society. Civic virtues are closely connected with the characters of individuals; therefore, many studies have focused on the development of character and citizenship in the university education context (Annette, 2000, 2005; King & Mayhew, 2002).

2.5.5 Global and International Perspective

The global and international perspective is a central goal of today's universities (Altbach, 2007; Association of American Colleges and Universities, 2007; Brodin, 2010). Multiple terminologies such as "global mindset", "intercultural competence", "global competence", "global citizenship" and "global learning" (Li, 2013; Lunn, 2008) used in global university education emphasise the importance of the global and international perspective as one of the

most significant learning outcomes. Researchers identified the substantive and the perceptual dimensions of the global perspective (Case, 1993; Crawford, & Kirby, 2008; Pike, 2000), including knowledge about the features and functions of the world, such as global history and global systems, human values and human rights (substantive dimension), and the way of looking at the world, such as open-mindedness, empathy and non-stereotypes (perceptual dimension). Lunn (2008) highlighted the importance of sound knowledge of global issues and efficient skills in dealing with international events, as well as awareness and respect for diversity and complexity. Accordingly, global perspective is the ability to understand and respond to a local or an international event with a whole point of view, both in spatial and temporal dimensions.

Along with the increasing globalisation and internationalisation, changes have taken place where multiple worldviews and cultural heritage profoundly affect the way people think and survive (Altbach, Reisberg, & Rumbley, 2009; Braskamp & Engberg, 2011). As future employees, undergraduate students are required to become familiar with cultural norms and international affairs, to communicate and interact effectively inside and outside their environments (Li, 2013). A global and international perspective is crucial for them to take into account the whole of human society as well as the environments where they live, to understand, empathise and cooperate with persons with different values, beliefs, attitudes, as well as origin, race, religion, age, gender, or sexual orientation, and to explore important issues such as rights and responsibilities, diversity and identity, poor and rich, sustainability and environmental justice (AusAID, 2008; Braskamp & Engberg, 2011; Hart, 2006).

2.5.6 Self-directed Learning

Self-directed learning is an umbrella term which encompasses various important learning processes and outcomes (Loyens, Magda, & Rikers, 2008). An early and widely-cited definition of it is "a process in which individuals take the initiative, with or without the help from others, in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (Knowles, 1975, p. 18). Zimmerman (2002) illustrated a three-phase model consisting of the forethought phase, the performance phase and the self-reflection phase, in which sub-processes such as self-control, task analysis, self-motivational beliefs and self-judgment were proposed and supported by empirical evidence later (DiBenedetto & Zimmerman, 2013). Self-directed learning is beyond the mere process of knowledge acquisition and involving personality characteristics such as motivation and self-control. The process perspective focuses on cognitive activities such as goal setting, planning, and applying and monitoring strategies (Knowles, 1975; Schunk & Zimmerman, 2013; Zimmerman, Bonner, & Kovach, 1996), while the personality characteristic perspective implies the independence and autonomy of learning.

With multiple dimensions and versatile functions, self-directed learning is considered an ultimate educational goal which significantly impacts on students' academic achievement and ability to learn (Geddes, 2009; Hastie, Rudisill, & Wadsworth, 2013; McClelland & Wanless, 2012), especially in university education (Cheng & Chau, 2013; Levett-Jones, 2005; Wichadee, 2011). It has also been recognised as a core issue of lifelong education and whole person development, both as a means and an end, and has received a huge amount of attention in educational research and reform (Dumont, Istance, & Benavides, 2010; OECD,

2004; Singapore Ministry of Education, 2010). If the acquisition of knowledge and skills is one of the most important issues for university students in today's knowledge economy society, then self-directed learning, the foundation and instruments of learning to learn, should not be less important in any event.

In this study, the above six core competencies (basic and professional knowledge, creativity and problem solving, interpersonal communication, character and civic literacy, global and international perspective, and self-directed learning) are considered the six main competence domains which best represent the core competencies for twenty-first century university education. They have been adapted and incorporated into the conceptual framework of the current study (see Section 2.11.1) and will be discussed at length in subsequent chapters.

2.6 Do University Graduates Have Twenty-first Century Core Competencies?

Comparing the rich literature on indicators of core competencies for the twenty-first century, only a few studies have considered the issues of university students' preparedness of core competencies for the twenty-first century. It is quite common that most of the scholars and researchers who proposed the core competencies seldom address the following question: do our university graduates have core competencies for the twenty-first century? Although an increasing number of studies have aimed to develop valid scales to measure university students' competencies (e.g., Coetzee, 2014; Lin et al., 2014), the reports of graduate preparedness of these competencies have remained limited.

It is reasonable if the following assumption works: people propose so many competencies for university graduates because they think today's graduates are, to some extent, lacking these

competencies. For example, Professor Derek Bok, the former President of Harvard University, insisted on cultivating graduates with multiple capacities for the twenty-first century by criticizing the underachieving colleges and their graduates in America (Bok, 2006). From this point of view, the answer to the question in the section title may not be so positive.

Among studies concerned with graduate preparedness of core competencies, people show great interest in graduates' employability and career outcomes (e.g., Mason, Williams, & Cranmer, 2009; Xu, 2013), as well as their preparedness in specific subject areas, such as pre-service teachers (e.g., Sweeney & Drummond, 2013), and future doctors and nurses (e.g., Moore, Canaway, & O'Brien, 2010). In these studies, the employer's perspective was dominant, which showed an overemphasis on the market needs in the modern age (Lewis, 2006).

It is noteworthy to mention that Cheng and his associates developed and validated the Indicators of Undergraduate Students' Key Competences (IUSKC) for Taiwanese university students to gauge their view on what core competencies they consider important, and to what extent they have those core competencies (Cheng et al., 2011). Subsequently, Mok and her colleagues refined the scale and renamed it the 21st Century Core Competencies for University Education (21CCCUE), and validated it with new data collected from Mainland China and Macau (Mok et al., 2010, 2011).

Cheng et al. (2011) developed key competencies on the consensus of scholars and experts in education fields, representing the voice from inside the university. The study reported that business executives and university professors thought university students should have

positive personalities and a better mastery of professional knowledge, including information technology (IT) applications and writing ability, while the university students considered good character, such as being empathetic and possessing good morals, and interpersonal communication skills, such as respectful attitudes and tolerance. On the other hand, the inadequately possessed core competencies were the capacity for a second language, problem-solving skills, an open vision, critical thinking and self-directed learning.

In Hong Kong, the Education and Manpower Bureau has been conducting surveys on employers' opinions of graduates' performance as a way of tracking the value-added output (Education Bureau, 2010). According to the employers, the overall performance of graduates was quite satisfactory, as they are "generally meeting employers' required standard" and "sometimes exceeding employers' required standard" (Education Bureau, 2010, p. 9). Regarding the importance of the nine main aspects perceived by the employers, they rated "work attitude" as the most important, followed by "interpersonal skills," "analytical and problem-solving abilities," "English-language proficiency," "Chinese-language proficiency," "technical skills required for the job," "numerical competency," "information-technology literacy" and "management skills." Regarding the performance of graduates on these nine aspects as rated by the employers, the performed the best in "information-technology literacy," followed by "work attitude," "Chinese-language proficiency," "numerical competency," "interpersonal skills," "English-language proficiency," "technical skills required for the job," "analytical and problem-solving abilities" and "management skills."

In mainland China, only a small amount of research has been done on the core competencies of university students, many of which focus on competencies for future career development. A study based on a survey of 272 employers in Chongqing Municipality found that

professional ethics, the ability to cooperate in teamwork, and extensive knowledge are highly valued by employers, while foreign language and IT are less emphasised than before (Xiao, Liu, & Dai, 2008). Studies also reported that university students had a better mastery of subject knowledge (Ge, Zhou, Lu, & Li, 2011; Hu, Xu, Chen, & Wang, 2013), but were not good at teamwork, social adaptation, and compliance with moral constraints (Guo, Guo, & Li, 2014; Jin & Zhang, 2014; Li, 2011; Shen, Wang, & Guo, 2006). The local researchers summarised the shortage of existing research on the competencies of university students, claiming that research on competence models for Chinese university students is lacking, and no systemic and comprehensive studies with guaranteed validity and reliability exist. Most current studies were qualitative descriptions and lacked appropriate assessment approaches based on quantitative analysis (Lou, Zhong, & Duan, 2009).

In conclusion, current relevant studies on students' preparedness of core competencies for the twenty-first century are not comprehensive enough. In order to gain a relatively explicit understanding of the phenomenon, this study raises the question: How do university students rate themselves in these core competencies?

2.7 Can University Education Develop Twenty-first Century Core Competencies in Their Students?

The value of university education was seldom questioned in the traditional societies (Tilak, 2006). As Mishan (1969) noted, "[university] education is an investment and will pay for itself; and will increase the earnings of the beneficiary students and the government will recover its costs through consequent higher tax receipts." In China, university has been perceived as the spiritual home to pursue truth and the real stairs leading to successful

personal development, while university students were once called heaven-favoured children. However, the remarkable scientific discoveries and technological innovations which have been made in the middle and late twentieth century significantly changed humankind's life and minds. The subsequent competition in the global economy motivated people to critically analyse the effectiveness of education for its competitive weakness. Facing the serious challenges caused by market-promoting policies, the role of university education is reinterpreted and redefined, while new values, policies and practices replaced traditional and well-established values, concepts and approaches (Tilak, 2006). University education is no longer "a miracle cure or a magic formula opening the door to a world in which all ideals will be attained" (Delors et al., 1996, p. 11).

According to Bok (2006), the apparent complaints related to undergraduate education aimed at two aspects: a lack of clear vision and an overemphasis on vocationalism. A clear vison for undergraduate education helps mission development and value clarification. However, it is rare to see vision statements on university websites, including top universities such as Harvard University and Stanford University, even today. The mission statements of universities are much easier to find. Nevertheless, it is difficult to detect if a mission is achieved. First, the missions are introduced generally, for example, "to educate the citizens and citizen-leaders for our society . . . through our commitment to the transformative power of a liberal arts and sciences education" (http://www.harvard.edu/faqs/mission-statement). Although the sentences are well expressed and full of compassion, different people have different opinions when judging whether or not a graduate has achieved the mission. Second, even when mission statements provide more detailed and specific descriptions, there are usually no ready-made measures to implement an evaluation mechanism to determine the graduate's achievement. However, it is encouraging to see that some universities have taken

steps to develop graduate attributes and measurements based on their missions (e.g., Lin et al., 2014; Moalosi, Oladiran, & Uziak, 2012).

Another critique of university education is related to the rapid increase in vocationalism that has occurred in recent years (Bok, 2006; Grubb & Lazerson, 2005; Peach, 2010). The market reforms aim to make university education institutions responsive to market forces without distinguishing between education and any commercial product (Tilak, 2006). Researchers (e.g., Côté, & Allahar, 2011; Marks, 1999) have raised their concerns about the longstanding question of university education: namely, what is the ultimate goal of undergraduate education: liberal education or vocational preparation? It seems that university education's traditional functions of the production and dissemination of knowledge are under attack if universities merely aim to prepare their students for work (Tilak, 2006). The opponents of vocationalism share the view that the shift towards a vocational emphasis leads to decreases in students' critical-thinking skills and senses of moral, civic and social responsibility (Bok, 2006; Grubb & Lazerson, 2005). Bok further noted that there is a growing tendency to turn universities into vocational training camps, in which the priority is given to the occupational needs instead of preparing graduates "to live a full life as widely informed, reflective human beings" (Bok, 2006, p. 3).

In China, with the rapid expansion of university education, the quality of undergraduate education has been cast in a doubtful and critical light even more. Educators and researchers have shown their concern for the quality of university graduates and have called for teaching reforms (Guo & Nie, 2014; Liu & Lv, 2013; Lv, 2013; Ma, 2006; Yao, 2010); however, most of them only discussed the theory and lack of practical details. Although a small amount of research has been done on the core competencies of university students, most of these studies

were motivated by concern for the severe employment difficulties faced by university students in recent years.

What is the idea of a university in the twenty-first century? There has been a new round of debate in recent years (Bond, Ciancanelli, & Wright, 2012; Collini, 2012; Holmwood, 2011; O'Byrne & Bond, 2014). O'Byrne and Bond (2014) observed three competing paradigms that are arising in the United Kingdom: the intellectual model, the managerial model and the consumerist model. According to O'Byrne and Bond (2014), the intellectual model incorporates the traditional idea of a university as an academics centre, not a business or a feeder to the marketplace. The managerial model emphasises the role of the government and policymakers as well as capital and regulatory agencies in the management of university affairs. The focus of the consumerist model is on the satisfaction of students, parents, employers and media, showing a market-driven obsession with commodification. Each of these models exists in a dualistic relationship with the others; however, the managerial and consumerist models have become the dominant dualism, and the intellectual model is facing the threat of being supplanted (O'Byrne & Bond, 2014). Although these three models are competing with one another at the present stage, universities much achieve a consensus of core values to balance the visions of managers, academics and students (O'Byrne & Bond, 2014).

Eventually, returning to the question in this section title, the good news is that university education can develop twenty-first century core competencies in their students, at least to a significant extent, given the will to perform it. However, the bad news is that there are no reliable methods to measure the perceived adequacy of university education in developing these competencies. Bok (2006) once said that both faculties and their deans and presidents

were not compelled to search continuously for the best way to educate their students. It seems that universities should carry out their responsibilities and try their best to make such efforts. The current study also aims to explore the adequacy of university education in developing twenty-first century core competencies in graduates from the students' perspectives. It may contribute to the efforts of university education in its self-accomplishment.

2.8 Seeking Effective Ways to Develop Core Competence: From an Ecological Perspective

Recently in Europe, the lifelong learning perspective led to concerns on the development of competencies across and beyond educational stages (Weinert et al., 2011). For example, the German National Educational Panel Study (NEPS) aimed to assess competencies from early childhood to late adulthood with multi-cohort large-scale assessment approaches (Artelt et al., 2013). NEPS experts selected target competencies by considering their importance for future job careers, the general life satisfaction of individuals and the well-functioning of society, and these competencies were defined as functional achievement dispositions under the combined effects of families, schools, and other relevant factors across the lifespan (Artelt et al., 2013).

Embedding competencies into the ecological system reveals the nature of the development of human competencies. According to social cognitive theory (Bandura, 1986, 1992), behaviour, personal characteristics, and environmental influences are triadic reciprocal determinants working together towards the development of different human competencies. These three factors interact with each other and influence each other bi-directionally (Bandura, 1986, 1992): (1) Personal characteristics, such as beliefs, expectations, competencies, and emotional inclination, guide and affect behaviour, while behavioural experiences modify and

impact thought patterns and emotional reactions; (2) Behaviour changes the environment, and in turn, is altered by the changed environmental conditions; (3) Personal characteristics select and create the social environment and are also shaped and modified by social influence. The view of reciprocal causation highlighted the influential determinants and their interactions in the development of human competencies. It seems that putting competencies into the ecological system helps to enhance the understanding of the importance and the development of these competencies at different life stages.

The widely accepted ecological model proposed by Bronfenbrenner (1994) emphasised the individual-environment interaction in a developmental perspective. Bronfenbrenner concluded five socially organised subsystems that individuals develop in and interact with, namely, microsystems, mesosystems, exosystems, macrosystems and chronosystems. Figure 2.1 represents the relationships of the first four subsystems, while the chronosystems indicate a time dimension. Individuals connect with various subsystems directly or indirectly.

According to Bronfenbrenner (1994), a microsystem is the immediate environment where an individual lives, including key developmental settings such as family, school, peer group and workplace. A mesosystem indicates the relationships between two or more direct settings such as school and family, performing as a system of microsystems. An exosystem indicates the relationships between two or more settings in which at least one of them is indirect to the individual such as the parents' workplace, family social networks, and neighbourhood community. A macrosystem represents the overarching culture or subculture which impacts all the micro-, meso-, and exosystems, and refers particularly to belief systems, bodies of knowledge, customs, lifestyle, etc. Bronfenbrenner's ecological theory of human

development has shed light on the role of environmental systems with different contents and structures in an individual's development processes.

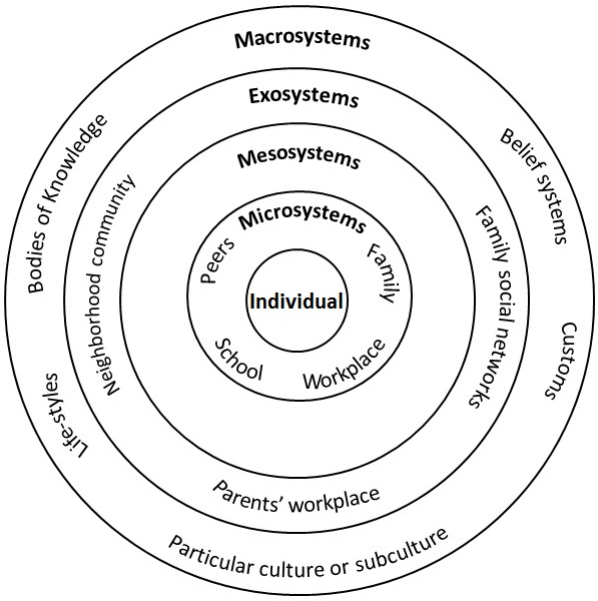


Figure 2.1. Bronfenbrenner's Ecological Theory of Human Development

Note. From "Ecological models of human development," by U. Bronfenbrenner, 1994, *Readings on the development of children, 2*, pp. 39-40.

From the ecological perspective, competencies develop under and interact with different environmental influences with respect to individual differences over the lifespan. Individuals develop their competencies through interactions with environmental systems directly, such as family education and formal schooling, and indirectly, such as family interaction and communication. These interactions first take place in families, then in schools and with peers, then in communities and societies, and finally in nations and the world. The environmental systems provide not only training through which competencies are developed and mature, but also challenges for new and remarkable competencies. Individuals not only learn and develop different competencies from the interactions with these systems, but also change these systems and their interactions with new and remarkable competencies. Therefore, it is

necessary and imperative to put competencies in the ecological model when exploring the importance and the development of the competencies.

Bronfenbrenner's theory (1994) has been considered the most widely accepted theoretical framework for studying individuals in ecological contexts (Neal & Neal, 2013). The ecological systems were adopted by many studies that focused on an individual's development (Christens & Faust, 2014; Neal & Neal, 2013). However, few researchers have tried to build on theoretical frameworks of competence development by proposing the interrelated nature of students and the ecological systems that interact to influence their development. In Hong Kong, The Hong Kong Education Bureau adapted Bronfenbrenner's theory (1994) as the theoretical backdrop in the Assessment Package for the Affective and Social Outcomes (APASO) of daily schooling outcomes, which has been used effectively by schools and the government for school improvement and policymaking since its launch in 2010 (http://apaso.edb.gov.hk). In this study, Bronfenbrenner's ecological systems theory (1994) is adopted into the conceptual framework for formalizing strategies for the development of indicators of core competencies for the twenty-first century (see Section 2.11.1).

2.9 Rasch Model

The traditional methods treat observed categorical scores as interval data (Stevens, 1946), assuming that the raw data has proportional meaning regardless of its ordinal property. The impropriety confounds the nature of observed scores and causes problems such as item dependency and sample dependency (Hambleton & Swaminathan, 1985). To achieve the goal of objective measurement, Georg Rasch developed the Rasch model (Rasch, 1960) to convert

ordinal raw scores into Rasch logit scores which are calibrated as interval scales. The Rasch measurement has been very useful for assessments measuring a person's ability, attitudes, characteristics, and other personal traits, particularly in psychological and educational settings, and is widely applied in large-scale assessments, such as the Programme for International Student Assessment (PISA) and the International Civic and Citizenship Education Study (ICCS).

Likert scales (Likert, 1932) have long been widely used to collect attitude data. The key feature of such scales is that no matter what attitudes are assessed, the possible responses are formally on the disagree-agree continuum such as strongly disagree, disagree, neutral, agree, and strongly agree, and commonly on a four-point, five-point, six-point, or seven-point scale. Traditionally, Likert scales were treated as interval scales and summed to an overall score, disregarding the subjective nature of the data, causing counterintuitive and mathematically inappropriate results (Bond & Fox, 2007, p. 101). In the present study, Likert-type items are adopted and analysed using the Rasch model. Hence, the principal concepts of the Rasch analysis are briefly introduced in the following paragraphs.

In the classic Rasch model for dichotomous responses (Rasch, 1960), the probability of a specified response is modelled as a logistic function of person and item parameters:

$$\log\left(\frac{P_{ni1}}{P_{ni0}}\right) = \theta_n - \delta_i, \qquad (1)$$

Where θ_n is the proficiency level of examinee n; δ_i is the difficulty of item i; P_{ni1} is the probability of scoring 1, namely a correct answer, on item i for examinee n; and P_{ni0} denotes a wrong answer. In the context of this study, an "examinee" is equivalent to a university student who responded to the questionnaire. The "proficiency level of an examinee" or "the

ability of an examinee" represents the student's attitude to the endorsement of the measured latent trait such as the importance of core competencies. Difficulty of an item means to what extent a questionnaire item is endorsed by the respondents. A more difficult item means an item in the questionnaire which is more difficult to be endorsed (or agreed to), and a less difficult item refers to a questionnaire item that is less difficult to be endorsed by the respondents. Unlike the situation of dichotomous responses in Equation 1, this study adopts the Likert scale using polytomous scores (see Equation 3), which is introduced in the following paragraphs.

The Rasch model measures in terms of a particular unit called a logit (Wright and Stone, 1979), which transforms raw scores into interval-level data. In Equation 1, ability θ and difficulty δ are at the same logit unit, and the sources of influencing observed response are clearly differentiated and parameterised on a common interval scale, suggesting drawbacks of traditional methods (such as item dependency and sample dependency) no longer exist. The values of ability θ or difficulty δ vary from negative infinity and positive infinity theoretically, mostly within ± 3 in practice. Since item difficulty and person ability share the same calibration, it is typical to display both of them in a vertical scale which is called the item-person map or Wright map (Wilson, 2011). The Wright maps of each scale used in this study are presented in Chapter 3.

Not limited to a dichotomous outcome, the Rasch model has been extended to fit polytomous scores. Masters (1982) developed the partial credit model as follows:

$$\log\left(\frac{P_{nij}}{P_{ni(j-1)}}\right) = \theta_n - \delta_{ij} \equiv \theta_n - (\delta_i + \tau_{ij}), \qquad (2)$$

where P_{nij} is the probability that person n, on encountering item i, would be observed in category j; τ_{ij} is the j-th step parameter of item i; and the others are defined as above. If items in a test share the same set of thresholds, such as Likert items, a feasible constraint could be imposed on Equation 2 so that the rating scale model (Andrich, 1978) is formed:

$$\log\left(\frac{P_{nij}}{P_{ni(j-1)}}\right) = \theta_n - (\delta_i + \tau_j), \tag{3}$$

where τ_j does not have the subscript of i, suggesting all the items share the same set of thresholds. The partial credit model is suitable for constructed-response items, whereas the rating scale model is for rating scale items or Likert items. Since the questionnaire used in this study involved items with four options organized in a typical Likert scale way, the rating scale model was used to analyse the data here.

The Rasch measurement provides a number of indices including the Infit statistics, the Outfit statistics, and the Rasch reliability to indicate the quality of a scale. Only when there is a satisfied model-data fit, will the measures of person ability and item difficulty be interval and comparable. Infit and Outfit are measures of the mean square error (MNSQ), indicating the difference between the expected score and observed data in the Rasch measurement. Their values range from 0 to positive infinity, with the expectation value equalling 1. Infit is information-weighted estimates which is more sensitive to the pattern of responses to items targeted on the person, whereas Outfit is unweighted and more sensitive to unexpected responses by persons on items (Linacre, 2014). Acceptable values of MNSQ are in the range of 0.5–1.5 (Linacre, 2014), while some researchers adopt stricter standards such as 0.6–1.4, 0.7–1.3 and 0.8–1.2 (Linacre, 2014; Wright & Linacre, 1994).

Traditionally, the reliability of a scale is defined as the proportion of true variance to observed variance. One of the most popular reliability statistics used in social science research is Cronbach's alpha (Cronbach, 1951), which provides internal consistency or the average correlation of items on a scale. In the Rasch measurement model, the true variance is the adjusted observed variance by measurement error, and the error variance is a mean-square error inflated by the misfit of the data to the model (Wright, 1996). Rasch practitioners develop the separation index instead of conventional internal consistency coefficients (Linacre, 2014; Wright, 1996). The person/item reliability (person/item separation index) indicates the "reproducibility of relative measure location" (Linacre, 2014, p. 618), and a high person/item reliability indicates a high probability in estimating person/item with high measures having higher measures than in estimating person/item with low measures (Linacre, 2014).

Since some of the aforementioned research on core competencies have used the Rasch model to deal with their data and take advantage of interval measurement (Cheng et al., 2011; Mok et al., 2010, 2011), this study follows the example of these studies and uses the Rasch approach in the data analysis.

2.10 Limitations of the Current Literature

Although the explorations of core competencies for the twenty-first century in Western cultures are abundant, comparatively fewer studies are found in the Eastern countries. Native research is imperative for the Eastern countries, because the differences that exist between the West and the East are not only geographical, regional and cultural, but also economical, technical and institutional. The experiences and methods of university education systems and

the reforms of teaching models in developed countries provide guidance for developing countries, but they cannot be directly put into practice in developing countries. The same applies to the exploration of core competencies of university students. Take, for example, cultural variation; the most promising dimension of cultural variation is individualism versus collectivism (Heine, 2010; Triandis, Bontempo, Villareal, Asai, & Lucca, 1988), and differences have been widely found between individualist societies and collectivist societies, such as in morality (Tabellini, 2008), self-efficacy (Bandura, 1995), and motivation (King & McInerney, 2014). Specifically, when talking about self-directed learning, which is one of the six domains of core competencies for twenty-first century university education, autonomy and independence have been emphasised in all literature. However, research found that in the Asia-Confucius cultural education context, students have some uncomfortable emotions related to independent study practices and even oppose autonomy (Gieve & Clark, 2005; Rao & Chan, 2009).

The explorations of core competencies mentioned above mostly focused on experts' viewpoints such as policymakers and educators. Few studies concern students' perspectives on core competencies and their perceptions on university education in developing the competencies. However, students are one of the key stakeholders of education, and their perspectives are most important if teachers want to motivate them and to maximise the effects of our teaching (Shvidko, Evans, & Hartshorn, 2015). To bring the "missing perspective" (Tymon, 2013, p. 849) back is one of the aims of this study. In addition, few studies have focused on the core competencies of university students in China. The existing research consists of mostly qualitative descriptions. It is necessary and imperative to conduct systematic and comprehensive studies based on quantitative analysis, especially using valid tools to guarantee the reliability of the research.

Finally, in the existing explorations of core competencies for the twenty-first century, little attention has been given to (1) students' preparedness of these competencies, and (2) the perceived adequacy of university education in developing these competencies in graduates. These two aspects are, nevertheless, crucial to the implementation of competence development. In addition, few current studies have set up theoretical frameworks for the optimized development of core competencies in university campuses.

2.11 Conceptual Framework and Research Questions

The main focus of the current study is to explore university students' perceptions on core competencies for twenty-first century university education, which is composed of three aspects: the importance of core competencies, self-ratings on possessing these competencies, and the adequacy of university education in developing these competencies in their graduates. Therefore, five research questions were developed to address these aspects and their relationships. Before that, a conceptual framework was laid out serving as the theoretical background in which the development of core competencies are conceptualised.

2.11.1 Conceptual Framework of the Study

With reference to the indicators of core competencies for the twenty-first century (Binkley et al, 2012; Delors et al., 1996; OECD, 2010; Rychen & Salganik, 2003; Stein, 2000; Wiek et al., 2011), six domains of core competencies were identified as the most important core competencies for twenty-first century university students (see Section 2.5). In these six domains of core competencies, basic and professional knowledge and interpersonal

communication skills have formed the foundation of one's development, while creativity and problem-solving ability, global perspective and self-directed learning would enhance the odds of survival and development, and even bring unique values to the individual. Finally, good character and citizenship would ensure one's talents for legitimate purpose and contributing to society. In this study, the six domains of core competencies conform to the identification criteria of core competencies for university education (see Section 2.3) which were adapted from Prahalad and Hamel (1990). The criteria suggest that graduate students with core competencies should: (1) have good survivability and sustainability; (2) be capable of making significant contributions to human society; and (3) have their own characteristics and unique values.

It can be seen from the text in Section 2.8 that Bronfenbrenner's ecological model (1994) has not been used as a framework for studying university students' competence development. Nevertheless, the ecological model can be applied to establish a framework that integrates the above six domains of core competencies in order to facilitate our understanding of crucial abilities and skills for the twenty-first century. This conceptual framework provided the theoretical background which revealed the developmental nature of the target competencies, and contributed to further considerations on the development of these competencies.

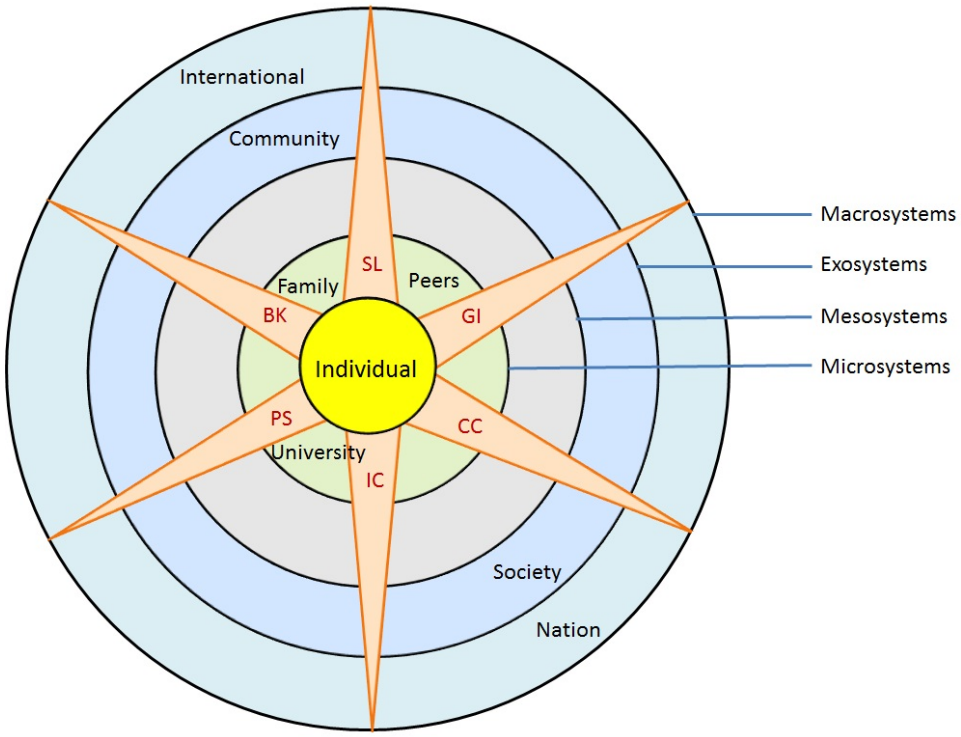


Figure 2.2. The conceptual framework of the current study.

Figure 2.2 depicts the conceptual framework of the current study, the backdrop against which the core competencies were conceptualised according to their development. The six domains of core competencies are put into the ecological systems, adapted from Bronfenbrenner (1994), which includes microsystems, exosystems, mesosystems, and macrosystems (see Section 2.8). The abbreviations "BK", "PS", "IC", "CC", "GI", and "SL" stand for the six domains of core competencies, including "Basic and Professional Knowledge", "Creativity and Problem Solving", "Interpersonal Communication", "Character and Civic Literacy", "Global and International Perspective", and "Self-directed Learning", respectively. Students acquire and develop these core competencies as well as other competencies needed for their study and life naturally in interactions with different environmental influences, which in turn affect their environmental settings.

In the competence development processes of university students', the microsystems comprise the immediate environmental settings such as family, peer group and university. Among them, university may be the most influential setting since students live on the campus and spend most of their time learning and studying. The mesosystem indicates the relationships between two or more environmental settings of the microsystems. This means that in certain situations, these settings come together and interact to form a new experience for an individual. These two environmental systems have a direct and longstanding influence on an individuals' development. To university students, the exosystems refer to kinds of community and societal influences, which affect them indirectly but sometimes may have a huge impact. The macrosystem includes influences at the national and international level which indirectly and gradually affect an individuals' development. The chronosystem which has been included in Bronfenbrenner's theory (1994) is not involved in this model, for the university years are considered a homogeneous level.

The conceptual framework of this study provides an ecological and developmental perspective to consider the variables important to undergraduates at this stage of their life. The four subsystems indicate individual-environmental interactions proceeding from the near to the distant, which are consistent with the famous Chinese Confucianism: "xiushen (cultivate oneself), qijia (regulate the family), zhiguo (rule the state), and pingtianxia (pacify the country)". University undergraduates are in the advanced stage of "xiushen", the initial stage of "qijia", and the preparation stage of "zhigou" and "pingtianxia". When selecting core competencies for university undergraduates, this conceptual framework served as conceptual guidance for selecting and considering the list of competencies.

2.11.2 Research Questions

To get a holistic and deep understanding of university students' perceptions on core competencies for twenty-first century university education, the first step in the explorations essentially focuses on the importance of core competencies. Accordingly, the first research question (RQ1) is: What competencies are considered important by university students for themselves in the twenty-first century?

Since the six domains of core competencies adapted in this study could best represent the core competencies for twenty-first century university education according to the existing literature (Delors et al., 1996; OECD, 2010; Rychen & Salganik, 2003; Stein, 2000; Wiek et al., 2011), it is assumed that all these competencies are perceived as important by university students. According to Bronfenbrenner's theory (1994), students develop their competencies by experiencing the interactions of the individual and the ecological systems. The more direct ecological systems provide more opportunities for individuals to learn and practise a new competency. This study assumes that competencies developed and used in the close and direct ecological systems would be given more importance than those in the distant and indirect environmental systems. For example, in general, competencies such as Interpersonal Communication and Basic and Professional Knowledge would be rated as more important than the Global and International Perspective. However, if competencies in terms of the Global and International Perspective are highly valued and often practised in university education, students may also speak highly of them.

While the importance of each competency is identified by university students, it is considered appropriate to instead concentrate on the possession problem. That is, the extent to which, in

the students' opinion, they have these competencies. Therefore, the second research question (RQ2) is: How do university students rate themselves in these competencies?

It has been reported that university students consider that they possess good character and a better mastery of interpersonal communication skills, but were lacking certain capacities such as second language, problem-solving skills, open vision, critical thinking and self-directed learning (Cheng et al., 2011). However, research of this kind is quite rare. According to Bronfenbrenner's theory (1994), it is assumed that the close and direct ecological systems would provide more opportunity to develop a certain competency. Among the six domains of core competencies, students may rate highly those often practised, such as Interpersonal Communication and Basic and Professional Knowledge. Character and Civic Literacy would also be highly rated for the self-report bias (Donaldson & Grant-Vallone, 2002; Mattheos, Nattestad, Falk-Nilsson, & Attstrom, 2004). People seldom claim that they lack civic literacy or have moral character issues. However, Creativity and Problem Solving and Self-directed Learning may be scored lower because these competencies are difficult to master. In addition, the Global and International Perspective would be lowly rated since it belongs to the distant ecological systems.

The third research question (RQ3) is: From the students' perspectives, how adequate is university education in developing these competencies in graduates for the twenty-first century?

The quality of university education has been criticised, while the perceived adequacy of university education in developing twenty-first century competencies has been doubted (see Section 2.7). Nevertheless, university education should at least be able to equip students with

Basic and Professional Knowledge. Ideally, university classes may also develop students' competencies in terms of Interpersonal Communication, Self-directed Learning and Creativity and Problem Solving, supported by university clubs and societies which provide multiple opportunities for students to practise. Although university education has a positive effect on the development of core competencies such as Character and Civic Literacy and Global and International Perspective, influences from other environmental settings such as family and society also contribute significantly.

After the explorations in the above three aspects of students' perceptions on core competencies, this study turns to the relationships between students' standpoints on these three aspects to better understand the situation. Therefore, the fourth research question (RQ4) is: What are the relationships between students' perceptions on the three aspects about core competencies for the twenty-first century, namely, importance, possession and adequacy? Thus far, no clear link has been established between these three aspects according to the existing documents. This study provides such information in Chapter 4.

Since the gender, grade and location differ among student participants in this study, it is reasonable to detect these differences. Thus, the fifth research question (RQ5) is: Are there any differences in the perspectives of university students in terms of gender, grade and location?

Few investigations have focused on students' perceptions of core competencies for the twenty-first century which included the importance of core competencies, self-rating of the possession, and adequacy of university education. Therefore, limited information could be used to predict the differences in terms of gender, grade and location. Generally, university

seniors are expected to possess a certain competence to a higher extent than juniors. As for the location difference, it is assumed that competencies related to the Global and International Perspective would be evaluated more highly by Macau students than Zhejiang students.

2.12 Chapter Summary

In this chapter, the concept of competence has been discussed to lay the groundwork for discussions of core competencies for twenty-first century university education. With reference to the indicators of core competencies for the twenty-first century and Bronfenbrenner's ecological model of human development, a conceptual framework was developed to serve as the research context and guideline for selection and conceptualisation of the core competencies. The preliminary explorations in Chinese societies were introduced, as well as the discussion on the limitations of the current literature. The Rasch model was also introduced since Rasch logit scores were used to calibrate the results of this study. At the end of this chapter, five research questions were raised. The research methods to address these research questions are introduced in the next chapter.

CHAPTER 3

RESEARCH METHODS

The current study draws on a mixed methods research design known as the "third methodological movement" (Tashakkori & Teddlie, 2003, p. ix). The mixed methods research combines the perspectives and merits of both quantitative and qualitative approaches, and is expected to be the dominant methodological tools in many research domains in the new century. In this study, the quantitative approach aims to collect numeric data from university students using a survey questionnaire, in order to explore students' perspectives on core competencies and their university education in developing these core competencies, and to examine the relationships and differences of these perspectives between student participants of different gender, grade and location. The qualitative approach aims to provide descriptive and interpretative soft data as complementary explanations of the research questions using semi-structured interviews.

3.1 Mixed Methods Research Design and Notation System

This section briefly introduces the mixed methods research and its notation system. Following the introduction, the partial mixed sequential dominant status design (Leech & Onwuegbuzie, 2009) of the current study is graphically demonstrated (see Figure 3.1). Here 'partial' means the two research approaches were partially mixed, 'sequential' means the two research approaches were conducted in tandem, and 'dominant status' means in this study, the quantitative approach was the dominant method.

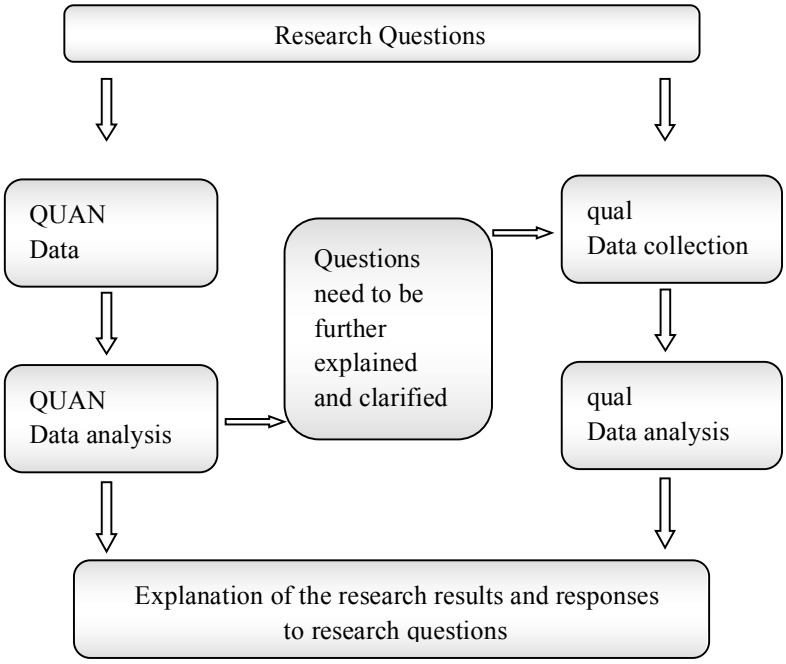


Figure 3.1 Partial mixed sequential dominant status design of the study.

3.1.1 Mixed Methods Research

Generally, a study combining both quantitative and qualitative approaches in the whole or partial process of investigation of the same underlying phenomenon is considered mixed methods research (Leech & Onwuegbuzie, 2009). Mixed methods research represents a type of research design integrating quantitative and qualitative approaches in research methods, data collection, analysis and interpretation, or in inferences (Tashakkori & Teddlie, 2003). There are many similar terms such as methodological triangulation (Morse, 1991), combining qualitative and quantitative research (Creswell, 1994), blended research (Thomas, 2003), and mixed methods research (Creswell & Plano, 2011; Leech & Onwuegbuzie, 2009; Tashakkori & Teddlie, 2003).

Relative to quantitative research and qualitative research, mixed methods research is considered the third major research paradigm and is becoming increasingly articulated and recognised (Johnson, Onwuegbuzie, & Turner, 2007; Tashakkori & Teddlie, 2003). As research paradigms, quantitative research holds a post-positivist worldview and is interested in numerical analysis, qualitative research holds a constructivist worldview and deals with narrative data, while the mixed methods research takes a pragmatic position and is interested in both types of data (Tashakkori & Teddlie, 2003). Combining elements of the quantitative and qualitative approaches, both deductively and inductively, meaningful research is undertaken pragmatically, which accesses the real world instead of metaphysical truths (Tashakkori & Teddlie, 1998).

Several benefits have been identified for integrating quantitative and qualitative research (Collins, Onwuegbuzie, & Sutton, 2006; Denzin, 1978; Rossman & Wilson, 1985). Greene, Caracelli, and Graham (1989) presented five main purposes to employ a mixed methods research: triangulation, complementarity, development, initiation, and expansion. Collins, Onwuegbuzie, and Sutton (2006) listed four rationales comprising participant enrichment, instrument fidelity, treatment integrity, and significance enhancement. Although the mixed methods paradigm is still in its adolescence (Tashakkori & Teddlie, 2003) and much remains to be developed and improved, it has attracted more and more researchers for use in their studies, giving it credence. Moreover, since the mixed methods research is still evolving and developing, researchers have the opportunity to be creative in utilizing the research paradigm and finding the best way for their own mixed research studies.

3.1.2 Research Design and Notation System

With the increase in the amount of mixed methods research, a myriad of mixed methods designs have appeared in various publications (Creswell, 1994; Creswell & Plano Clark, 2007; Morse, 1991; Tashakkori & Teddlie, 2003). Although the typology of mixed methods designs cannot be exhaustive, researchers try to simplify and synthesise existing research designs to provide integrated and systematic versions. Among them, Leech and Onwuegbuzie (2009) proposed a three-dimensional typology of mixed methods designs based on content analysis, in which the three dimensions are level of mixing (partially mixed versus fully mixed), time orientation (concurrent versus sequential), and emphasis of approach (equal status versus dominant status). Therefore, eight types of mixed research designs are derived by crossing each of two different conditions of these three dimensions. Leech and Onwuegbuzie (2009) also developed a notation system for the eight-design framework, which is a modification of a representative piece of work by Morse (1991).

According to the three-dimensional typology of mixed methods designs (Leech & Onwuegbuzie, 2009), the current study is a partial mixed sequential dominant status design. It is partial mixed because the quantitative and qualitative portions in this study were not converged until both types of data had been analysed. In practice, the quantitative data were collected first, and then the qualitative data were collected for more interpretative information of the quantitative results. Finally, the qualitative research in this study was purposively set as explanatory supplements to the quantitative results, and the quantitative portion was in the dominant status. Using the notation system (Leech & Onwuegbuzie, 2009; Morse, 1991), the current study can be expressed as “QUAN→qual”, where the capital letters indicate dominance, and the arrow denotes a sequential relationship. The truncated words, “QUAN”

and “qual”, stand for the quantitative and qualitative approaches, respectively. Figure 3.1 is a graphical representation of the partial mixed sequential dominant status design study.

3.2 The Quantitative Research Design

As illustrated above, this study is a partial mixed sequential dominant status design in which the quantitative approach takes the leading role. The quantitative research aims to respond to all five research questions of the current study, which has been diagrammed in the flowchart of the research framework (see Figure 1). The quantitative data was collected in a written survey of twenty-first century core competencies for university education using convenience samples. The data analysis includes descriptive statistics, correlation analysis, Rasch measurement, and three-way analysis of variance (ANOVA), using Winsteps (Version 3.81.0) (Linacre, 2014) and SPSS (Version 21). In this section, research participants, research instruments and the procedures used in data collection and analysis are described.

3.2.1 Sample

The sample is comprised of 5,042 students with different majors (see Figure 3.2) from public universities in Zhejiang Province (4,027) and Macau (1,015), respectively. There are 1,772 (35.1%) male students and 3,234 (64.1%) female students, while 36 students did not report their gender. Table 3.1 presents the sample distribution by gender and year level. In Zhejiang Province, 50.5% of students are from year 1, 22.2% from year 2, 16.6% from year 3, and 10.1% from year 4. Comparatively, the ratio of grades among Macau students, which ranged from 19.4% to 30.0%, is more balanced. As for the ratio of gender, the two locations are similar to each other. Both had approximately 64% female students. According to MOE

(2013) statistics, 51.8% of female students have been enrolled in normal and short-cycle courses in higher education nationwide, and the figure rose to 55% in Zhejiang Province. The unbalanced gender ratio is partly a result of convenience sampling and partly a reflection of the disproportionate distribution of female and male students in the populations of the universities in the sample. The unbalanced distribution of students across year levels is mainly a result of convenience sampling. . The data was collected between 2010 and 2011.

In this study, participants are from public universities in Zhejiang Province and Macau. There are research partners in Zhejiang Province and Macau who are interested in and willing to facilitate the exploration of core competencies for the twenty-first century university education. The title of this study used the term 'two Chinese societies', which tried to emphasize the different educational systems. The three cities in Zhejiang province are more similar to one another collectively in comparison with Macau: They are in the same province of China and are under the same education system & Higher Education Act. Macau as a Special Administrative Region has its own educational system & Higher Education Act.

Table 3.1

Sample Distribution of 5,042 University Students from Zhejiang and Macau

		Zhejiang		Macau		Total	
		Count	%	Count	%	Count	%
Gender	Male	1,407	34.9	365	36.0	1,772	35.1
	Female	2,585	64.2	649	63.9	3,234	64.1
	Missing	35		1		36	
	Total	4,027		1,015		5,042	
Year level	Year 1	2,035	50.5	239	23.5	2,274	45.1
	Year 2	893	22.2	275	27.1	1,168	23.1
	Year 3	670	16.6	304	30.0	674	19.3
	Year 4	407	10.1	197	19.4	604	12.0
	Missing	22		0		22	

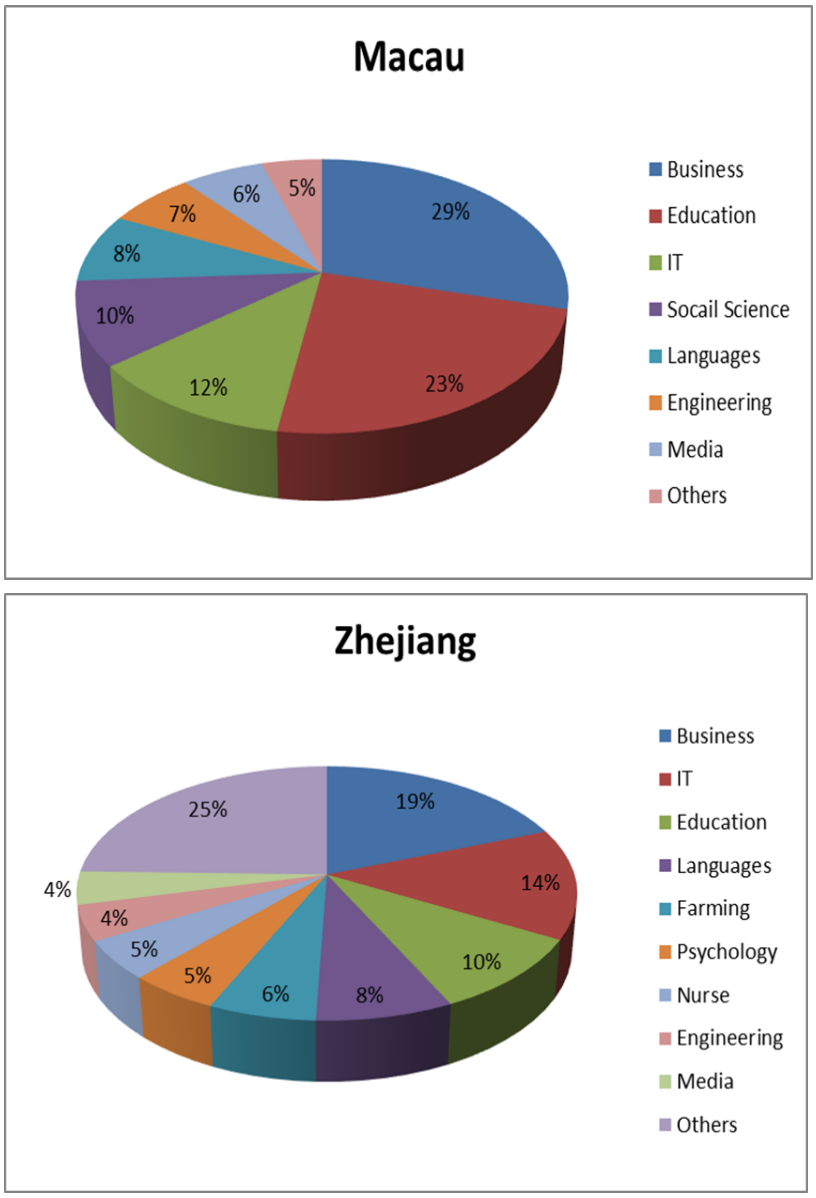


Figure 3.2 The distribution of student majors in 21CCCUE survey

3.2.2 Assessment Instruments

The 21CCCUE scale is a self-report questionnaire involving 40 Likert-type items organised according to six domains (Cheng et al., 2011). The domains are: Basic and Professional Knowledge (BK); Creativity and Problem Solving (PS); Interpersonal Communication (IC); Character and Civic Literacy (CC); Global and International Perspective (GI); and Self-

directed Learning (SL). There are five items in the GI domain, while the other domains each have seven items. Three questions are asked with regard to each of the 40 items in the questionnaire. They are: (1) Which of the following should be possessed by university graduates in the twenty-first century? The response scale comprises four options indicating increasing levels of importance, namely, “Can do without it”, “It would be nice to have”, “Should have” and “Must have”; (2) To what extent do you think of yourself as having these competencies? The response options are “Not at all”, “To a small extent”, “To a certain extent” and “To a large extent”; (3) How helpful is university education in developing these competencies in students? The response options are “Not at all helpful”, “Not too helpful”, “Reasonably helpful” and “Very helpful”. Therefore, the 21CCCUE scale is comprised of three subscales, namely, the Importance Subscale, the Possession Subscale, and the Adequacy Subscale. The 21CCCUE scale was originally developed in Chinese and the Chinese version was used in its applications, including this study. At the stage of scale development, an expert panel including 25 scholars and experts in general education fields met to ensure relevance and adequate coverage of contents, and it was re-checked by professors in Macau when it was being used in Macau.

3.2.3 Procedures

The source of the data for the quantitative research is the existing database of an unfunded project named Core Competencies for University Graduates of the 21st Century, hosted by Professor Magdalena Mo Ching Mok and her colleagues. This source is appropriate for the current study in which university students were invited to participate and to respond to the 21CCCUE scale. Responses to each subscale, namely, the perceived importance of 40 competencies listed in the questionnaire, the extent to which students consider themselves as

having possessed the competencies, and the perceived adequacy of university education in developing the competencies, were analysed in sequence by fitting the rating scale model (Andrich, 1978).

As the flowchart of the research framework shows in Figure 1, Rasch analysis was conducted separately to respond to the first three questions, namely RQ1, RQ2 and RQ3. The analysis consisted of a validation of the assessment of each subscale, and a measurement of students' responses on the corresponding subscale. Indices including person and item reliabilities, item difficulty, item fit, and differential item functioning (DIF) in gender and locations were generated and checked (Linacre, 2014). More will be introduced about these indices in a later section of this chapter. Descriptive statistics were used to describe the participants' perceptions on each subscale separately, including the importance of core competencies for the twenty-first century (the Importance Subscale), self-rating on the possession of the 40 competencies listed in the scale (the Possession Subscale), and the perceived adequacy of university education in developing these competencies (the Adequacy Subscale). To answer the fourth question, RQ4, correlation analysis was used to examine the relationships between students' responses to the three subscales in the 21CCCUE scale, respectively. The fifth question, which aims to compare grade, gender and location differences in the perceptions of university students, was inspected by three-way ANOVA. To conclude, the data analysis includes the Rasch measurement, descriptive statistics, correlation analysis and three-way ANOVA. The Rasch analysis was conducted with the Winsteps software (version 3.81.0) (Linacre, 2014), while the others were analysed using SPSS (version 21).

3.2.4 Variables Used in the Quantitative Part of the Current Study

The quantitative part of the current study focuses on the core competencies of university graduates in the twenty-first century and aims to explore the importance of the core competencies, the self-rating of possessing the core competencies, and the perceived adequacy of university education in cultivating the core competencies from the perspectives of university students. Accordingly, these three variables are of interest in this study, namely, the importance of core competencies, self-rating of possessing the core competencies, and adequacy of university education in cultivating the core competencies. Each variable contains the aforementioned 40 items in six domains, and were measured by the students' responses to a four-level response scale. It is, therefore, necessary and important to introduce these domains first.

The domain of Basic and Professional Knowledge comprises competencies involving those knowledge and skills that serve as the foundation of students' learning and facilitate their study and work currently and in the future. Basic knowledge is no longer limited to the traditional comprehension-speaking-reading-writing-calculation. The needs of the new age generate new requests of basic skills, such as IT applications, critical thinking and decision making (Ananiadou & Claro, 2009; Binkley et al., 2012). As for the professional knowledge, each university student is supposed to have a major, which provides professional knowledge in the specific area. In this domain, there are seven items including "Professional knowledge", "Ability to express in writing", "Capacity for empirical deduction", "Capacity for IT application", "Capacity for logical analysis", "Ability for critical thinking" and "Decision making".

The domain of Creativity and Problem Solving comprises competencies which have been highly valued in many fields. The cluster of competencies work together as higher-order thinking skills devoted to solving problems successfully, and even creatively, in the academic context and practical society. Recently, with the increasing criticism of the overemphasis on rote learning of university instruction, attention has been given to the development of university students' creativity and problem-solving skills theoretically and empirically (Celik, 2008; Seechaliao et al., 2011). In this domain, there are seven items including "Creativity", "Self-potential development", "Imagination", "Keen observation", "Attitude for innovation and change", "Adventurous spirit" and "Problem-solving skills".

The domain of Interpersonal Communication includes competencies leading to successfully connecting with others, which have been seen as necessary and essential factors for individual development and social cohesion (Troth et al., 2012). They have been emphasised by individuals and organisations not only because efficient interpersonal communication contributes to success across a variety of academic and professional contexts (Worley et al., 2008), but communication difficulties will take their toll on undergraduate students in a wide range of settings, and even affect their daily lives (Barr et al., 2005). In this domain, there are seven items: "Attitudes of respect and tolerance", "Verbal ability", "Ability to listen to others", "Ability to manage emotion", "Ability to work in team", "Leadership and coordination" and "Ability to interact".

The domain of Character and Civic Literacy includes competencies related to morals, virtues, values, ethics and citizenship which greatly contribute to the whole person education of university students. Character development and civic socialisation are considered major goals

of education as well as learning and academic achievement (Berkowitz, 2012). In China, Confucianism advocated that virtue is more important than wisdom to a gentleman, and cultivation of morality has been a tradition at all levels of the Chinese education system. This domain includes seven items: “Positive personality”, “Humanities and art appreciation”, “Empathy and moral standards”, “Respect human rights and freedom”, “Practise democracy and justice”, “Ability for social participation” and “Ability for value judgment”.

The Global and International Perspective domain includes competencies related to being aware of global affairs, having the skills to deal with international events, and respecting different cultures. Global education has been emphasised by modern universities as one of the most significant learning outcomes (Altbach, 2006; Brodin, 2010). Along with the increasing globalisation and internationalisation, undergraduate students are required to be familiar with cultural norms and international affairs, and to communicate and interact effectively inside and outside their environments (Li, 2013). This domain contains five items: “Capacity for second language”, “Open vision”, “Respect for cultural diversity”, “Familiar with international affairs” and “Concept of global village”.

The domain of Self-directed Learning includes competencies to guarantee individuals’ initiative and effective learning, with which the process of knowledge acquisition and personality characteristic are combined to contribute to successful and independent cognitive activities. Self-directed Learning has been considered an ultimate educational goal which significantly impacts on students’ academic achievement and ability to learn (Hastie et al., 2013; McClelland & Wanless, 2012), and is recognised as a core issue of lifelong education and “whole person” development in university education (Cheng & Chau, 2013; Levett-Jones, 2005; Wichadee, 2011). This domain has seven items: “Capacity for independent

study", "Set learning goals and strategies", "Control learning process", "Manage learning environment", "Ability to use learning resources", "Reflect on learning effectiveness" and "Ability to assess learning outcomes".

3.2.4.1 Importance of Core Competencies

The importance variable of core competencies means students' perceptions on the importance range from 1 to 4 for each item (competence) using the Importance Subscale of the 21CCCUE. Here, the numbers 1, 2, 3 and 4 represent four levels of importance, and they are: "Can do without it", "It would be nice to have", "Should have" and "Must have". An item with a higher score represents that the competency is perceived relatively important than those with a lower score. Rasch analysis was conducted to validate the assessment of importance of core competencies. Indices including person and item reliabilities, item difficulty, item fit and DIF in gender and locations are reported below.

3.2.4.1.1 Reliability of Item and Person Measures

In Rasch analysis, item and person reliabilities are reflected in terms of the item separation reliability and the person separation reliability indices. In this study, the analysis shows that the assessment has a Rasch item reliability of 1.00, an item separation index of 22.81, a Rasch person reliability of 0.93, and a person separation index of 3.56. Both item and person reliabilities are statistically high, suggesting an excellent reliability of the assessment. The item separation index 22.81 means that the items can be separated into nearly 23 groups according to the students' responses. As to the person separation index, approximately four student groups can be separated by items. The difference of separation ability between item and person is reasonable, because it is much easier to separate 40 items by 5,042 students

than to separate 5,042 students by 40 items. Internal consistency of assessment reflected by Cronbach's alpha is 0.95, indicating that the scale has a high degree of internal consistency.

3.2.4.1.2 Item Fit, Item Difficulty and Wright Map

Besides the reliability, the Rasch analysis also provides other indices including the Infit statistics and the Outfit statistics to validate a scale. As presented in Table 3.2, there is strong evidence from the item goodness of fit (Infit and Outfit) that the items adhere to the Rasch Rating Scale model. In this study, all items have Infit and Outfit MNSQ values ranging from 0.79 to 1.53, indicating a good fit with the Rasch model.

In Table 3.2, the item difficulty estimated values are listed in the first column, which range from -1.24 (item IC1: "Attitudes of respect and tolerance") to 1.19 logits (item GI5: "Concept of global village"). The Rasch analysis places items and students on the same measurement scale in which the mean of item difficulties was constrained at zero for model identification. With this set up, items with negative/positive measures are easy/hard to be endorsed as important by students. In the context of this study, therefore, the larger the estimate of item difficulty, i.e., the more difficult an item is, the less importance is given to the competency. This property of Rasch analysis applies to the other two subscales, namely, the Possession Subscale and the Adequacy Subscale.

In the Rasch model, the Wright Map is a visual representation of the relationship between item difficulty and person proficiency. In Figure 3.3, the "#" signs on the left panel represent the students while the alphanumeric characters on the right panel represent the item thresholds. Each item here has three thresholds (e.g. GI5.4, GI5.3, and GI5.2 for GI5) as each

item has four response options. For example, students above GI5.4 are likely to select the "Must have" option in item GI5. Students between GI5.4 and GI5.3 are likely to select the "Should have" option in the same item. Students between GI5.3 and GI5.2 are likely to select the "It would be nice to have" option, and students below GI5.2 are likely to select the "Can do without it" option. The vertical straight line in the middle denotes the scale of measured latent traits, which means the endorsement of the importance of core competencies here. Items in the upper part of the scale are more difficult items than those located in the lower part, and students in the upper part of the scale are relatively lenient students compared to those located in the lower part. In this case, "the difficult items" represent items that are more difficult to recognise as important core competencies than others, while "lenient students" indicate those who are more inclined to endorse a core competence as important more than other students.

Since item difficulty and person proficiency share the same calibration of the scale, it is clear at a glance to make a comparison between them. The mean item difficulty ranges between -1.24 and 1.19 logits, and the mean estimates of the three thresholds across all items in the rating scale are -2.47, -0.02 and 2.50 logits, respectively. Consequently, the real span of item difficulty ranges from -3.98 to 3.69 logits. The person proficiency estimates range from -7.51 to 7.54 logits. In general, the 40 items in the 21CCCUE scale are well-developed and useful to measure students' attitudes toward the importance of core competencies.

Table 3.2

Item Parameter Estimates (in logit) and Fit Statistics for the Importance Subscale

			Infit		Outfit	
Item	Measure	SE	MNSQ	ZSTD	MNSQ	ZSTD
Basic & Professional Knowledge (BK)						
1. Professional knowledge	-0.80	0.03	1.27	9.90	1.42	9.90
2. Ability to express in writing	-0.35	0.02	1.01	0.28	1.06	2.57
3. Capacity for empirical deduction	0.54	0.02	0.99	-0.70	1.00	0.02
4. Capacity for IT application	0.45	0.02	1.06	2.81	1.08	3.75
5. Capacity for logical analysis	-0.12	0.02	0.96	-2.04	0.98	-0.95
6. Ability for critical thinking	-0.21	0.02	1.08	4.20	1.10	4.71
7. Decision making	-0.29	0.02	0.98	-1.22	1.00	0.15
Creativity & Problem Solving (PS)						
1. Creativity	0.50	0.02	0.99	-0.31	0.99	-0.31
2. Self-potential development	0.37	0.02	0.99	-0.62	0.99	-0.47
3. Imagination	0.48	0.02	1.02	1.02	1.02	1.21
4. Keen observation	0.27	0.02	0.89	-6.00	0.89	-5.83
5. Attitude for innovation and change	0.37	0.02	1.03	1.44	1.03	1.34
6. Adventurous spirit	1.01	0.02	1.23	9.90	1.24	9.90
7. Problem-solving skills	-0.67	0.03	1.21	9.90	1.53	9.90
Interpersonal Communication (IC)						
1. Attitudes of respect and tolerance	-1.24	0.03	0.97	-1.58	0.90	-3.83
2. Verbal ability	-0.56	0.03	0.88	-6.64	0.88	-5.48
3. Ability to listen to others	-0.46	0.02	0.92	-4.25	0.92	-3.90
4. Ability to manage emotions	-0.43	0.02	0.93	-3.52	0.92	-3.54
5. Ability to work in a team	-0.70	0.03	0.91	-4.74	0.89	-4.97
6. Leadership and coordination	0.60	0.02	0.99	-0.56	0.99	-0.63
7. Ability to interact	-0.20	0.02	0.96	-2.18	0.95	-2.65
Character & Civic Literacy (CC)						
1. Positive personality	-1.08	0.03	1.06	2.94	1.03	1.12
2. Humanities and art appreciation	1.03	0.02	1.10	5.03	1.10	5.20
3. Empathy and moral standards	-0.53	0.02	1.01	0.56	1.01	0.26
4. Respect human rights and freedom	-0.62	0.03	1.06	3.10	1.05	1.97
5. Practise democracy and justice	0.26	0.02	1.16	7.64	1.15	7.26
6. Ability for social participation	-0.01	0.02	0.89	-5.86	0.90	-5.27
7. Ability for value judgment	-0.52	0.02	0.93	-3.85	0.92	-3.89
Global & International Perspective (GI)						

1. Capacity for second language	0.22	0.02	1.26	9.90	1.28	9.90
2. Open vision	0.13	0.02	0.86	-7.80	0.85	-7.88
3. Respect for cultural diversity	0.15	0.02	1.02	1.02	1.01	0.73
4. Familiar with international affairs	0.94	0.02	1.00	0.11	1.00	0.22
5. Concept of global village	1.19	0.02	1.24	9.90	1.25	9.90
Self-directed Learning (SL)						
1. Capacity for independent study	-0.20	0.02	0.91	-4.51	0.90	-4.90
2. Set learning goals and strategies	-0.17	0.02	0.94	-3.05	0.93	-3.21
3. Control learning process	0.03	0.02	0.84	-8.87	0.83	-8.96
4. Manage learning environment	0.43	0.02	0.89	-5.92	0.89	-5.67
5. Ability to use learning resources	-0.11	0.02	0.79	-9.90	0.79	-9.90
6. Reflect on learning effectiveness	0.05	0.02	0.90	-5.37	0.89	-5.50
7. Ability to assess learning outcomes	0.24	0.02	0.88	-6.17	0.88	-6.01

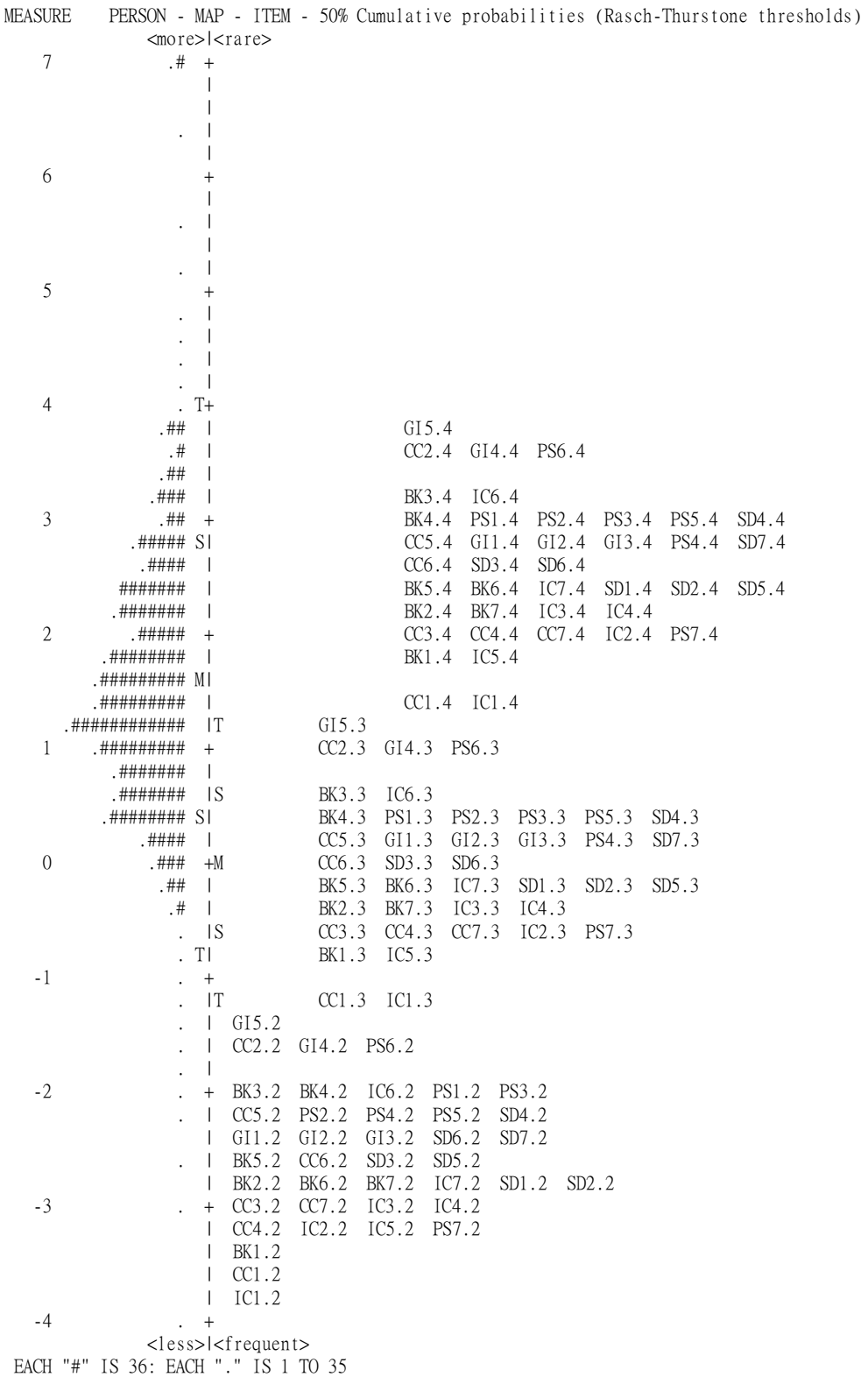


Figure 3.3 Wright map of items and persons of the Importance Subscale.

3.2.4.1.3 Differential Item Functioning

DIF is considered an important indicator to check the construct equivalence across groups (Wang, 2008). If test-takers with the same abilities in certain measured latent traits have different probabilities in correctly responding to certain items, then it can be claimed that there is a DIF. The DIF contrast is used to present the difference in difficulty of the item between different groups, which should be at least 0.5 logits for DIF to be noticeable (Linacre, 2014; Wang, 2008). Strictly speaking, a DIF item should be revised or deleted. Nevertheless, a real test is always imperfect, however, and an item containing some degree of DIF is reasonable.

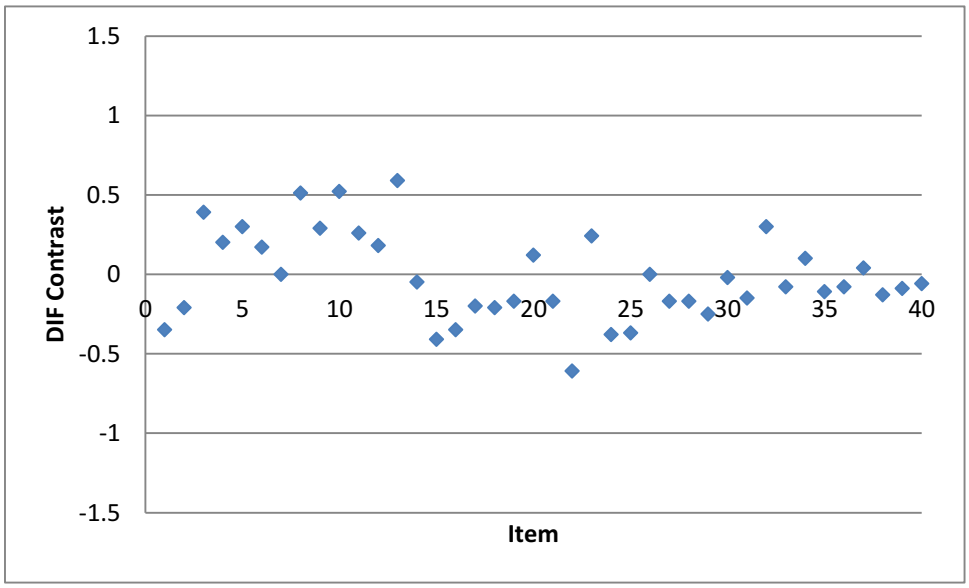
The analysis found that four items had DIF contrast values greater than 0.5 logits in gender, and six items had DIF contrast values greater than 0.5 logits in locations. The items with gender DIF are: “Creativity” (0.51), “Imagination” (0.52), “Adventurous spirit” (0.59) and “Positive personality” (-0.61). In this case, the first three items with positive DIF contrast values indicate that, after controlling for the ability of male and female students, they are more easily endorsed as important by male students than by female students, while the last item with a negative DIF value means it is relatively easier for female students than for male students to endorse as important even after controlling for their abilities.

The items with location DIF are: “Creativity” (-0.57), “Problem-solving skills” (-1.17), “Positive personality” (-0.56), “Capacity for second language” (0.54), “Respect for cultural diversity” (0.63) and “Familiar with international affairs” (0.56). Accordingly, the first three items with negative DIF values indicate that they are more easily endorsed as important by students in Zhejiang Province than by those in Macau, even after controlling for the ability of students in these two locations. The last three items with positive DIF values indicate that

they are relatively easier for Macau students than for Zhejiang students to endorse as important, even after controlling for the ability of students in these different locations.

All DIF contrast values of the 40 items are represented by dots in Figure 3.4. As can be seen, most of the DIF contrast values of the 40 items are located in a range of -0.5 to 0.5 logits, indicating that most of them are not substantial. All the items demonstrating DIF found in this study would be retained for two reasons: (1) These items are crucial for the content and structure of the 21CCCUE scale which cannot be simply dispensed with; (2) The assessment of the current study is a low-stakes attitude questionnaire and the amount of DIF of these items is considered to be acceptable.

(a) DIF by gender



(b) DIF by location

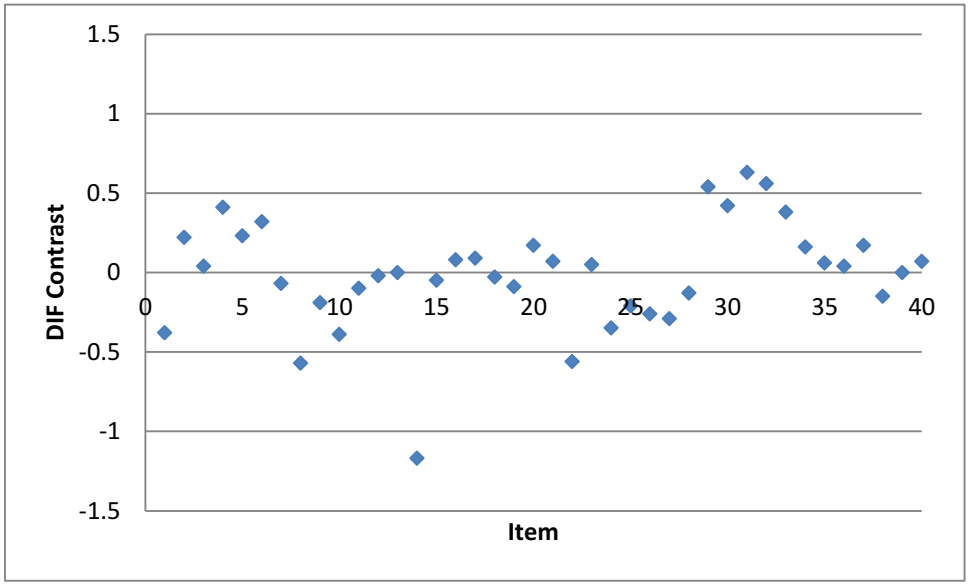


Figure 3.4 Gender and location DIF of the Importance Subscale.

3.2.4.2 Self-rating of Possessing the Core Competencies

The variable, self-rating of possessing the core competencies, means the students' self-ratings on each of the items (competence) to consider whether they are sufficiently equipped or not, as measured by the Possession Subscale of the 21CCCUE. There are four response levels for students to choose from, namely, "Not at all", "To a small extent", "To a certain extent" and "To a large extent", represented by numbers 1 to 4, respectively. An item with a higher score indicates that the competency is rated as more adequately equipping the student than those with a lower score. The Rasch analysis was conducted to validate the assessment of self-rating of possessing the core competencies. Indices including person and item reliabilities, item difficulty, item fit, and DIF in gender and locations were reported.

3.2.4.2.1 Reliability of Item and Person Measures

The analysis found that the assessment had a Rasch item reliability of 1.00, an item separation index of 21.03, a Rasch person reliability of 0.92, and a person separation index of 3.34. Both item and person reliabilities are statistically high suggesting an excellent reliability of the assessment. The item separation index 21.03 means that the items can be separated into nearly 21 groups according to responses by the students. As to the person separation index, approximately three student groups can be separated by items. The internal consistency index of Cronbach's alpha is 0.96, indicating that the scale has a high degree of internal consistency.

3.2.4.2.2 Item Fit, Item Difficulty and Wright Map

The results show that these 40 items have Infit and Outfit MNSQ values ranging from 0.81 to 1.36, indicating a good fit to the Rasch Rating Scale model. In Table 3.3, the item difficulty estimated values are listed in the first column, ranging from -1.18 (item CC1: "Positive personality") to 0.76 (item PS2: "Self-potential development"). In this study, the larger the estimate of item difficulty, i.e., the more difficult an item is, the less sufficiency is attached to possessing a certain competency.

The Wright Map (see Figure 3.5) gives a visual representation of the relationship between item difficulty and person proficiency of the Possession Subscale. Likewise, the "#" signs on the left panel of the map represent the students while the alphanumeric characters on the right panel represent the item thresholds. Each item here has three thresholds for they were developed in a four-point scale (e.g. GI5.4, GI5.3, and GI5.2 for GI5). For example, students above GI5.4 are likely to select the "To a large extent" option in item GI5. Students between GI5.4 and GI5.3 are likely to select the "To a certain extent" option in the same item. Students between GI5.3 and GI5.2 are likely to select the "To a small extent" option, and students below GI5.2 are likely to select the "Not at all" option. The vertical straight line in the middle denotes the scale of measured latent traits, which means students' self-ratings on each competency. Items in the upper part of the scale represent items that are more difficult to be rated as sufficiently possessed core competencies than those located in the lower part, and students in the upper part of the scale indicate students who are more inclined to regard themselves as having possessed a certain competency than those located in the lower part.

As can be seen from Figure 3.4, the alignment between item difficulty and student proficiency is satisfactory, although more students tended to be located on the upper part of the scale. The mean item difficulty is between -1.18 and 0.76 logits, and the estimates of the three thresholds in the rating scale are -1.73, -0.56 and 2.29 logits, respectively. Thus, the real span of item difficulty ranges from -2.91 to 3.05 logits. The person proficiency estimates range from -6.76 to 7.29 logits. Generally speaking, these items were well-developed and useful to measure students' self-rating of possessing these core competencies.

Table 3.3

Item Parameter Estimates (in logit) and Fit Statistics for the Possession Subscale

			Infit		Outfit	
Item	Measure	SE	MNSQ	ZSTD	MNSQ	ZSTD
Basic & Professional Knowledge (BK)						
1. Professional knowledge	0.66	0.02	1.35	9.90	1.36	9.90
2. Ability to express in writing	-0.17	0.02	0.82	-8.88	0.82	-9.23
3. Capacity for empirical deduction	0.28	0.02	0.86	-6.78	0.87	-6.24
4. Capacity for IT application	0.34	0.02	0.94	-3.08	0.94	-2.84
5. Capacity for logical analysis	-0.10	0.02	0.84	-7.87	0.84	-7.92
6. Ability for critical thinking	-0.08	0.02	0.95	-2.43	0.93	-3.18
7. Decision making	0.04	0.02	0.82	-9.02	0.82	-9.24
Creativity & Problem Solving (PS)						
1. Creativity	0.71	0.02	0.97	-1.26	0.99	-0.70
2. Self-potential development	0.76	0.02	0.94	-2.98	0.95	-2.25
3. Imagination	-0.03	0.02	1.04	2.09	1.04	1.92
4. Keen observation	0.14	0.02	0.98	-0.94	0.97	-1.29
5. Attitude for innovation and change	0.48	0.02	1.01	0.53	1.01	0.61
6. Adventurous spirit	0.62	0.02	1.20	9.23	1.22	9.90
7. Problem-solving skills	-0.18	0.02	0.81	-9.51	0.81	-9.90
Interpersonal Communication (IC)						
1. Attitudes of respect and tolerance	-1.12	0.03	1.12	5.61	1.12	5.29
2. Verbal ability	-0.20	0.02	0.87	-6.56	0.87	-6.64
3. Ability to listen to others	-0.92	0.03	1.07	3.28	1.04	1.82
4. Ability to manage emotion	-0.31	0.02	1.10	4.61	1.09	4.35

5. Ability to work in a team	-0.58	0.03	1.01	0.54	0.99	-0.45
6. Leadership and coordination	0.38	0.02	1.02	1.05	1.02	0.72
7. Ability to interact	-0.28	0.02	1.00	-0.15	0.97	-1.21
Character & Civic Literacy (CC)						
1. Positive personality	-1.18	0.03	1.20	9.18	1.16	6.56
2. Humanities and art appreciation	0.27	0.02	1.00	0.05	1.01	0.42
3. Empathy and moral standards	-0.96	0.03	1.09	4.43	1.07	3.22
4. Respect human rights and freedom	-1.04	0.03	1.05	2.48	1.04	1.62
5. Practise democracy and justice	0.19	0.02	1.15	6.87	1.15	6.88
6. Ability for social participation	0.08	0.02	1.00	0.12	1.00	-0.21
7. Ability for value judgment	-0.62	0.03	0.89	-5.39	0.87	-6.28
Global & International Perspective (GI)						
1. Capacity for second language	0.33	0.02	1.00	0.06	1.02	0.90
2. Open vision	0.08	0.02	0.91	-4.56	0.90	-5.10
3. Respect for cultural diversity	-0.45	0.03	1.04	2.01	1.02	0.99
4. Familiar with international affairs	0.74	0.02	1.09	4.08	1.10	4.60
5. Concept of global village	0.62	0.02	1.19	8.74	1.21	9.32
Self-directed Learning (SL)						
1. Capacity for independent study	0.19	0.02	0.97	-1.57	0.95	-2.24
2. Set learning goals and strategies	0.13	0.02	0.96	-1.88	0.95	-2.24
3. Control learning process	0.27	0.02	0.92	-4.04	0.92	-4.06
4. Manage learning environment	0.39	0.02	0.95	-2.35	0.95	-2.26
5. Ability to use learning resources	-0.04	0.02	0.86	-7.11	0.86	-7.11
6. Reflect on learning effectiveness	0.24	0.02	0.95	-2.21	0.95	-2.67
7. Ability to assess learning outcomes	0.31	0.02	0.96	-2.07	0.95	-2.20

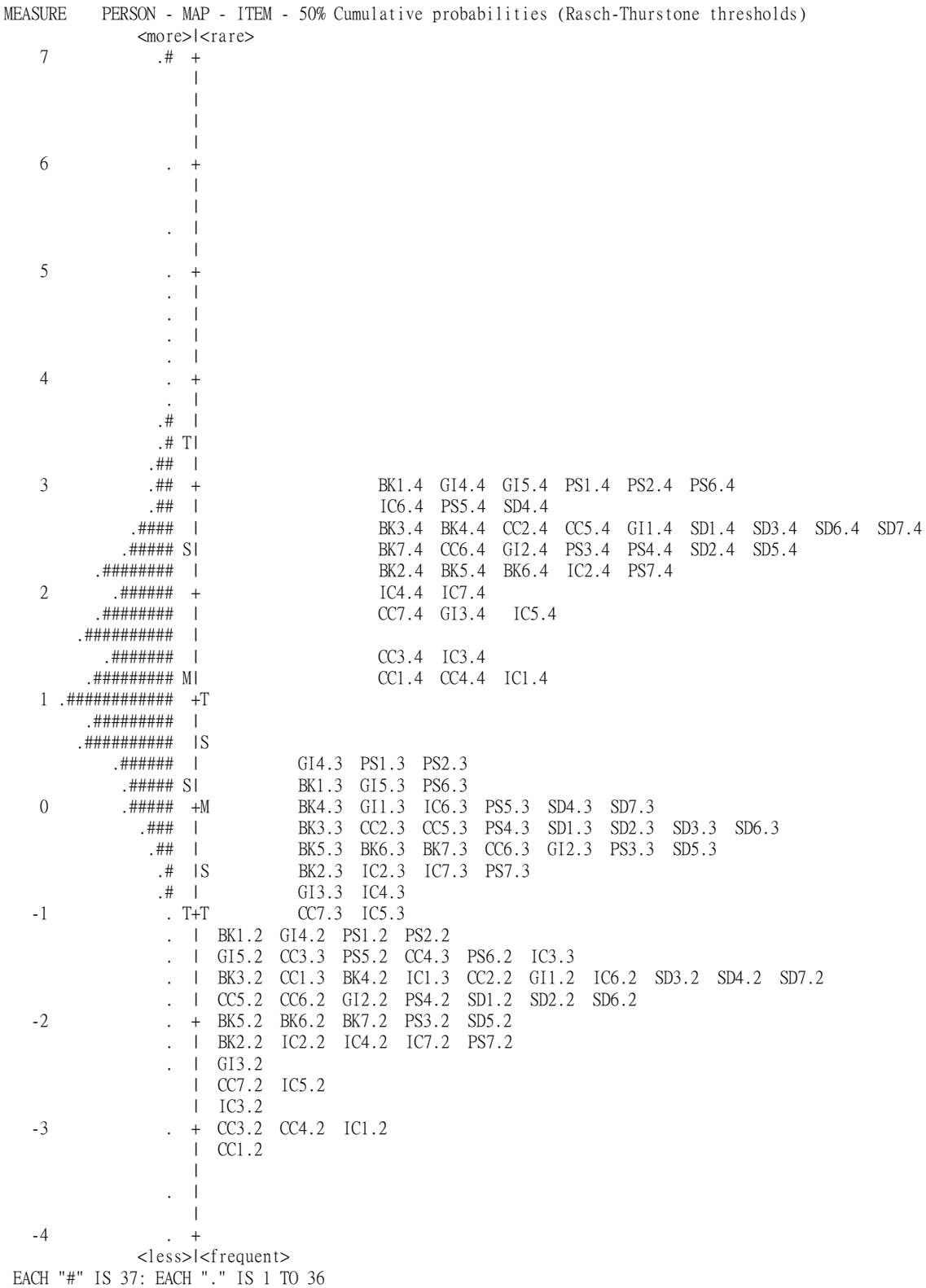
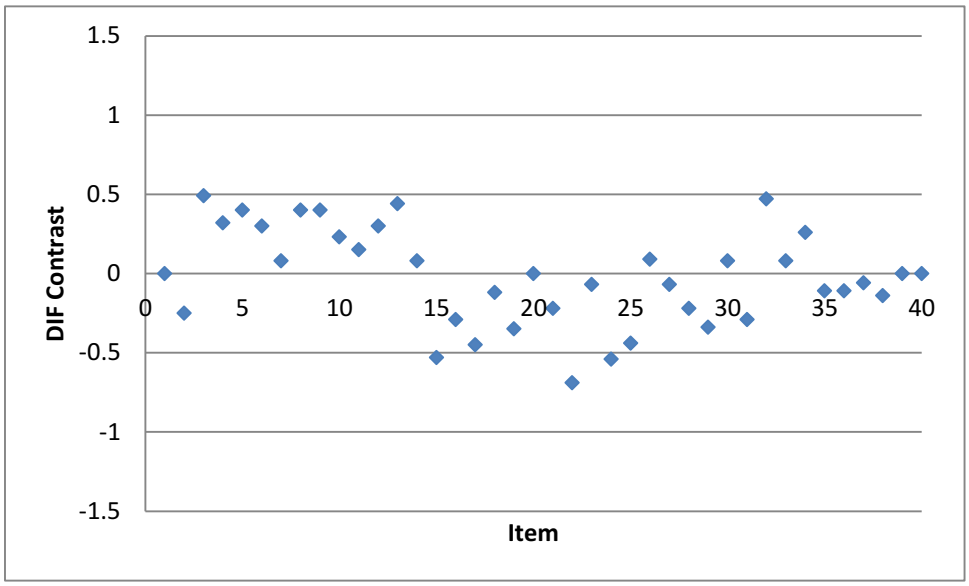


Figure 3.5 Wright map of items and persons of the Possession Subscale.

3.2.4.2.3 Differential Item Functioning

Gender DIF and location DIF were checked for the Possession Subscale. The analysis found two items had DIF contrast values greater than 0.5 logits in gender, namely “Positive personality” (-0.69) and “Empathy and moral standard” (-0.54). This means that these two items are more likely for male students to regard as possessed competencies than female students, even after controlling for the ability of male and female students. No item had a DIF value greater than 0.5 logits in locations, meaning that the subscale is equivalent for Zhejiang students and Macau students. All DIF contrast values of the 40 items are represented by dots in Figure 3.6. Given that the assessment in this study is a low-stakes attitude questionnaire, and that most items with DIF involved relatively small values of DIF contrasts, all items in the questionnaire are retained for subsequent analysis.

(a) DIF by gender



(b) DIF by location

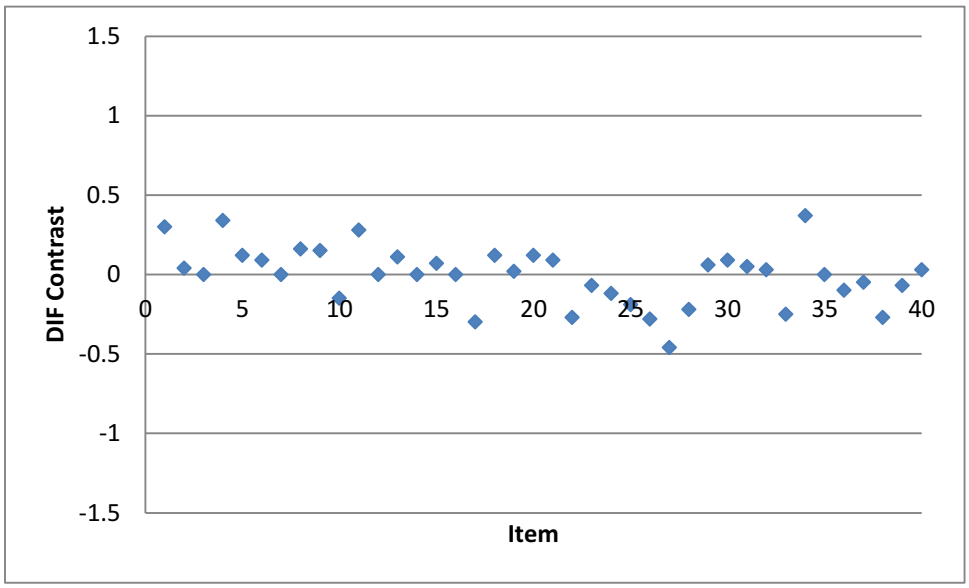


Figure 3.6 Gender and location DIF of the Possession Subscale.

3.2.4.3 Perceived Adequacy of University Education in Cultivating the Core Competencies

The variable, perceived adequacy of university education in cultivating the core competencies, means students' perceptions of the extent that each of the items (competencies) has been adequately cultivated by universities in nurturing their students as measured by the Adequacy Subscale of the 21CCCUE. The response options are "Not at all helpful", "Not too helpful", "Reasonably helpful" and "Very helpful", represented by numbers 1 to 4, respectively. An item with a higher score indicates that the competency is perceived as more adequately cultivated by university education than those with a lower score. The Rasch analysis was conducted to validate the assessment of perceived adequacy of university education in cultivating the core competencies. Indices including person and item reliabilities, item difficulty, item fit, and DIF in gender and locations were reported.

3.2.4.3.1 Reliability of Item and Person Measures

The analysis found that the assessment had a Rasch item reliability of 1.00, an item separation index of 17.41, a Rasch person reliability of 0.93, and a person separation index of 3.72. Both item and person reliabilities are statistically high suggesting an excellent reliability of the assessment. The item separation index of 17.41 means that the items can be separated into nearly 17 groups according to responses by the students. The person separation index of 3.72 means that approximately four student groups can be separated by items. The internal consistency index of Cronbach's alpha is 0.97, representing that the scale has a high degree of internal consistency.

3.2.4.3.2 Item Fit, Item Difficulty and Wright Map

Using the criterion recommended in the literature (Linacre 2014) of Infit and Outfit MNSQ values inside the range of 0.5 to 1.5 to be an indication of good data-model fit, the analysis shows that all items, with only one exception, in the assessment have Infit and Outfit MNSQ values ranging from 0.86 to 1.47, which indicated a good fit to the Rasch model (Table 3.4). The exceptional item (BK1: "Professional knowledge") had an acceptable Infit value of 1.47, but a large Outfit MNSQ value of 1.66. The item difficulty estimated values are listed in the first column of Table 3.4, and range from -1.37 (item BK1: "Professional knowledge") to 0.75 logits (item PS3: "Imagination"). In this study, items with negative/positive measures are easy/hard to be endorsed as adequately cultivated by university education. That is to say, the larger the estimate of item difficulty, the less helpful the students perceive university education is in developing the competency measured by the item.

The Wright Map (see Figure 3.7) gives a visual representation of the relationship between item difficulty and person proficiency on the Adequacy Subscale. The "#"s on the left panel of the map represent the students while the alphanumeric characters on the right panel represent the item thresholds. Each item here has three thresholds for they were developed in a four-point scale (e.g. GI5.4, GI5.3, and GI5.2 for GI5). For example, students above GI5.4 are likely to select the "Very helpful" option in item GI5. Students between GI5.4 and GI5.3 are likely to select the "Reasonably helpful" option in the same item. Students between GI5.3 and GI5.2 are likely to select the "Not too helpful" option, and students below GI5.2 are likely to select the "Not at all helpful" option. The vertical straight line in the middle denotes the scale of the measured latent trait, which means the extent of the perceived adequacy of university education in developing core competencies in students. Items in the upper part of

the scale are more difficult items than those located in the lower part, and students in the upper part of the scale are more satisfied students in the sense that they are more likely to endorse a competency as adequately cultivated by universities in contrast to those located in the lower part. In this case, “the more difficult items” represent items perceived as being less adequately developed by the university than “the less difficult items”, while the “more satisfied students” were those who were more inclined to perceive university education as having developed the competencies in them than the “less satisfied students”. It can be seen form the Figure 3.6 that the alignment between item difficulty and student proficiency is satisfactory, although more students tended to be located on the satisfied end. The estimated item difficulty ranged between -1.37 and 0.75 logits, and the mean estimates of the three thresholds across all items in the rating scale are -1.93, -0.19, and 2.12 logits, respectively. Consequently, the real span of item difficulty ranges from -3.30 to 2.87 logits. The person proficiency estimates ranged from -6.90 to 7.08 logits. The analysis showed that the items in the 21CCCUE scale are well-developed and useful to measure students’ perceptions on the adequacy of university education.

Table 3.4

Item Parameter Estimates (in logit) and Fit Statistics for the Adequacy Subscale

			Infit		Outfit	
Item	Measure	SE	MNSQ	ZSTD	MNSQ	ZSTD
Basic & Professional Knowledge (BK)						
1. Professional knowledge	-1.37	0.03	1.47	9.90	1.66	9.90
2. Ability to express in writing	-0.12	0.02	1.01	0.57	1.04	1.77
3. Capacity for empirical deduction	0.13	0.02	0.94	-3.23	0.97	-1.42
4. Capacity for IT application	0.06	0.02	1.01	0.46	1.05	2.29
5. Capacity for logical analysis	-0.16	0.02	1.00	-0.03	0.98	-0.69
6. Ability for critical thinking	-0.07	0.02	0.98	-1.09	0.98	-1.08
7. Decision making	0.07	0.02	0.91	-4.70	0.89	-5.26
Creativity & Problem Solving (PS)						
1. Creativity	0.64	0.02	0.94	-3.25	0.95	-2.63
2. Self-potential development	0.37	0.02	0.93	-3.58	0.92	-3.92
3. Imagination	0.75	0.02	0.97	-1.55	0.97	-1.23
4. Keen observation	0.42	0.02	0.87	-7.10	0.86	-7.25
5. Attitude for innovation and change	0.49	0.02	0.92	-4.31	0.90	-4.76
6. Adventurous spirit	0.74	0.02	1.00	0.21	0.99	-0.44
7. Problem-solving skills	-0.33	0.02	0.96	-2.14	0.92	-3.46
Interpersonal Communication (IC)						
1. Attitudes of respect and tolerance	-0.18	0.02	0.97	-1.56	0.96	-2.00
2. Verbal ability	-0.39	0.02	1.00	-0.08	0.98	-0.92
3. Ability to listen to others	-0.07	0.02	1.02	0.89	1.01	0.24
4. Ability to manage emotions	0.31	0.02	1.01	0.73	0.99	-0.43
5. Ability to work in a team	-0.61	0.02	1.04	2.16	1.01	0.33
6. Leadership and coordination	0.02	0.02	1.02	0.99	1.00	-0.05
7. Ability to interact	-0.41	0.02	0.99	-0.56	0.95	-2.23
Character & Civic Literacy (CC)						
1. Positive personality	-0.08	0.02	0.98	-1.20	0.97	-1.26
2. Humanities and art appreciation	0.24	0.02	1.07	3.44	1.10	4.40
3. Empathy and moral standards	0.10	0.02	0.92	-4.17	0.93	-3.43
4. Respect human rights and freedom	0.13	0.02	0.98	-1.21	0.97	-1.40
5. Practise democracy and justice	0.36	0.02	1.00	0.07	1.01	0.55
6. Ability for social participation	-0.12	0.02	1.01	0.37	0.99	-0.45
7. Ability for value judgment	-0.12	0.02	0.90	-5.12	0.88	-5.80
Global & International Perspective (GI)						

1. Capacity for second language	-0.66	0.02	1.37	9.90	1.47	9.90
2. Open vision	-0.35	0.02	1.05	2.63	1.07	3.15
3. Respect for cultural diversity	-0.19	0.02	1.08	3.99	1.11	4.90
4. Familiar with international affairs	0.43	0.02	1.04	2.18	1.06	2.89
5. Concept of global village	0.70	0.02	1.14	6.84	1.15	7.04
Self-directed Learning (SL)						
1. Capacity for independent study	-0.45	0.02	0.98	-0.88	0.96	-1.56
2. Set learning goals and strategies	-0.08	0.02	0.90	-5.12	0.90	-4.91
3. Control learning process	0.00	0.02	0.89	-5.58	0.88	-5.54
4. Manage learning environment	0.13	0.02	0.90	-4.97	0.89	-5.39
5. Ability to use learning resources	-0.41	0.02	0.98	-1.14	0.96	-1.85
6. Reflect on learning effectiveness	0.06	0.02	0.90	-5.01	0.89	-5.25
7. Ability to assess learning outcomes	0.04	0.02	0.90	-5.36	0.88	-5.66

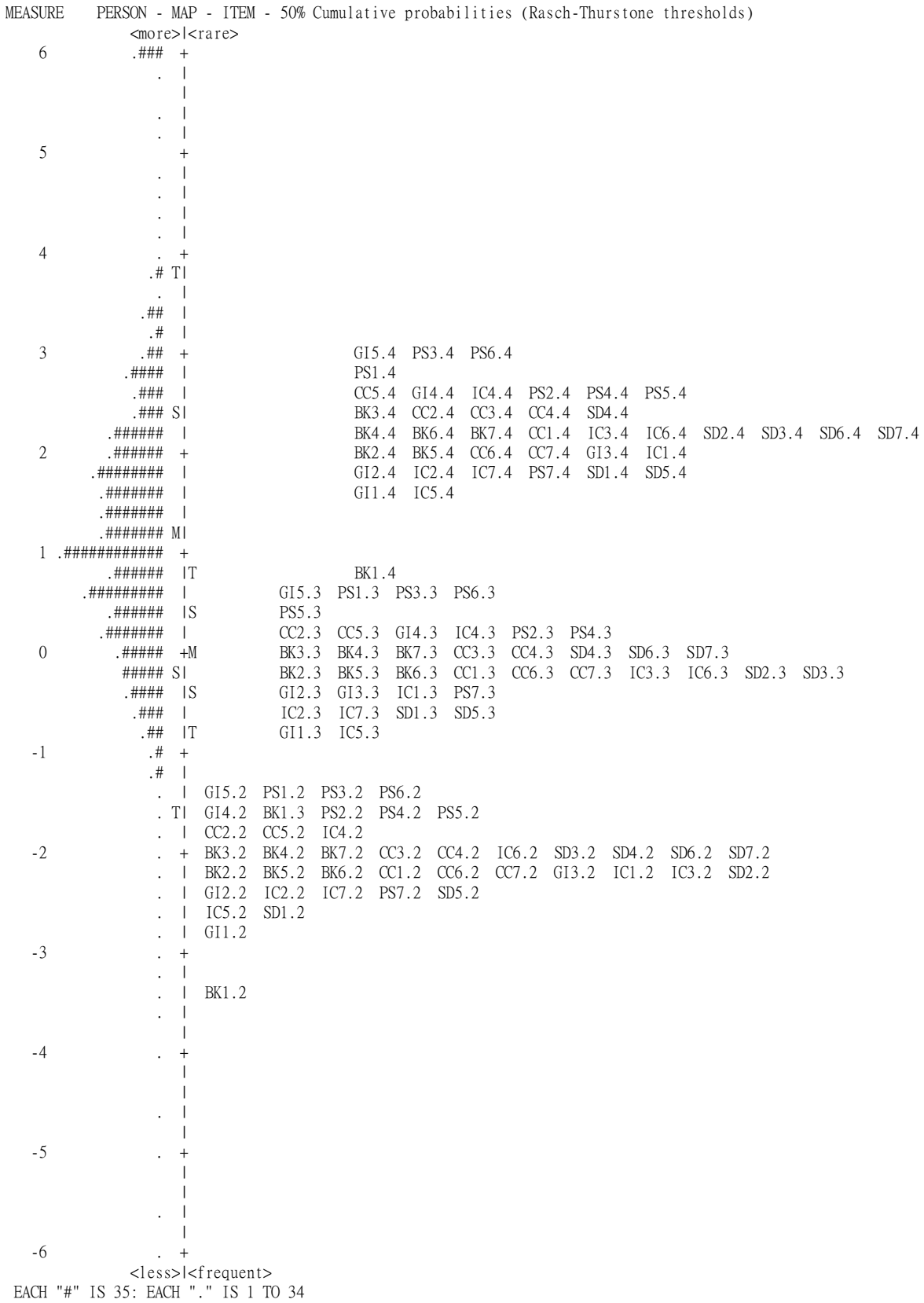
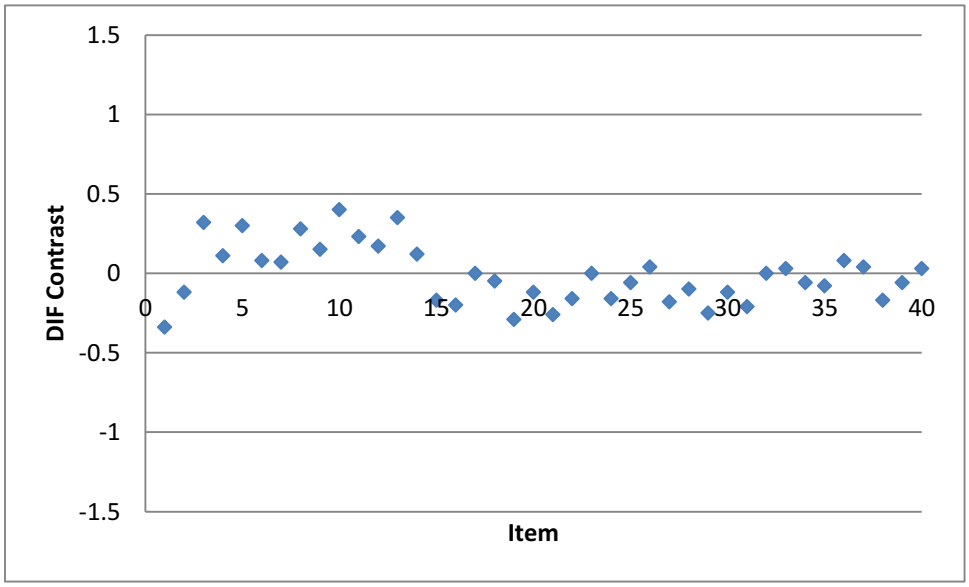


Figure 3.7 Wright map of items and persons of the Adequacy Subscale.

3.2.4.3.3 Differential Item Functioning

In this study, gender DIF and location DIF have been checked for the Adequacy Subscale. The analysis found three items had DIF contrast values greater than 0.5 in location, namely "Ability to express in writing" (0.59), "Ability to listen to others" (0.58) and "Ability for social participation" (-0.66). In this case, the first two items with positive DIF contrast values indicate that they are more easily endorsed as highly relevant to the perceived adequacy of university education by Zhejiang students than Macau students, even after controlling for the ability of students in these two locations. And the last item with a negative DIF contrast value means that, after controlling for the ability of students in these different locations, it is more easily endorsed as highly relevant to the perceived adequacy of university education by students in Zhejiang Province than by those in Macau. The analysis found that there was no item with a DIF contrast value greater than 0.5 logits in gender, which means the scale was equivalent in meaning to male and female students. All DIF contrast values of the 40 items are represented by dots in Figure 3.8. Since the assessment in this study is a low-stakes attitude questionnaire, and the above three items demonstrating DIF involved relatively small values of DIF contrasts, all items in the Adequacy Scale are retained for subsequent analysis.

(a) DIF by gender



(b) DIF by location

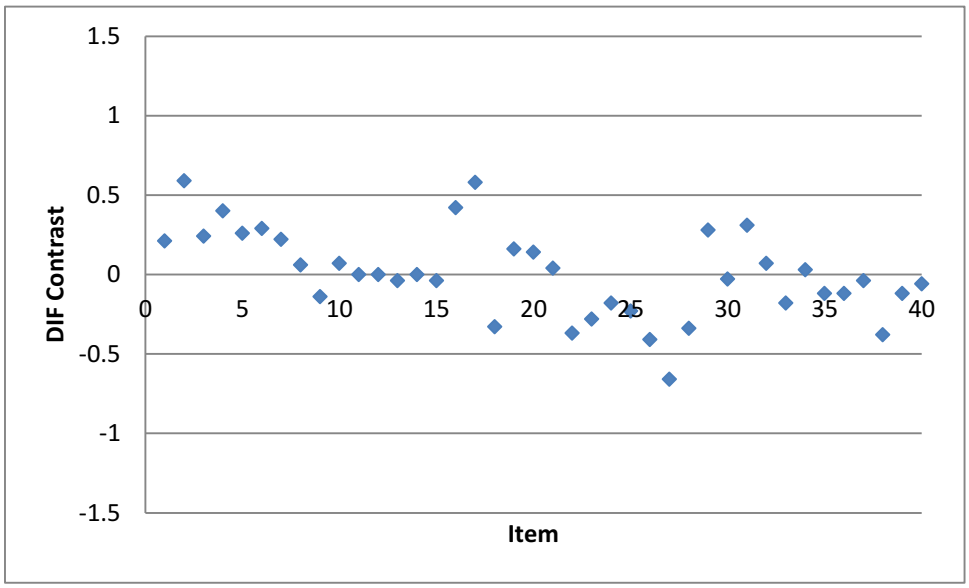


Figure 3.8 Gender and location DIF of the Adequacy Subscale.

3.3 The Qualitative Research Design

The current study is a partial mixed sequential dominant status design including both quantitative and qualitative approaches. The qualitative approach is of secondary importance in the research with the intention of serving as an important complementary part to the quantitative approach. Semi-structured interviews were used to investigate perceptions on the importance of core competencies for the twenty-first century and the perceived adequacy of university education in developing those competencies in students, with both teachers and students of selected universities. In this section, research participants, research instruments and the procedures used in data collection are described.

3.3.1 Sample

The participants in the sample are comprised of 16 university undergraduate students (four focus groups of four students each, two groups from Zhejiang Province and two groups from Macau), and eight university teachers (half from Zhejiang Province and half from Macau). The sample selection criteria for the students were undergraduates at different year levels in balanced gender, and preference given to those who are articulate. Actually in the real situation, only year 4 students volunteered to participate in the study. None of these students participated in the quantitative survey (21CCCUE) before. All the focus groups were year 4 students majoring in Humanities. The criteria for teachers were those working in universities in Zhejiang/Macau over five years, experienced in undergraduate teaching. Working in university more than five years is a criterion to ensure she or he is quite familiar with university education, as well as the university where the teacher is employed. The criterion of

experience in undergraduate teaching means that she or he has access to undergraduate students and knows them well. All the interviews took place in 2013.

3.3.2 Instruments

To investigate student participants' perceptions, a semi-structured focus group interview was employed, focusing on questions as follows: (1) What competencies do you think are important to undergraduates nowadays? (2) To what extent do you think they possess these competencies? (3) How adequate is your university education in developing these competencies in graduates for the twenty-first century? Or what roles can universities perform in cultivating students or to equip students with these core competencies? With these questions, "how" and "why" questions were asked for further clarification and interpretation.

For the teacher participants, semi-structured individual interviews were conducted, and focussed on questions such as: (1) What competencies do you think are important to undergraduates nowadays? (2) To what extent do you think they possess these competencies? (3) How adequate is your university's education in developing these competencies in graduates for the twenty-first century? Or what roles can universities perform in cultivating students or to equip students with these core competencies? With these questions, "how" and "why" questions were asked for further clarification and interpretation.

3.3.3 Procedures

University students and teachers were invited to participate in the interview. In each location (Zhejiang and Macau), students were divided into two groups of four people each with

balanced gender. To facilitate the interview, a focus group was employed, and semi-structured questions were helpful to create the atmosphere grassroots perspective and to motivate the participants. The main interview questions were: (1) What competencies do you think are important to undergraduates nowadays? (2) To what extent do you think you possess these competencies? (3) How adequate is your university education in developing these competencies in graduates for the twenty-first century? With these questions, "how" and "why" questions were asked for further clarification and interpretation.

As for the teachers, individual interviews were adopted for privacy reasons. The main purpose of the teacher interview was to acquire interpretations of the students' opinions found in the survey questionnaire. The interview questions included: (1) What competencies do you think are important to undergraduates nowadays? (2) To what extent do you think they possess these competencies? (3) What roles can universities perform in cultivating students or to equip students with these core competencies? All these questions are helpful to understand the teachers' cognition and attitude of the research questions, and reveal the teachers' vocational vision and ambition, which will facilitate or limit the development of their students. Then, some results of the survey questionnaire were shown to the interviewee, and questions were asked, such as: "In our survey with the students, the researcher found some phenomena, such as . . .; what's your opinion about that?" With these questions, "how" and "why" questions were also asked for further clarification and interpretation. Each interview lasted approximately one hour and recorded with the students' and teachers' consent.

The analysis of qualitative data includes several steps. First, the opinions of each interviewee were transcribed and summarised based on the records. This step is time-consuming but fundamental to prepare data for further analysis. Second, all the textual data was read

carefully and relevant concepts, themes and issues were highlighted and coded manually. The coding process is a critical step which links the data and the researcher's ideas and perspectives. To guarantee the consistency of the coding, a trained research assistant was recruited to check the codes and classifications of all the interview transcriptions. The kappa coefficient (Cohen, 1960) was calculated to evaluate the agreement level between the researcher and the research assistant. The kappa coefficients for the coding of the student interview and teacher interview were 0.89 and 0.87, respectively, indicating substantial agreement for both coding tasks (Hallgren, 2012). Third, the researcher interpreted the meaning of the concepts and themes acquired from the coding process and summarised them as results of the qualitative research. Finally, as a mixed methods research study, the interpretations and inductive conclusions of qualitative data were combined with quantitative results to jointly contribute to the discussion of the thesis.

3.3.4 Variables Used in the Qualitative Part of the Current Study

The qualitative part of the current study aims to provide descriptions and interpretations corresponding to the research questions. Serving to complement the quantitative research, the qualitative part is focused on similar variables as the quantitative part, but has different perspectives and operational definitions. There are three variables involved, namely, important core competencies, competence evaluation of the university graduates, and perceived adequacy of university education in cultivating the core competencies.

3.3.4.1 Important Core Competencies

In the qualitative part, the variable, important core competencies, refers to core competencies proposed by student and teacher interviewees in responding to the interview question, "What competencies do you think are important to undergraduates nowadays?" Each competency the interviewees mentioned was recorded and then summarised in tables. One table summarises core competencies from student interviewees, and the other incorporates those from teacher interviewees. Both perspectives from student and teacher interviewees are used as helpful supplements to the quantitative research for further clarification and interpretation.

3.3.4.2 Competence Evaluation of the University Graduates

Following the first interview questions about what competencies are considered important to twenty-first century university students, the next question was, "To what extent do you think they possess these competencies?" The variable, competence evaluation of the university graduates, refers to the student and teacher interviewees' comments on university students' core competency levels, in which the core competencies refer to those proposed by interviewees responding to the first interview question.

3.3.4.3 Perceived Adequacy of University Education in Cultivating the Core Competencies

The variable, perceived adequacy of university education in cultivating the core competencies, refers to the student and teacher interviewees' remarks on the adequacy of university education in cultivating the important core competencies which the interviewees mentioned before, in response to the third interview question which focuses on the adequacy

of university education in developing core competencies in graduates for the twenty-first century.

3.4 Ethics and Confidentiality

The data used in this study involve students' responses to the 21CCCUE scale, students' responses in the focus group interview, and teachers' responses in the individual interviews, in which both student participants and teacher participants are from universities in Zhejiang Province and Macau. The source of the data for the quantitative research, that is, students' responses to the 21CCCUE scale, is from the existing database of an unfunded project named Core Competencies for University Graduates of the 21st Century, hosted by Professor Magdalena Mo Ching MOK and her colleagues. Prior consent for using the data in the current research was obtained from the principal investigator and the ethics approval from HKIED has been obtained.

As for the interview data from university students and teachers, all the interviews are in accordance with the HKIEd's Guidelines on Ethics in Research. In this study, every participant was recruited without any coercion. After being well-informed about the aims and procedures of the study, the participant's right to withdraw from the study at any time, and that all information related to the participants will remain confidential, each participant signed a written agreement about data use and confidentiality. The information collected from the interviews contains no sensitive aspects of the participants' behaviour, and no physical or psychological risks could be raised by any process of this study.

3.5 Summary

This chapter introduced the mixed methods research design and its notation system adopted in the current study, detailed in the quantitative and qualitative research designs, respectively. In the quantitative research design, the sample, assessment instruments, research procedures and variables were presented, as well as the psychometric properties of each subscale of the 21CCCUE scale. In the qualitative research design, the sample, research instruments, procedures and variables were also presented. In the end, details were given to introduce the research ethics and confidentiality. Based on the research methods presented in this chapter, the following chapters will elaborate on the results and findings.

CHAPTER 4

RESULTS

This chapter reports the results corresponding to the five research questions of this study. The first three sections give accounts of university students' perceptions on the importance of core competencies for the twenty-first century, self-ratings on possessing these core competencies, and the perceived adequacy of university education to develop these core competencies. Following the mixed methods design, the results of quantitative and qualitative measures which focused on the same research question are reported successively in the corresponding section. The fourth section reports relationships between students' standpoints on the Importance Subscale, the Possession Subscale and the Adequacy Subscale. The last section identifies the differences in terms of gender, grade and location in students' perspectives on core competencies for the twenty-first century.

4.1 University Students' Standpoints on the Importance of Competencies for the Twenty-first Century

This section aims to respond to RQ1, "What competencies are considered important by university students for graduates in the twenty-first century?" by means of understanding students' perceptions on the importance of core competencies. Analysis was conducted in Rasch measurement. The Rasch measurement provided item difficulty estimates for all 40 items of the Importance Subscale, which suggested different levels of importance are attached to the 40 competencies by university students. In addition, qualitative evidence was derived from interviews with university students and teachers to deepen the understanding of the quantitative results.

Table 4.1 reports frequency counts (percentages) for each response option in the Importance Subscale. In general, students attach great importance in the core competencies listed in the Importance Subscale. On average, the percentage of responses associated with "Can do without it (scored as 1)" is only 1.6% compared to 48.3% of respondents on average who opted for "Should have (scored as 3)," and 35.7% who opted for "Must have (scored as 4)". The option of "It would be nice to have" (scored as 2) ranges from 6.5% to 35.1%, indicating that some competencies, such as "Humanities and art appreciation" (35.1%), "Adventurous spirit" (34.6%), "Concept of global village" (34.5%), "Familiar with international matters" (34.3%), "Leadership" (28.9%), and "Creativity" (27.6%), to name a few, are perceived as desirable, but not essential. The percentage of missing values is around 0.4%, which suggests that of the core competencies listed in the questionnaire, they are generally relevant to the respondents for their decision-making.

Table 4.1

Percentages (%) of Options on Importance Subscale Items

Item	Options				
	Can do without it 1	It would be nice to have 2	Should have 3	Must have 4	Missing
Average Over All Items	1.6	14.3	48.3	35.7	0.4
A. Basic & Professional Knowledge					
1 Professional Knowledge	1.6	8.6	42.2	47.4	.2
2 Ability to express in writing	.6	12.2	52.4	34.6	.2
3 Capacity for empirical deduction	1.6	25.6	53.3	19.2	.2
4 Capacity for IT application	1.7	24.0	53.1	20.8	.4
5 Capacity for logical analysis	.8	15.4	52.9	30.6	.3
6 Ability for critical thinking	1.6	14.6	49.3	34.3	.2
7 Decision making	1.0	13.9	49.5	35.3	.3
B. Creativity & Problem Solving					
8 Creativity	1.3	27.6	49.0	21.9	.2
9 Develop self-potential	1.2	25.5	48.7	24.4	.2
10 Imagination	1.6	25.8	50.8	21.4	.3
11 Keen observation	1.2	21.7	52.6	24.1	.4
12 Attitude for innovation	1.9	24.6	48.7	24.6	.3
13 Adventurous spirit	4.9	34.6	43.1	17.2	.2
14 Problem-solving skills	1.2	10.7	42.6	44.4	1.0
C. Interpersonal Communication					
15 Attitudes of respect and tolerance	.6	6.5	36.8	55.9	.3
16 Verbal ability	.6	10.2	49.4	39.5	.3
17 Ability to listen to others	.7	11.6	49.8	37.6	.3
18 Ability to manage emotions	.9	11.7	49.6	37.4	.4
19 Ability to work in a team	.7	9.9	45.7	43.4	.3
20 Leadership and coordination	1.7	28.9	48.7	20.4	.3
21 Ability to interact	1.0	15.7	49.3	33.8	.3
D. Character & Civic Literacy					
22 Positive personality	1.0	7.2	38.5	52.8	.5

23	Humanities and art appreciation	3.3	35.1	47.2	14.0	.4
24	Empathy	1.1	11.0	47.6	39.9	.4
25	Respect human rights	1.1	11.1	44.3	43.1	.4
26	Practise democracy	2.3	21.9	48.5	26.9	.4
27	Ability for social participation	1.2	16.1	54.4	28.0	.3
28	Ability for value judgment	.9	10.7	48.8	39.2	.4
E.	**Global & International Perspective**					
29	Capacity for second language	2.5	21.5	47.4	28.2	.4
30	Open vision	1.3	18.8	53.2	26.2	.4
31	Respect for cultural diversity	1.9	19.2	51.4	27.1	.4
32	Familiar with international matters	2.6	34.3	47.9	14.9	.4
33	Concept of global village	6.4	34.5	45.1	13.5	.5
F.	**Self-directed Learning**					
34	Capacity for independent study	1.0	14.9	50.5	33.2	.4
35	Set learning goals	1.1	15.1	50.9	32.4	.4
36	Control learning process	1.2	16.7	54.3	27.3	.5
37	Manage learning environment	1.8	22.6	54.9	20.4	.4
38	Ability to use resources	.8	14.5	55.1	29.3	.4
39	Reflect on learning effectiveness	1.1	18.8	51.1	28.6	.4
40	Ability to assess learning outcome	1.5	19.9	54.3	23.9	.5

Figure 4.1 represents students' perceptions on the Importance Subscale by item difficulty estimates which can be found in the first column of Table 3.2. The 40 competencies on the horizontal axis are listed in descending order of importance by Rasch logit. The higher score a competency received on the vertical axis, the more important it was rated by students. It can be seen in Figure 4.1, Item IC1 (Attitudes of respect and tolerance) has the highest score while Item GI5 (Concept of global village) has the lowest score. There are drastic drops between Items IC1 and CC1 (Positive personality), Items CC1 and BK1 (Professional Knowledge), Items IC6 (Leadership and coordination) and GI4 (Familiar with international

matters), and Items CC2 (Humanities and art appreciation) and GI5. The decrease of any other two adjacent items is relatively gradual. The results show that there is no specific domain in which all the items are scored higher or lower than the other domains. The most important core competencies and the least important core competencies will be further reported in the following sections.

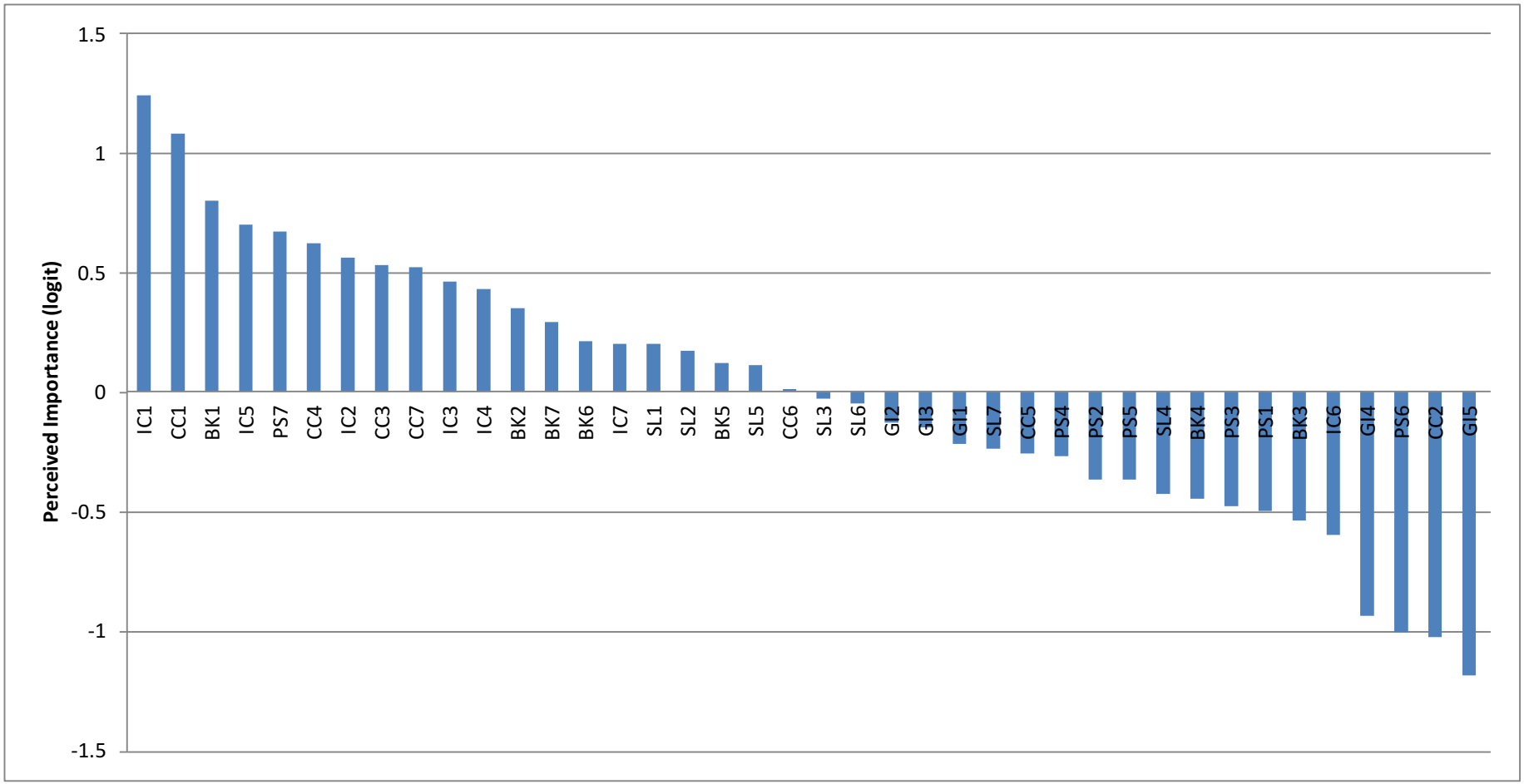


Figure 4. 1. Perceived importance (average) of core competencies of six domains.

Figure 4.2 shows students' perceptions on the importance of all the core competencies by six domains. The relative importance can be ranked by the within-domain averaged difficulty measures. In descending order, they are *Interpersonal Communication, Character and Civic Literacy, Basic and Professional Knowledge, Self-directed Learning, Creativity and Problem Solving, and Global and International Perspective.*

Figure 4.2. Perceived importance (average) of core competencies of six domains.

Table 4.2 summarises core competencies proposed by the student interviewees, which are allocated to seven domains (see the first column). In order to be consistent with the quantitative approach, the original domains of the 21CCCUE scale were used in the classification of interview data. In the wordings of the participants, five of the six original domains of the 21CCCUE scale emerged from the interviews, except for the domain of *Global and International Perspective.* Since there were examples of participants' comments which cannot be classified into the existing domains, a new domain was established with the name *Others.* The second column of the table reports core competencies mentioned by student interviewees with example expressions, in which the letter M indicates Macau and the letter Z indicates Zhejiang. The last column shows the frequency of mentions by Macau students and Zhejiang students, respectively.

Table 4.2

Core Competencies Proposed by University Students

Domain	Competence and example expressions from students	Frequency of mentions	
		Macau	Zhejiang
A. Basic & Professional Knowledge	• Professional knowledge and skills M: "Basic skills and knowledge are both important, no matter in the past or in the future." Z: "University students should have concrete and professional knowledge to be qualified in their future work."	1	4
	• Reflection M: "Students have to understand their own strengths and weaknesses, then improve themselves." Z: "Students should reflect on themselves and understand themselves deeper."	2	2
	• IT application M: "It is important to master IT skills. I did not realize it until I encountered problems in practice." Z: "University students must be able to communicate with others on computers."	1	1

	• Ability to think M: "To think is important. Subject knowledge is only a base for students to think how to make use of the knowledge upon it."	1	0
B. Creativity & Problem Solving	• Creativity Z: "The third competence that a university student should have is creativity."	0	3
	• Problem-solving skills Z: "University students should have professional knowledge as well as problem-solving skills."	0	1
C. Interpersonal Communication	• Interaction M: "I think interpersonal communication skills are very important. The lack of communication skills causes troubles in one's life and work." Z: "University students need an all-round development. They should learn how to communicate and collaborate with other people."	1	2
	• Emotion Management M: "Emotional Quotient (EQ) is also important. Students who can handle their emotions have an even greater chance of being employed because they know how to maintain interpersonal relations." Z: "EQ has a big influence on interpersonal relations, career development and personal growth."	1	1
	• Work in team Z: "University students need an all-round development. They should learn how to communicate and collaborate with other people."	0	1
	• Expressive skill Z: "University students should also have expressive skills to communicate effectively."	0	1
D. Character & Civic Literacy	• Good character M: "The most important competence is one's personal character. You should not do harm to society for your own interest. That is selfish." Z: "Students should have integrity and ambition, trying to do one's part for oneself and the country."	4	3
	• Moral standard	2	2

	M: “Morality and good habits are also important. Although such education should begin in primary school, these competencies for many university students have not been well developed.” Z: “Students should be of righteous character and have the courage to speak out for the injustice and unfairness happening in society.”		
	• Sense of responsibility M: “Professional skill is not necessary for most jobs. What really matters is your attitude, such as your sense of responsibility.” Z: “Student should be responsible for own actions and to society, be a civil, social creature.”	2	2
	• Ambition M: “Students should have ambition to improve themselves.” Z: “Students should have integrity and ambition, trying to do one’s part for oneself and the country.”	1	2
	• Civic literacy Z: “Students should have legal knowledge to restrain their behaviour and establish the rule of law society.”	0	2
	• Having life planning Z: “Students should have a plan for their future path. Otherwise they will be puzzled about their future.”	0	1
E. Global & International Perspective	-	0	0
F. Self-directed Learning	• Ability to learn M: “It is important to have the ability to learn. People who learn quickly have more advantages at work.”	2	0
G. Others	• Physical fitness M: “Physical ability is also important. Students should have regular body training because health is a top priority.”	1	0
	• Ability to maintain a family M: “Many students get married immediately after graduation, but also get divorced soon. They have to	1	0

	learn how to communicate with their family members."		
	• Driving skills Z: "Students have to learn to drive, as well as to communicate with others over the Internet. It is the new way of walking and talking."	0	1

In Table 4.2, examples of participants' comments involving knowledge and skills that serve as the foundation of the students' learning and facilitate their current and future study and work are allocated to the domain of *Professional and Basic Knowledge*. Four core competencies, i.e., Professional knowledge and skills, Reflection, IT application, and Ability to think, are listed in this domain with a total of 12 mentions, five from Macau and seven from Zhejiang. The domain of *Creativity and Problem Solving* comprises examples of the participants' comments which involve a cluster of competencies that work together as higher-order thinking skills devoted to solving problems successfully, and even creatively, in the academic context and practical society. There are two core competencies, i.e., Creativity and Problem-solving skills, listed in this domain with a total of four mentions from Zhejiang students. The domain of *Interpersonal Communication* includes examples of participants' comments involving competencies leading to successfully connecting with others, which have been seen as a necessary and essential factor for individual development and social cohesion. There are four core competencies, i.e., Interaction, Emotion management, Work in a team and Expressive skill, listed in this domain with a total of six mentions, two from Macau and four from Zhejiang. The domain of *Character and Civic Literacy* includes examples of participants' comments related to morals, virtues, values, ethics and citizenship which greatly contribute to the whole person education of university students. There are six core competencies, i.e., Good character, Moral standard, Sense of responsibility, Ambition, Civic literacy and Having a life plan, listed in this domain with a total of 21 mentions, nine

from Macau and 12 from Zhejiang. The domain of *Self-directed Learning* includes examples of participants' comments which are related to guaranteeing an individuals' initiative and effective learning. One core competency (i.e., Ability to learn) is listed in this domain with a total of two mentions from Macau students. The domain of *Others* includes examples of participants' comments which cannot be classified into the existing domains mentioned above. They are Physical fitness, Ability to maintain a family and Drive skills. The first two were mentioned by Macau students and the third was mentioned by Zhejiang students. The detailed information will be elaborated further in the following sections.

Table 4.3 presents core competencies enumerated by university teachers in Macau and Zhejiang. The classification of domains in Table 4.2 also applies to Table 4.3. The first column of the table lists different domains of core competencies, of which A to F are original domains of the 21CCCUE scale, while G is a new domain called *Others*, which includes examples of participants' comments which cannot be classified into the existing domains. The second column of the table reports core competencies mentioned by teacher interviewees with example expressions, in which the letter M indicates Macau and the letter Z indicates Zhejiang. The last column shows the frequency of mentions by Macau teachers and Zhejiang teachers, respectively.

Table 4.3

Core Competencies Proposed by University Teachers

Domain	Competence	Frequency of mentions	
		Macau	Zhejiang
A. Basic & Professional Knowledge	• Professional knowledge M: "Universities in the Greater China Region adopt the mechanism of professional studies, so professional knowledge is a must." Z: "Professional knowledge is the vital part of university students' core competence."	3	2

	• IT application M: "It is an IT era in the twenty-first century. Students have to make good use of IT for information searches." Z: "Students need to use IT in an effective way, to select and identify information appropriately, and to handle well the relationship between virtual and reality."	2	3
	• Reflection M: "Students have to reflect on themselves in order to correct mistakes and pursue improvement." Z: "Taking action only is not adequate. You should also reflect on yourself."	2	2
	• Analytical and organisational skills M: "Students should have analytical and organisational skills both in their studies and in work."	1	0
B. Creativity & Problem Solving	• Creativity Z: "Students should be creative and innovative, and avoid following others."	0	3
	• Problem-solving skills M: "Youngsters should be able to face and solve difficulties. It is a basic skill."	2	0
C. Interpersonal Communication	• Interaction M: "Interpersonal relations are not only about communication, but also about care and consideration." Z: "Interpersonal interaction is an important part of the comprehensive quality. Students should have skills of interpersonal communication, collaboration and coordination."	3	3
	• Expressive skill M: "Students should acquire a good level of language and communication ability."	4	0
	• Work in a team M: "With skills to communicate and collaborate, your presence makes the whole team stronger."	1	2

	Z: "Students should be able to work in a team, especially in this day and age."		
	• Appreciation of others M: "Interpersonal relations mean not only communicating, but also caring and understanding. Students should learn to appreciate others."	1	0
	• Emotion management M: "Emotion management is very helpful and can be cultivated through social activities.	1	0
D. Character & Civic Literacy	• Good character Z: "Students should have a good character and positively affect people in the community."	4	4
	• Sense of responsibility Z: "Sense of responsibility is an essential competence no matter what time it is."	0	3
	• Ambition Z: "This era has a high population but limited resources, so the competition is vigorous. Students should be able to face the competition."	0	2
	• Civicism Z: "Students should have civicism and take social responsibility."	0	1
	• Empathy M: "Students should have empathy, trying to think in other's shoes."	1	0
	• Ability for value judgment M: "We have to create a set of values and judgment criteria before we make judgments and decisions."	1	0
	• Have a life plan Z: "To succeed, one should also have achievement motivation and a life plan."	0	1
E. Global & International Perspective	• Global collaboration Z: "Students should develop the ability to work with others under globalisation."	0	1
	• Familiar with international cultures and behaviour Z: "Students should be familiar with international cultures and cross-cultural behaviour."	0	1

	• Global perspective Z: "To keep pace with the times, students should have a global idea and thinking."	0	1
F. Self-directed Learning	• Independent study M: "It is important to learn proactively since no one knows what our society will become in the future." Z: "Students have to finish their tasks spontaneously without having their teachers to push them."	2	1
	•Continuous learning M: "University is not the destination of learning. One should keep learning even when he or she starts to work." Z: "Students should learn continuously. No matter how much knowledge they have learnt in university, they will lag behind others once they stop learning."	1	2
	• Ability to know M: "In many countries, core competencies for university students are more or less similar, such as language skills, communication skills, information technology, the ability to know, etc. All these competencies are important, but not easy to cultivate through routine teaching."	1	0
G. Others	• Physical fitness Z: "Only people of good physical quality acquire the core competiveness."	0	1

In Table 4.3, examples of teachers' comments involving knowledge and skills that serve as the foundation of students' learning and facilitate their current and future study and work are allocated to the domain of *Professional and Basic Knowledge*. Four core competencies, i.e., Professional knowledge, IT application, Reflection, and Analytical and organisational skills, are listed in this domain with a total of 15 mentions, eight from Macau and seven from Zhejiang. The domain of *Creativity and Problem Solving* comprises examples of participants' comments involving a cluster of competencies which work together as higher-order thinking

skills devoted to solving problems successfully, and even creatively, in the academic context and practical society. There are two core competencies listed in this domain, i.e., Creativity and Problem-solving skills, with a total of five mentions, two from Macau and three from Zhejiang. The domain of *Interpersonal Communication* includes examples of participants' comments which involves competencies leading to successfully connecting with others, which have been seen as a necessary and essential factor for individual development and social cohesion. There are five core competencies, i.e., Interaction, Expressive skill, Work in a team, Appreciation of others, and Emotion management, listed in this domain with a total of 10 mentions, five from Macau and five from Zhejiang. The domain of *Character and Civic Literacy* includes examples of participants' comments related to morals, virtues, values, ethics and citizenship which greatly contribute to the whole person education of university students. There are seven core competencies, i.e., Good character, Sense of responsibility, Ambition, Civicism, Empathy, Ability for value judgment and Having a life plan, listed in this domain with a total of 18 mentions, six from Macau and 12 from Zhejiang. The domain of *Global and International Perspective* includes examples of participants' comments related to being aware of global affairs, having the skills to deal with international events, and respecting different cultures. There are three core competencies, i.e., Global collaboration, Familiar with international culture and behaviour, and Global perspective, listed in this domain with a total of three mentions, all from Zhejiang. The domain of *Self-directed Learning* includes examples of participants' comments related to guaranteeing an individuals' initiative and effective learning. Three core competencies, i.e., Independent study, Continuous learning, and Ability to know, are listed in this domain with a total of eight mentions, four from Macau and four from Zhejiang. The domain of *Others* includes only one comment called Physical fitness, proposed by one of the Zhejiang teachers. The detailed information will be elaborated further in the following sections.

4.1.1 The Most Important Core Competencies Perceived by University Students

As Table 4.1 shows, students attached great importance to the majority of core competencies listed in the Importance subscale. On average, these competencies were rated as either "should have" or "must have" by 79% of the respondents, suggesting that they were generally considered important by the university students. At a domain level, the results (Figure 4.2) show that university students consider *Interpersonal Communication* and *Character and Civic Literacy* as two of the most important core competence domains. Among the six domains of the 21CCCUE scale, the domain of Interpersonal Communication is considered the most important domain to university students, while the domain of Character and Civic Literacy is ranked second. According to the level of perceived importance of each item (see Figure 4.1), all competencies except one (Item IC6: Leadership and Coordination) in the Interpersonal Communication domain received above average scores (positive logits), which in descending order are "Attitudes of respect and tolerance", "Ability to work in a team", "Verbal ability", "Ability to listen to others", "Ability to manage emotions", and "Ability to interact". In the domain of Character and Civic Literacy, five items received positive logits. In descending order, they are "Positive personality", "Respect human rights and freedom", "Empathy and moral standards", "Ability for value judgments" and "Ability for social participation".

As for the individual competencies (see Figure 4.1), the most important competencies rated by university students are, in descending order, "Attitudes of respect and tolerance" (Item IC1), "Positive personality" (Item CC1), "Professional knowledge" (Item BK1), "Ability to work in a team" (Item IC5), "Problem-solving skills"(Item PS7), "Respect for human rights"

(Item CC4), “Verbal ability” (Item IC2), “Empathy and moral standards” (Item CC3), and “Ability for value judgments” (Item CC7). According to the level of perceived importance of each item (see Figure 4.1), Item IC1 and Item CC1 each got a value above the average by one logit, and the other seven items each got a value above the average by 0.5 logits. In many academic situations, one logit equals approximately one year of growth (DeMars & Linacre, 2004). Even though this study is not focused on academic achievements, it is not unreasonable to use 0.5 logits as a cut-point for determining the most important and the least important core competencies.

The interviews with university students provided information to deepen the understanding of the quantitative results. The interview question to students was, “What competencies do you think are important to undergraduates nowadays?” Dozens of core competencies were enumerated by the Macau and Zhejiang university students, which are summarised in Table 4.2. As shown in Table 4.2, most of the core competencies that students suggested fall into domain D, *Character & Civic Literacy*, while most of the others fall into the domains *Interpersonal Communication* and *Basic and Professional Knowledge.* Both the Macau and Zhejiang university students consider “Professional knowledge”, “IT application”, “Interaction”, “Emotional management”, “Moral standards”, “Sense of responsibility” and “Reflection” important core competencies for twenty-first century university students. These competencies can be allocated in domains A, C and D, which are *Basic and Professional Knowledge*, *Interpersonal Communication*, and *Character & Civic Literacy*, respectively.

4.1.2 The Least Important Core Competencies Perceived by University Students

The results show that the least important competence group perceived by university students is the *Global and International Perspective,* followed by the domain of *Creativity and Problem Solving*. In the 21CCCUE scale, the domain of *Global and International Perspective* received the lowest average item difficulty estimate (see Figure 4.2), in which all the items received below-average scores (negative logits) of perceived importance (see Figure 4.1). In descending order, these GI competencies are "Concept of global village", "Familiar with international affairs", "Capacity for second language", "Respect for cultural diversity" and "Open vision". As for the *Problem Solving* domain, only one item (Item PS7: Problem solving) got an above-average score (positive logits), while the others were rated as less important than the average level of importance (see Figure 4.1). In descending order, these PS competencies are "Adventurous spirit", "Creativity", "Imagination", "Self-potential development", "Attitude for innovation and change", and "Keen observation".

As for the individual competencies (see Figure 4.1), the least important competencies rated by university students are, in descending order, "Concept of global village" (Item GI5), "Humanities and art appreciation" (Item CC2), "Adventurous spirit" (Item PS6), "Familiar with international affairs" (Item GI4), "Leadership and coordination" (Item IC6), "Capacity for empirical deduction" (Item BK3), and "Creativity" (Item PS1). According to the level of perceived importance of each item (see Figure 4.1), Item GI5, Item CC2 and Item PS6 each got a value above the average by one logit, and the other four items each got a value above the average by 0.5 logits. Although these competencies were rated as the least important, each of them got an average score above 2 (raw score, see Table 4.1).

The qualitative evidence echoes the quantitative results above. In the interviews (see Table 4.2), neither students in Macau nor in Zhejiang mentioned any core competence in the

domain of *Global and International Perspective*. In the domain of *Problem Solving*, only two items, namely, “Creativity” and “Problem-solving skills”, were mentioned by Zhejiang students.

4.1.3 Complementary Explanations to Research Question One from the Perspectives of Interviewees

As a mixed methods research, the qualitative part of this study provides the perspectives of student and teacher interviewees regarding the research questions, and serves as descriptive and interpretative supplementary information to the quantitative study. Responding to research question one, the complementary explanations are addressed below.

4.1.3.1 Perspectives of Student Interviewees

It is very common for students to propose core competencies from their own experiences, relating their own thinking and feelings. For example, one senior student in Macau told us that she used to read a lot and seldom interacted with others; thus, she found herself weak in interactions during her internship. Now, she understood the importance of interactions and considered “Interaction” as one of the most important competencies for the twenty-first century. Many students revealed their cognitive process of understanding the importance of certain core competencies, which was always connected with their probation activity, internship and job hunting experience. Some core competencies are repeatedly stressed, such as “Professional knowledge”, “Emotional management”, “Moral standards” and “Sense of responsibility”, implying that university students have high and diversified expectations of themselves and their peers.

For competencies that they have little information about or very few experiences with, or competencies related to more indirect or distant ecological systems, the students cannot initiate discussing these, and need to be prompted. For example, competencies in the Global and International Perspective domain have not been mentioned by any student interviewees. However, when the researcher asked the interviewees whether "Concept of global village" is important to undergraduates for the twenty-first century, many of them considered this competency very important and necessary to possess. Of course, there are students who do not think "Concept of global village" is very important to them, and their reason is that, although connecting with foreign students is interesting and meaningful, such competencies are important to the management class or the authority, not to ordinary people like them.

4.1.3.2 Perspectives of Teacher Interviewees

To enrich the understanding of students' perspectives, teachers' comments on important core competencies for the twenty-first century are collected and summarised. The interview question to teachers is, "What competencies do you think are important to undergraduates nowadays?" Table 4.3 presents the core competencies listed by university teachers in Macau and Zhejiang. As shown in Table 4.3, the core competencies suggested by university teachers cover all six domains from A to F. Competencies including "Professional knowledge", "IT application", "Reflection", "Interaction", "Work in a team", "Good character", "Independent study" and "Continuous learning" are emphasised by both Macau and Zhejiang teachers. These competencies can be allocated in domains A, C, D and F, which are *Basic and Professional Knowledge, Interpersonal Communication, Character & Civic Literacy*, and *Self-directed Learning,* respectively. In addition, after being proposed by the university students, the competency, "Physical fitness", was also proposed by one of their teachers.

Just like university students' opinions, teachers consider *Basic and Professional Knowledge* very important for twenty-first century university students. Many teachers regard "Professional knowledge" as an indispensable ingredient of core competencies for students, but they also think that possessing only professional knowledge is not enough, for students should be capable of continuous learning and prepared with sustainable study skills, that is, self-directed learning. In addition, the retrieval, analysis and application of information become important and necessary skills in the present network era, and self-reflection is another necessity to guarantee success in the future. Almost every teacher in our interview emphasised the importance of *Character & Civic Literacy*, with the competencies of "Sense of responsibility", "Good character", and "Ambition" repeatedly mentioned by different teacher interviewees. Teachers think that graduates nowadays have a similar level of knowledge and skills; however, the primary decisive factor to a successful future is personal character. That is, good character, a positive work attitude, a sense of responsibility, and other personality characteristics are more important for graduates to achieve success when they leave the university to go out into the world.

Another question to teacher interviewees was, "In our students' survey ther author find that competencies in the domain of *Global and International Perspective* are ranked as the least important. Do you think *Global and International Perspectives*, such as "Concept of global village", are important competencies or not? And what's your opinion on the survey results?" Almost every teacher interviewee considered competencies of *Global and International Perspective* to be very important. A teacher in Macau explained that because Macau is a small and affluent place, students there are a bit short-sighted so they do not realise the importance of a *Global and International Perspective*. The teacher thought students may need some

shocks to help expand their vision. He added, however, that many of his students want to go abroad.

4.2 University Students' Self-ratings on Competencies for the Twenty-first Century

This section aims to respond to RQ2, "How do university students rate themselves on core competencies for the twenty-first century?" by means of understanding students' self-ratings on competencies for the twenty-first century. Analyses were conducted by Rasch measurement. The Rasch measurement provided item difficulty estimates for all 40 items of the Possession Subscale, representing the different extent of university students' possession of these 40 competencies. The qualitative study also provided student and teacher interviewees' comments on university students' core competence levels, which was used to deepen the understanding of the quantitative results. Here, the core competencies refer to those proposed by interviewees responding to the first interview question (see Tables 4.2 and 4.3).

Table 4.4 reports frequency counts (percentages) for each response option in the Possession Subscale. It can be seen that, in general, students perceive themselves as having acquired most of the competencies to some extent. The average percentage of responses associated with "Not at all" (scored as 1) is 2.9%. Note that "Professional knowledge" had the largest percentage of 8.6%, which will be discussed in the next chapter. In contrast, the figures of responses associated with "To a certain extent" (scored as 3) and "To a large extent" (scored as 4) are 52.7% and 20.6%, respectively. The option of "To a small extent" (scored as 2) ranges from 4.7% to 25.6%, indicating that some competencies, such as "Familiar with international matters" (25.6%), "Develop self-potential" (25.4%), "Adventurous spirit"

(25.0%), “Creativity” (24.4%), and “Attitude for innovation” (22.0%), to name a few, are perceived as not well-possessed. The percentage of missing values is around 3.2%, which suggests that the majority of the items are competencies relevant to the students.

Table 4.4

Percentages (%) of Options on Self-assessment Subscale Items

Item	Options				
	Not at all 1	To a small extent 2	To a certain extent 3	To a large extent 4	Missing
Average Over All Items	2.9	16.6	52.7	20.6	3.2
A. Basic & Professional Knowledge					
1 Professional Knowledge	8.6	15.1	53.0	18.1	5.3
2 Ability to express in writing	1.8	7.8	61.5	26.8	2.1
3 Capacity for empirical deduction	2.8	14.0	58.9	19.5	4.8
4 Capacity for IT application	3.4	15.7	56.1	20.2	4.6
5 Capacity for logical analysis	2.2	9.2	59.0	26.5	3.2
6 Ability for critical thinking	2.7	10.6	55.4	28.2	3.2
7 Decision making	2.4	11.6	57.3	24.8	4.0
B. Creativity & Problem Solving					
8 Creativity	4.4	24.4	49.8	16.7	4.7
9 Develop self-potential	4.4	25.4	48.4	16.2	5.7
10 Imagination	2.5	13.2	52.7	28.8	2.8
11 Keen observation	2.9	16.2	50.6	26.7	3.7
12 Attitude for innovation	3.7	22.0	48.8	21.5	4.0
13 Adventurous spirit	5.0	25.0	44.2	22.0	3.8
14 Problem-solving skills	1.8	9.5	56.4	28.8	3.5
C. Interpersonal Communication					
15 Attitudes of respect and tolerance	1.3	4.7	40.2	51.2	2.5
16 Verbal ability	1.9	9.5	56.8	29.7	2.2
17 Ability to listen to others	1.5	5.4	43.8	47.0	2.3
18 Ability to manage emotions	2.2	10.5	49.8	34.8	2.8
19 Ability to work in a team	1.8	7.9	47.9	40.0	2.4

20	Leadership and coordination	4.2	19.1	50.0	23.2	3.5
21	Ability to interact	2.4	10.4	50.3	33.8	3.2
D.	**Character & Civic Literacy**					
22	Positive personality	1.2	5.2	37.9	53.4	2.3
23	Humanities and art appreciation	3.3	15.9	54.9	22.5	3.5
24	Empathy	1.4	4.8	44.5	47.6	1.7
25	Respect human rights	.9	5.1	42.8	49.2	2.0
26	Practise democracy	3.3	17.3	49.0	26.7	3.7
27	Ability for social participation	2.5	14.4	53.9	26.5	2.7
28	Ability for value judgment	1.3	6.0	51.2	38.4	3.1
E.	**Global & International Perspective**					
29	Capacity for second language	3.6	15.0	58.3	20.4	2.7
30	Open vision	2.4	14.0	55.2	25.5	3.0
31	Respect for cultural diversity	1.7	8.7	50.0	36.6	2.9
32	Familiar with international matters	5.3	25.6	48.4	17.9	2.8
33	Concept of global village	5.7	21.1	49.7	19.4	4.2
F.	**Self-directed Learning**					
34	Capacity for independent study	3.1	16.1	53.5	24.8	2.5
35	Set learning goals	2.5	16.1	53.6	25.9	1.9
36	Control learning process	2.9	17.5	54.0	23.2	2.5
37	Manage learning environment	3.3	19.5	53.0	21.5	2.7
38	Ability to use resources	2.0	12.1	56.7	27.0	2.2
39	Reflect on learning effectiveness	2.8	18.1	52.0	24.7	2.5
40	Ability to assess learning outcome	3.3	18.0	52.4	23.1	3.1

Figure 4.3 represents students' perceptions on 40 competencies listed in the Possession Subscale by item difficulty estimates which can be found in the first column of Table 3.3. The competencies on the horizontal axis are listed in descending order by the extent of possession. The higher score a competency got on the vertical axis, the greater extent of possession the students rated it. It can be seen in Figure 4.3, Item CC1 (Positive personality)

has the highest score while Item PS2 (Self-potential development) has the lowest score. There is one sharp drop between Items IC3 (Ability to listen to others) and CC7 (Ability for value judgment), and two obvious drops in Items GI3 (Respect for cultural diversity) and IC4 (Ability to manage emotions), and Items PS5 (Attitude for innovation) and PS6 (Adventurous spirit). The decrease of any other two adjacent items is relatively gradual. The results show that there is no specific domain in which all the items are scored higher or lower than the other domains. Competencies perceived as sufficiently possessed (the highest extent of possession) and those perceived as insufficiently possessed (the lowest extent of possession) will be further reported in the following sections.

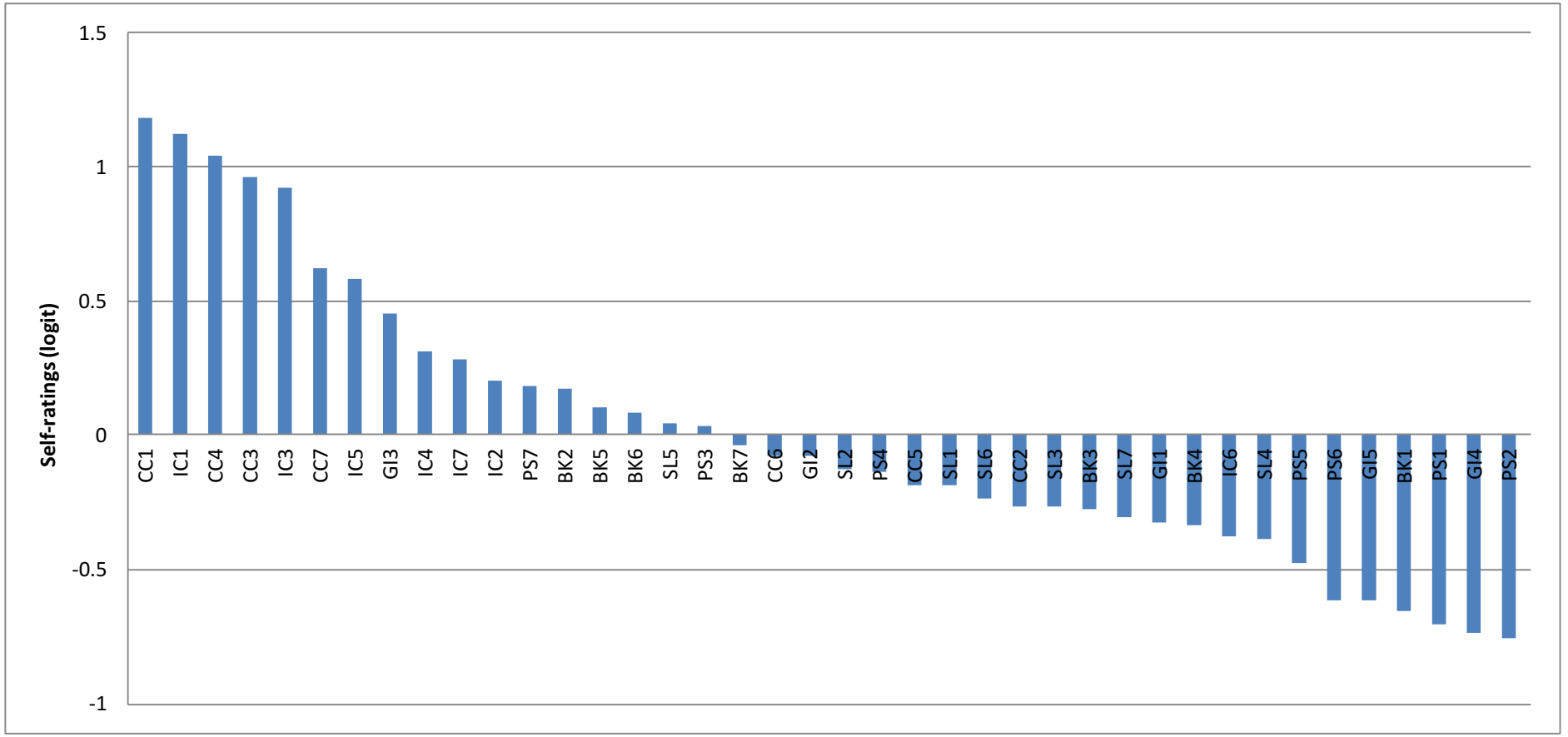


Figure 4.3. Students' self-ratings on 40 core competencies in descending order.

Figure 4.4 shows students' perceptions on the possession of core competencies in 21CCCUE by six domains. The relative importance can be ranked by the within-domain averaged difficulty measures. In descending order, they are *Character and Civic Literacy*, *Interpersonal Communication*, *Basic and Professional Knowledge*, *Self-directed Learning*, *Global and International Perspective*, and *Creativity and Problem Solving*.

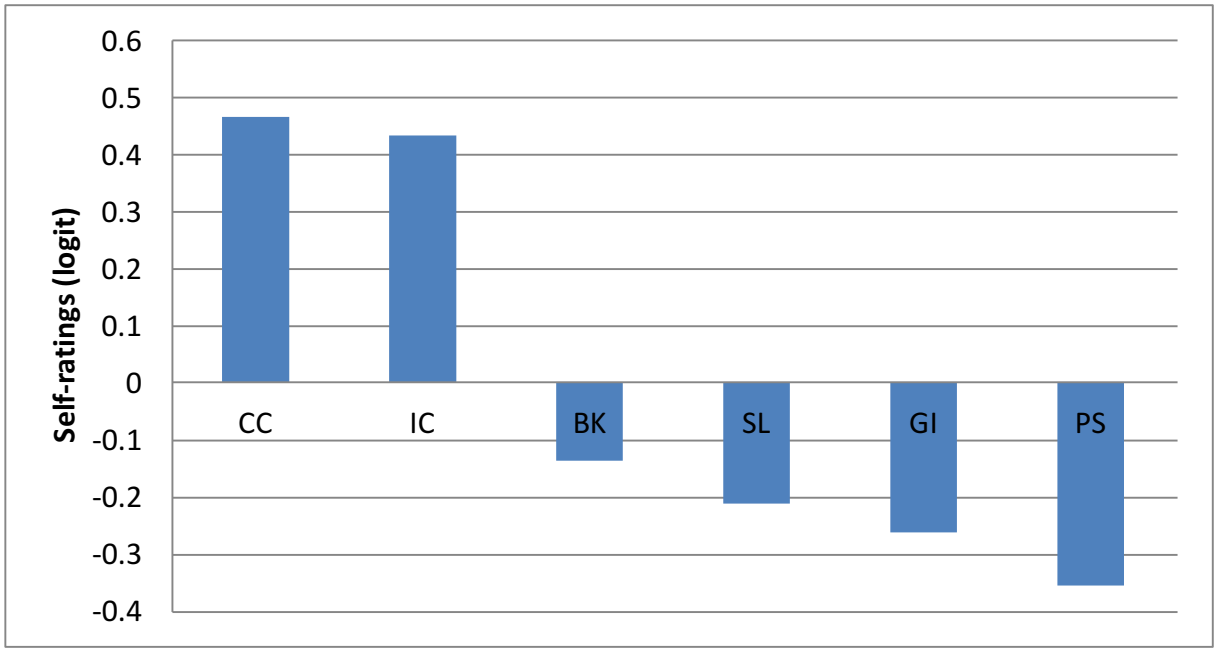


Figure 4.4. Self-ratings (average) of six domains.

4.2.1 Competencies Perceived as Better Possessed

As Table 4.4 shows, students perceive themselves as having possessed most of the competencies listed in the Possession Subscale to some extent. On average, these competencies received 80% agreement as possessed by the respondents to either a certain extent or a large extent, suggesting that they generally considered themselves having a better mastery of these competencies. At a domain level, the results show that the domains of

Character and Civic Literacy and *Interpersonal Communication* are the two competence domains perceived as possessed to a high extent by university students. According to the 21CCCUE scale, the domain of CC is ranked first, followed by the domain of IC (see Figure 4.4). As shown in Figure 4.3, four items received above-average scores (positive logits) in the CC domain, which in descending order are "Positive personality", "Respect human rights and freedom", "Empathy and moral standards", and "Ability for value judgments". In the IC domain, five items received above-average scores. In descending order, they are "Attitudes of respect and tolerance", "Ability to listen to others", "Ability to work in a team", "Ability to manage emotion", "Ability to interact", and "Verbal ability". The interviews with university students also found that students consider themselves to be better equipped with CC competencies than other competence domains, which will be elaborated in more detail in Section 4.2.3.

Figure 4.3 lists all the individual competencies in descending order by the extent of possession. Students rated "Positive personality" (Item CC1), "Attitudes of respect and tolerance" (Item IC1), "Respect human rights and freedom" (Item CC4), "Empathy and moral standards" (Item CC3), "Ability to listen to others" (Item IC3), "Ability for value judgments" (Item CC7), and "Ability to work in a team" (Item IC5) as sufficiently possessed competencies. It can be seen that Item CC1, Item IC1 and Item CC4 each received a value above the average by one logit, and the other four items each got a value above the average by 0.5 logits. According to the rule of thumb suggested by DeMars and Linacre (2004), this study chose 0.5 logits as a cut-point for determining the sufficiently possessed and the insufficiently possessed competencies.

4.2.2 Competencies Rated as Insufficiently Possessed

The results show that the less sufficiently possessed competence domains are *Creativity and Problem Solving* and the *Global and International Perspective*, as rated by university students. In the 21CCCUE scale, the PS domain received the lowest average item difficulty estimate (see Figure 4.4), in which all the items received below or marginal average scores (negative logits) of item difficulty estimates except Item PS7, "Problem solving". In descending order, these PS competencies are "Self-potential development", "Creativity", "Adventurous spirit", "Keen observation", "Imagination", and "Problem solving". In the GI domain, only one item (Item GI3: Respect for cultural diversity) received an above-average score (positive logits), while the others were rated as insufficiently equipped competencies. In descending order, these GI competencies are "Familiar with international affairs", "Concept of global village", "Capacity for second language" and "Open vision".

As for the individual competencies (see Figure 4.3), the top six competencies that students considered they possessed insufficiently are "Self-potential development" (Item PS2), "Familiar with international affairs" (Item GI4), "Creativity" (Item PS1), "Professional knowledge" (Item BK1), "Concept of global village" (Item GI5), and "Adventurous spirit" (Item PS6), in descending order. All these items received an absolute value above the average score by 0.5 logits, which is a cut-point used in this study for determining the sufficiently possessed and the insufficiently possessed competencies.

4.2.3 Complementary Explanations to Research Question Two from the Perspectives of Interviewees

To deepen the understanding of the quantitative results, interviewees' perspectives were summarised and reported. Following the first interview question about what competencies are considered important to twenty-first century university students, the second question was, "To what extent do you think they (university students) possess these competencies?" This section provides the student and teacher interviewees' comments on university students' core competency levels, in which the core competencies refer to those proposed by interviewees responding to the first interview question (see Tables 4.2 and 4.3).

4.2.3.1 Students' Comments on University Students' Core Competency Levels

In this study, student interviewees thought they and their peers have partly mastered the core competencies they mentioned before (when responding to the first interview question) and they are not satisfied with the situation. Sometimes, when students propose certain core competencies, there is a story about how they neglected it before only to find it is really important, or they gradually came to realise some competency is very important after experiencing some personal growth. For example, a senior student in Macau told us that she had neglected communication skills for a long time until she encountered difficulties during her internship. Most of the proposed core competencies, such as "Interaction", "Creativity", "Problem solving skills", "Work in a team", "Ability to learn", "Emotion management", "IT application", "Ambition", "Reflection", and even "Professional knowledge and skills", are skills that the student interviewees feel that they and their peers are not completely equipped with. Indeed, some competencies were considered appropriately mastered by certain

interviewees themselves, such as “Sense of responsibility” and “Moral standards”, but the interviewees do not think these competencies are appropriately mastered by their peer students. Thus, it can be perceived that student interviewees both in Macau and Zhejiang think themselves well-equipped with competencies in the domain of *Character and Civic Literacy*, such as “Moral standards”, “Sense of responsibility” and “Good character”. As for competencies in other domains, student interviewees did not show the same confidence.

4.2.3.2 Teachers’ Comments on University Students’ Core Competency Levels

To enrich the understanding of students’ perspectives, teachers’ comments on important core competencies for the twenty-first century are reported in this section. University teacher interviewees think that, compared with previous years, contemporary university students have a higher level of *Basic and Professional Knowledge*, especially in IT application, but are less competent in *Interpersonal Communication* and *Character and Civic Literacy*, including “Collaboration skills”, “Sense of responsibility”, “Perseverance”, “Initiative” and “Positive work attitude”. Actually, teachers have different perspectives about their students. Some teachers think today’s students are more creative than before, while others believe the opposite. A teacher in Zhejiang claimed that the students she taught were good at rote learning, instead of finding answers and raising questions by themselves, and they were satisfied with the status quo. Another Zhejiang teacher criticised the fact that some students lack the ability to take initiative, work independently and think critically, and prefer the easy route of following blindly, and are sometimes likely to resort to violence. A Macau teacher pointed out that nowadays students may be good at Internet networking, but very weak at socialisation in real society, for example, by using email to ask the family to dinner when living under the same roof. Another teacher in Macau believes modern students are not

different from those of 30 years ago, and it is the contrast from the rapid changes of the social environment and the high demands on graduate students which make today's students seem insufficient.

More than half of the teachers interviewed consider "Sense of responsibility" the main competency that contemporary students lack. For instance, one teacher interviewee told of a young graduate who disliked his job and asked his parents to call his company to resign for him. Teachers also point out that there is a dangerous false belief among students, and they want to take shortcuts rather than approaching their studies in a focussed, hands-on way. Furthermore, both teachers in Macau and Zhejiang emphasise that the end of university should be the beginning of a lifetime of learning for graduates. They think that few students realise this, and that the majority hold a misguided perspective that once they graduate from the university, they will never need to learn any more, which will do great harm to their future development.

4.3 University Students' Perceptions on the Adequacy of University Education to Develop Core Competencies in Graduates for the Twenty-first Century

This section aims to respond to RQ3, "From the students' perspectives, how adequate is university education in developing these competencies in graduates for the twenty-first century?" by means of understanding students' perceptions on the adequacy of universities to develop core competencies in graduates for the twenty-first century. Analyses were conducted by Rasch measurement. Rasch measurement provided item difficulty estimates for all 40 items of the Adequacy Subscale, which represent the different extents that university education adequately cultivates core competencies in their graduates. The qualitative study

provided student and teacher interviewees' remarks on the effectiveness of university education to deepen the understanding of the quantitative results, in which the core competencies refer to those proposed by interviewees responding to the first interview question (see Tables 4.2 and 4.3).

Table 4.5 reports frequency counts (percentages) for each response option in the Adequacy Subscale. It can be seen that, in general, students show an appropriate degree of satisfaction with their university education in developing listed competencies in their graduates. On average, the percentage of responses associated with "Not helpful" is 4.5%. Among these responses, the competency, "Adventurous spirit", received the highest percentage of 9.0%, followed by the competencies "Concept of global village" (8.9%) and "Imagination" (8.0%). In contrast, the percentages for the responses associated with "Reasonably helpful" and "Very helpful" are 43.2% and 29.9%, respectively. The option of "Not too helpful" ranges from 6.6% to 31%, indicating that some competencies, such as "Imagination" (31%), "Adventurous spirit" (29.1%), "Creativity" (28.7%), and "Attitude for innovation" (27.3%), are perceived as not well-developed by the university. The percentage of missing values is around 2.9%, which suggests that almost all answers are relevant responses.

Table 4.5

Percentages (%) of Options on University Education Subscale Items

Item	Options				
	Not at all helpful 1	Not too helpful 2	Reasonably helpful 3	Very helpful 4	Missing
Average Over All Items	4.5	19.6	43.2	29.9	2.9
A. Basic & Professional Knowledge					
1 Professional Knowledge	1.4	6.6	33.6	56.0	2.3
2 Ability to express in writing	2.9	17.2	47.9	29.6	2.5
3 Capacity for empirical deduction	2.9	21.5	47.7	24.5	3.4
4 Capacity for IT application	3.3	20.7	45.9	26.9	3.2
5 Capacity for logical analysis	2.7	17.5	46.4	30.6	2.7
6 Ability for critical thinking	3.3	18.7	45.2	29.8	3.0
7 Decision making	3.8	20.6	44.5	27.7	3.4
B. Creativity & Problem Solving					
8 Creativity	7.5	28.7	40.2	20.6	3.0
9 Develop self-potential	5.8	26.3	39.5	25.4	3.1
10 Imagination	8.0	31.0	38.6	19.4	3.0
11 Keen observation	5.6	26.4	41.4	23.3	3.3
12 Attitude for innovation	6.4	27.3	40.0	23.5	2.8
13 Adventurous spirit	9.0	29.7	37.6	20.7	3.0
14 Problem-solving skills	3.0	16.1	42.1	36.0	2.8
C. Interpersonal Communication					
15 Attitudes of respect and tolerance	3.9	17.1	42.5	33.6	2.9
16 Verbal ability	3.1	15.1	42.5	37.1	2.3
17 Ability to listen to others	4.2	18.2	43.6	31.0	3.0
18 Ability to manage emotion	6.7	23.1	40.5	26.6	3.1
19 Ability to work in a team	2.8	13.3	39.5	42.1	2.3
20 Leadership and coordination	4.7	19.7	42.4	30.3	3.0
21 Ability to interact	3.5	14.3	41.3	38.0	3.0
D. Character & Civic Literacy					
22 Positive personality	4.3	17.0	45.4	30.1	3.2

23	Humanities and art appreciation	5.3	21.0	46.4	24.3	3.0
24	Empathy and moral standards	4.6	19.3	46.8	26.5	2.7
25	Respect human rights and freedom	5.2	19.8	44.7	27.3	3.1
26	Practise democracy	6.2	23.2	43.4	24.0	3.2
27	Ability for social participation	4.2	17.7	43.0	32.6	2.5
28	Ability for value judgments	4.0	15.9	46.4	30.3	3.4
E.	**Global & International Perspective**					
29	Capacity for second language	2.6	12.0	41.2	42.1	2.1
30	Open vision	3.1	14.5	44.8	35.0	2.6
31	Respect for cultural diversity	3.4	16.8	44.2	32.4	3.1
32	Familiar with international matters	6.4	24.5	43.7	22.7	2.7
33	Concept of global village	8.9	26.4	41.7	19.0	4.0
F.	**Self-directed Learning**					
34	Capacity for independent study	2.9	13.0	44.8	36.8	2.5
35	Set learning goals	3.6	18.0	45.7	30.2	2.6
36	Control learning process	3.9	19.1	45.0	29.1	2.8
37	Manage learning environment	4.5	20.6	45.1	26.9	2.9
38	Ability to use resources	2.6	14.8	43.5	36.5	2.6
39	Reflect on learning effectiveness	4.2	20.4	43.4	28.6	3.3
40	Ability to assess learning outcome	4.2	19.0	45.0	28.0	3.7

Figure 4.5 represents the students' perceptions on the Adequacy Subscale by item difficulty estimates, which can be found in the first column of Table 3.4. The competencies on the horizontal axis are listed in descending order by the extent of perceived adequacy. The higher score a competency got on the vertical axis, the greater extent of perceived adequacy it was rated by students. It can be seen in Figure 4.5, Item BK1 (Professional Knowledge) has the highest score while Item PS3 (Imagination) has the lowest score. A drastic drop between Items BK1 and GI1 (Capacity for second language) shows that compared to any other competencies in the 21CCCUE scale, the competency of Professional Knowledge has the overwhelming superiority to be perceived as adequately developed in university education.

There are also obvious drops between Items IC5 (Ability to work in a team) and SL1 (Capacity for independent study), Items PS7 (Ability to assess learning outcome) and GI3 (Respect for cultural diversity), and Items PS5 (Attitude for innovation) and PS1 (Creativity). The decrease of any other two adjacent items is relatively gradual. The results show that there is no specific domain in which all the items are scored higher or lower than the other domains. Competencies perceived as sufficiently possessed (the highest extent of possession) and those perceived as insufficiently possessed (the lowest extent of possession) will be further reported in the following sections.

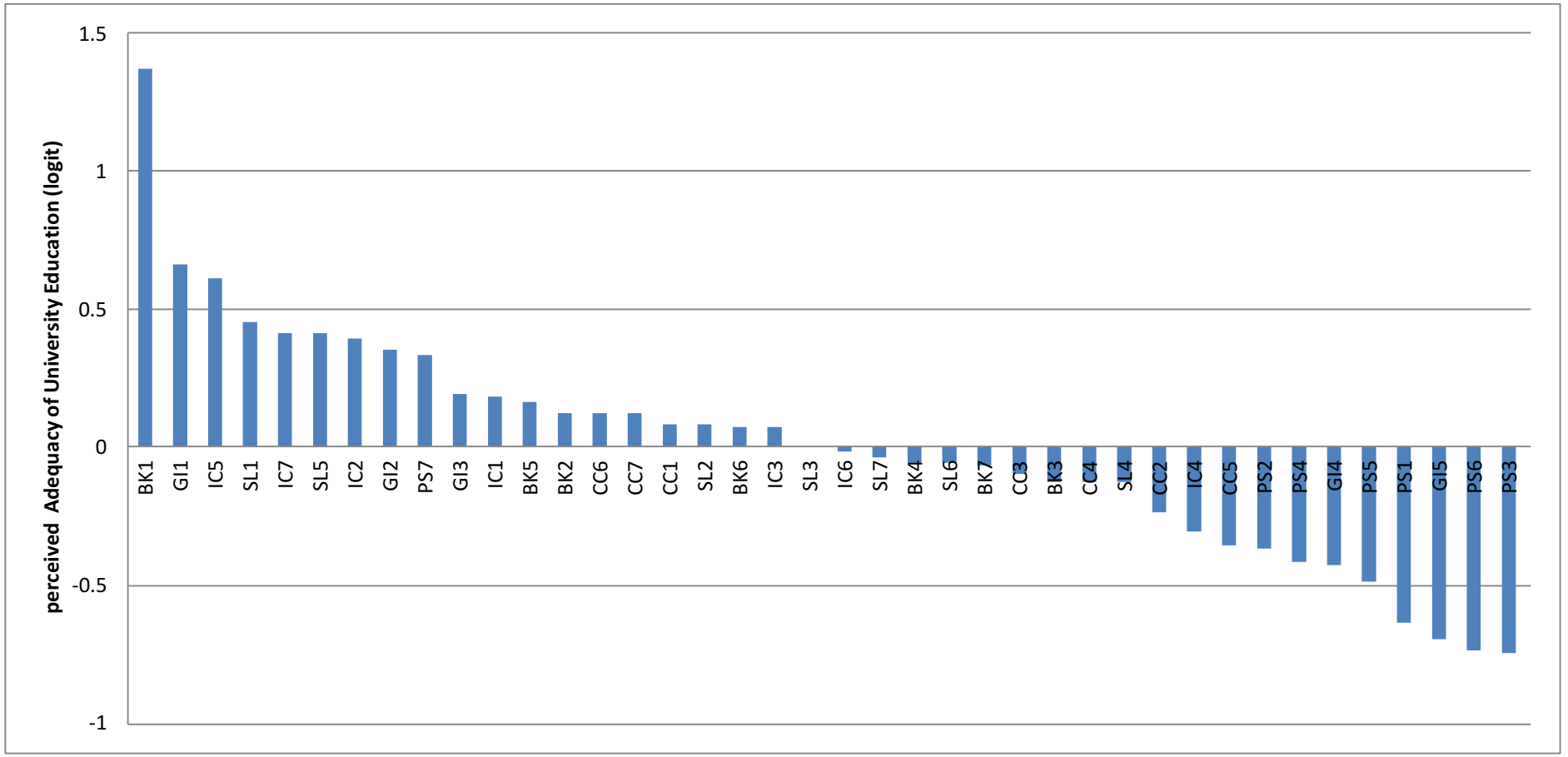


Figure 4.5. Adequacy of university education in descending order.

Figure 4.6 shows students' perceptions on the adequacy of university education in developing all the core competencies by six domains. The relative importance can be ranked by the within-domain averaged difficulty measures. In descending order, they are *Basic and Professional Knowledge*, *Interpersonal Communication*, *Self-directed Learning*, *Global and International Perspective*, *Character and Civic Literacy*, and *Creativity and Problem Solving*.

Figure 4.6. Adequacy of university education (Average) of six domains.

4.3.1 The Most Developed Core Competencies in University Education

Table 4.5 reports frequency counts (percentages) for each response option in the Adequacy Subscale. As shown, on average, these competencies received 73.1% agreement as adequately cultivated by university education, suggesting that university students have an

appropriate degree of satisfaction that their university education is developing the listed competencies in their graduates. At a domain level, the results show that university students consider *Basic and Professional Knowledge* and *Interpersonal Communication* as two of the most adequately developed core competence domains in university education. In the 21CCCUE scale, the domain of BK is considered the most adequately cultivated competency group by university education than other domains, while the domain of IC is ranked second (see Figure 4.6). According to the values of item difficulty estimates (see Table 3.4), four items received above average scores, which in descending order are "Professional knowledge", "Capacity for logical analysis", "Ability to express in writing", and "Ability for critical thinking". In the domain of IC, five items received above average scores. In descending order, they are "Ability to work in a team", "Ability to interact", "Verbal ability", "Attitudes of respect and tolerance" and "Ability to listen to others".

As for the individual competencies (see Figure 4.5), three of them were scored above the cut point (i.e., 0.5 logits) used in this study. In descending order, they are "Professional knowledge" (Item BK1), "Capacity for second language" (Item GI1) and "Ability to work in a team" (Item IC5). Among them, Item BK1 was rated as the most adequately developed competency in university education, leaving the others far behind.

4.3.2 The Least Developed Core Competencies in University Education

The results show that the least developed competence domain perceived by university students is *Creativity and Problem Solving*. In the 21CCCUE scale, the domain of PS received the lowest average item difficulty estimate (see Figure 4.6), in which all the items except one (Item PS7: Problem solving) received below average scores of item difficulty

estimates (see Table 3.4). In descending order, these competencies are “Imagination”, “Adventurous spirit”, “Creativity”, “Attitude for innovation and change”, “Keen observation” and “Self-potential development”.

As for the individual competencies (see Figure 4.5), the least developed competencies are “Imagination” (Item PS3), “Adventurous spirit” (Item PS6), “Concept of global village” (Item GI5) and “Creativity” (Item PS1). According to the cut point value of 0.5 logits used in this study, these four competencies emerged as inadequately developed competencies in university education.

4.3.3 Complementary Explanations to Research Question Three from the Perspectives of Interviewees

To give a deeper understanding of the quantitative results, this section provides student and teacher interviewees’ responses to the third interview question which focuses on how adequate university education is in developing core competencies in graduates for the twenty-first century. Remarks on the adequacy of university education are summarised, as well as the roles universities can perform in cultivating their students now and in the future.

4.3.3.1 Student Interviewees’ Remarks on the Adequacy of University Education

Student interviewees have different attitudes towards their university education. Some of them are content with their university education, while others are not quite satisfied with it. For example, more than half of the student interviewees complained that “there are few opportunities to practise and to apply what we have learnt”, and such situation “has hindered

the acquisition of important competencies". Students contend that "the exam-oriented education system is not appropriate for twenty-first century university education". They complain, however, that "most of the courses use examinations as the only means to evaluate students' achievements". This leads to some thought-provoking phenomena that are not uncommon in Chinese universities, such as "students show great enthusiasm to participate in the last class of every course, because their teachers will give hints about the exams at that time, while in other classes, skipping class is common". Some students believe that the traditional education model used in their universities is "not conducive to either learning or teaching". Their further explanation is that, "under the traditional education model, the textbook is outdated and divorced from practice", "the curriculum is stuffy and out of touch with life culture", "teaching becomes reading the text, and true learning never happens".

On the other hand, some students express their satisfaction with concrete systems and strategies adopted by their universities. For example, a Macau student thought "student unions and student clubs have received more and more encouragement and financial support from the university", which "has facilitated the extracurricular activities and enhanced students' ability and responsibility". Another student sang high praise for the college system her university adopted. She said that "the colleges are student communities with facilities such as hostels, canteens, and amenities in which students receive education and care". She thought the college she lived in was "distinctive" and "has cultivated many competencies in me through all sorts of meaningful activities", and she likes "the mentorship, student union and community service programs".

Students also expressed their expectations of university education. Some want their university "to provide a growth-promoting environment for both their learning and development" and

"to promote whole-person education". They want "more opportunities for practice and volunteer work to connect with reality, increase self-awareness, and form social responsibility". They want their curricular focus on "not only knowledge and skills, but also creativity, work attitude, responsibility, personality and the ability for independent and sustainable learning". They want "someone as a mentor" or "something like a university guide" to let them "realise the nature of university life at the very beginning", "to break the illusions that we do not need to work as hard as we did in high school", and "to impel us to plan our four years in university more actively and strategically".

4.3.3.2 Teacher Interviewees' Remarks on the Adequacy of University Education

Like our student interviewees, university teachers gave their opinions about the advantages and disadvantages of university education in talent cultivation. Some of them made outspoken remarks about "the deficiency of university education". For example, one teacher thought "the systematic defects in university education have been the main cause of educational failures". He believes that "political and economic issues excessively intervene in the running mechanism of university", and "the evaluation index of university performance is monotonic". As a result, faculty members as well as laymen "pay more heed to the profit, ranking, and publications of universities, ignoring the educational goals and talent cultivation". Another teacher admitted that "the traditional university education in Great China used to pay great attention to expounding knowledge of subjects, but not whole-person development". He thinks that "the ideal university education is difficult to achieve because of limited resources", and "the present university is not good at cultivating students' humanistic spirit".

Some teachers affirmed the achievements of their university. One example put forward is the "four-in-one model" practised at their university, which combines discipline education, general education, residential college and internships, and aims to nurture students' whole-person development. The teachers think "the model is quite effective in enhancing teaching and learning", as well as "improving the students' abilities to serve the community, to interact with others, and to develop self-awareness and social responsibility". Some teachers believe that "the university has recently made rapid progress in quality education". As a gathering place for community activities and athletic competitions, the present university "provides more and more opportunities for students to connect with the social reality and to challenge themselves". Some teachers believed that "the intensification of elective course reforms" and "the construction of general courses" make the course structure "more flexible and effective". Both teachers in Macau and Zhejiang praised their university to "frequently invited social celebrities and business executives to give speeches to university students" which is benefit to "promoting students' understanding of society and help them to set up practical and realistic vocational goals". They believe that all these implementations "facilitate the cultivation of important competencies for twenty-first century university students".

Teachers also put forward suggestions to improve the effectiveness of university education in cultivating students. They think many competencies such as "responsibility", "creativity" and "work attitude" are "difficult to cultivate through traditional classroom teaching"; therefore, "diversified studying modes and teaching patterns should be adopted", as well as "multiple practical activities such as internships and volunteer work". They think that "a mentorship program is another prospective implementation for undergraduates", in which the mentor is "an advisor of students' learning, a promoter of students' development, and also a learner from their students and a researcher on university education". Although teachers are not very

satisfied with the status quo of university education, they say they "will not lose heart" because they know that, "as university teachers, we are very powerful in educating and guiding students".

4.4 The Relationships between Students' Perceptions on the Importance of Competencies, Self-rating and University Education

This section aims to respond to RQ4, "What are the relationships between students' perceptions on the three aspects about core competencies for the twenty-first century, namely, importance, possession and adequacy?" The analysis found the subscales designed to measure these three aspects mildly to moderately correlate with each other. The results show that the Importance subscale is moderately correlated with both the Possession and Adequacy Subscales, with the Pearson Product Moment Correlation Coefficient equal to 0.76 and 0.61, respectively. Further, the Possession and the Adequacy Subscales are only mildly correlated, with the Pearson Product Moment Correlation Coefficient equal to 0.24. In order to get detailed perspectives on the relationships between students' perceptions on these three aspects, the relationships of each of these are elaborated with figures in the following sections.

4.4.1 Relationship between Students' Perceptions on the Importance and Self-assessment Subscales

Figure 4.7 gives a visual presentation of the relationship between the Importance and Possession Subscales. The horizontal axis stands for the importance of the competencies perceived by students, while the vertical axis represents the degree of possessing these

competencies by the students' self-rating. The horizontal and vertical dash lines divide the competencies into four quadrants: important and better possessed, important but not sufficiently possessed, not essential but better possessed, and not essential and not sufficiently possessed. Most of the competencies are located in the first and the third quadrants.

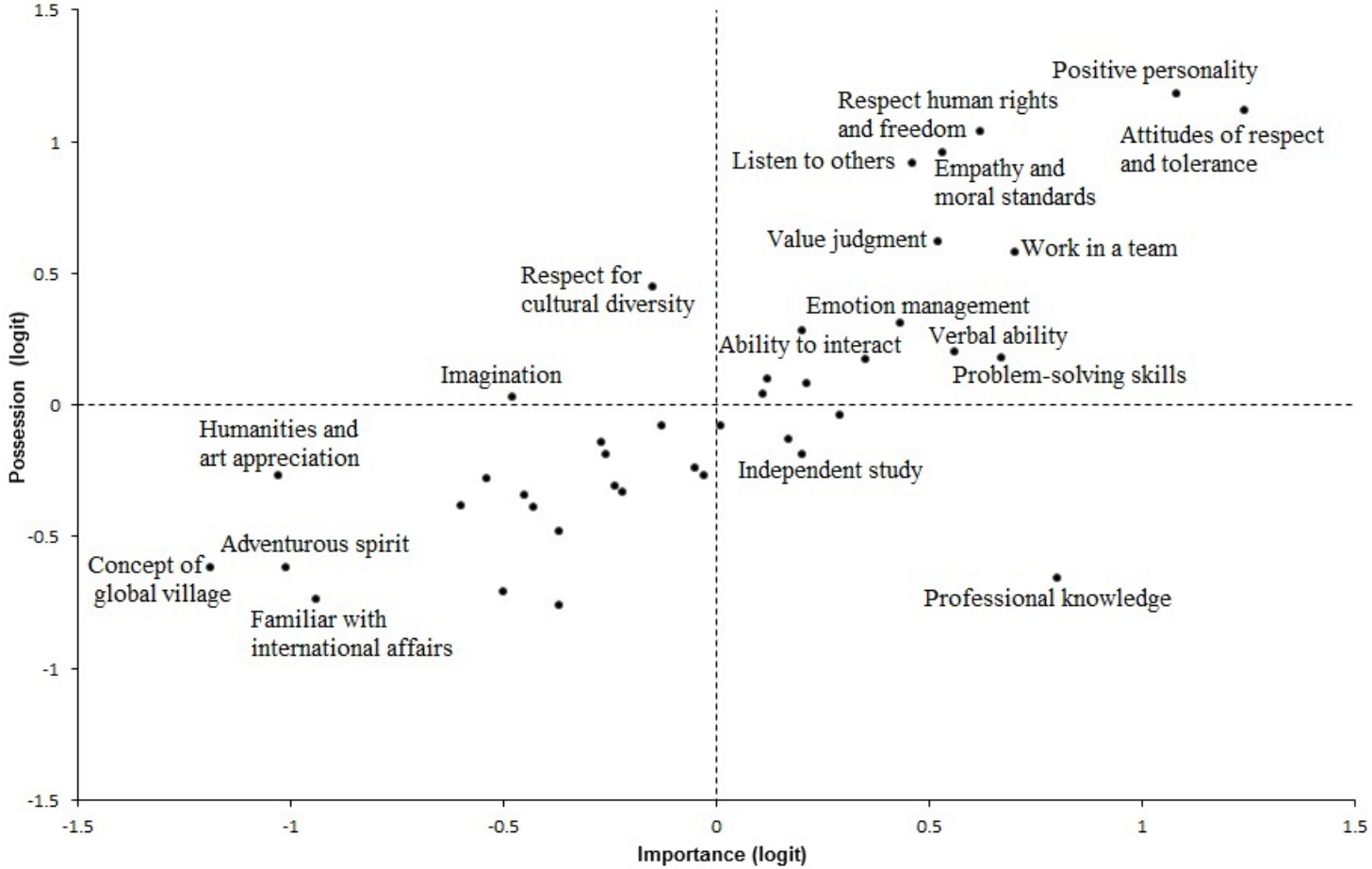


Figure 4.7. Relationship between the Importance and Possession Subscales.

Note. The horizontal/vertical dash lines denote the mean of item difficulty on the Importance/Possession Subscale.

In Figure 4.7, the dots in the first quadrant represent those competencies perceived by students as important and better possessed. Most of them are in the domains of *Interpersonal Communication* (including items of "Attitude for respect and tolerance", "Ability to listen to others", "Ability to work in a team", "Ability to manage emotion" and "Ability to interact") and *Character and Civic Literacy* (including items of "Positive personality", "Respect human rights and freedom", "Empathy and moral standards", "Verbal ability" and "Ability for value judgments"). There are also three items ("Ability to express in writing", "Ability for critical thinking" and "Capacity for logical analysis") in the domain of *Basic and Professional Knowledge*, one item ("Problem-solving skills") in the domain of *Creativity and Problem solving*, and another item ("Ability to use learning resources") in the domain of *Self-directed Learning*.

In the second quadrant, there are two items ("Respect for cultural diversity" and "Imagination" in the domains of *Global and International Perspective* and *Creativity and Problem solving* respectively), denoting competencies which are considered not essential but better possessed by students. The third quadrant has competencies perceived as neither essential nor sufficiently possessed. Among them are items of "Concept of global village", "Familiar with international affairs", "Adventurous spirit", "Humanities and art appreciation", "Creativity", "Self-potential development", "Attitude for innovation and change", "Manage learning environment", "Capacity for logical analysis", "Capacity for empirical deduction", and "Leadership and coordination", mostly in the domains of *Creativity and Problem solving*, *Global and International Perspective*, and *Basic and Professional Knowledge*. The dots in the fourth quadrant indicate competencies perceived as important but not sufficiently possessed. One item in this corner ("Professional knowledge" in the domain of *Basic and Professional Knowledge*) scored highly, while the other four items ("Capacity

for independent study" and "Set learning goals and strategies" in the domain of *Self-directed Learning*, "Decision making" in the domain of *Basic and Professional Knowledge*, and "Open vision" in the domain of *Global and International Perspective*) are in the marginal level.

4.4.2 Relationship between Students' Perceptions on the Importance and University Education Subscales

Figure 4.8 shows the relationship between the Importance and Adequacy Subscales. The horizontal axis stands for the importance of the competencies while the vertical axis represents the perceived adequacy of university education in developing these competencies. The horizontal and vertical dash lines divide the competencies into four quadrants: important and cultivated, important but not adequately cultivated, not essential but cultivated, and not essential and not adequately cultivated.

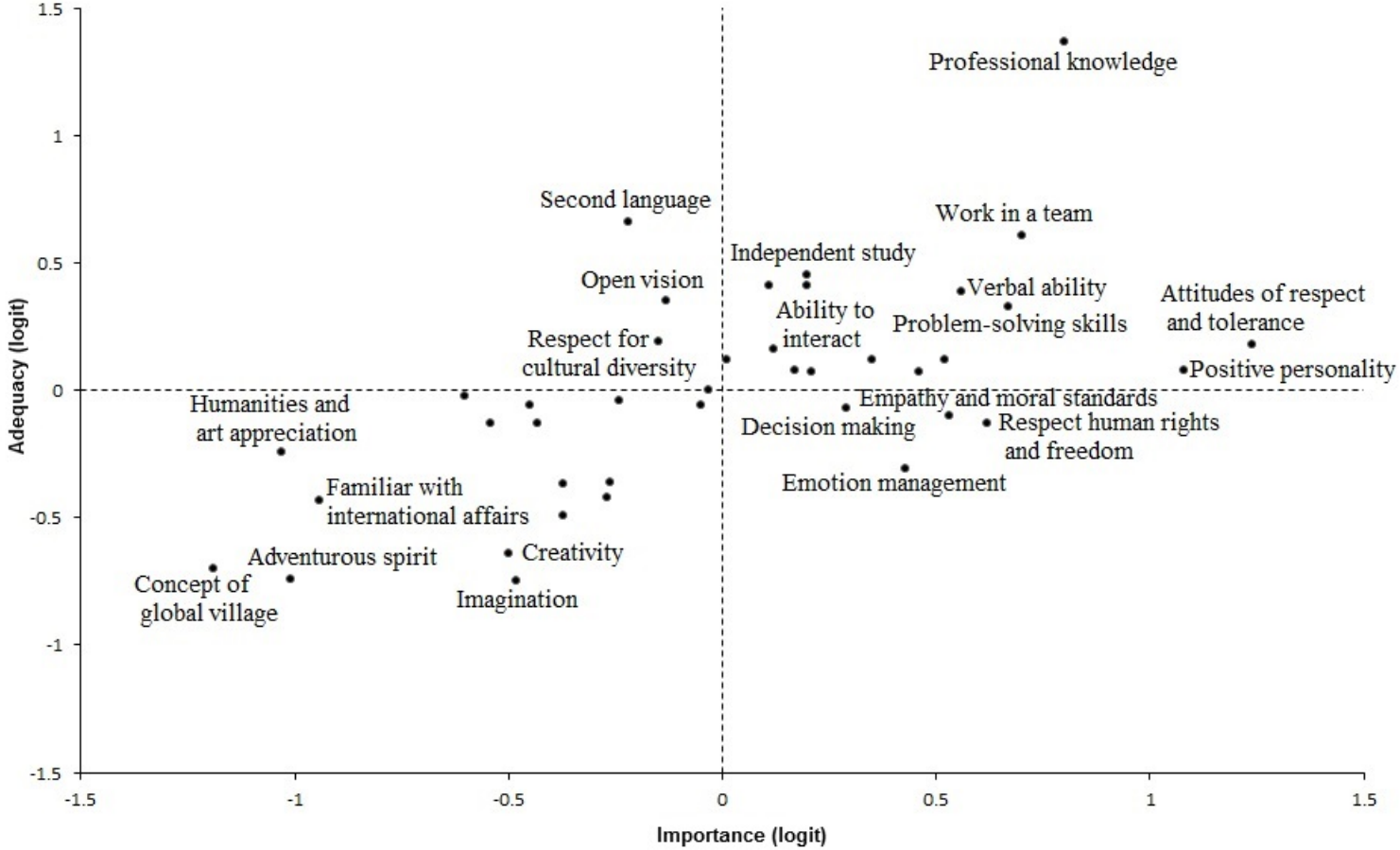


Figure 4.8. Relationship between the Importance and University Education Subscales.

Note. The horizontal/vertical dash lines denote the mean of item difficulty on the Importance/Adequacy Subscale.

In Figure 4.8, competencies located in the first quadrant include items of "Professional knowledge", "Ability to work in a team", "Attitudes for respect and tolerance", "Verbal ability", "Problem-solving skills", "Positive personality", "Ability for value judgments", "Ability to listen to others", "Ability to express in writing", "Ability to interact", "Capacity for independent study", "Ability to use learning resources", "Ability for critical thinking", "Capacity for logical analysis", "Set learning goals and strategies" and "Ability for social participation". These 16 items are considered important competencies and cultivated by university education, mostly in the domains of *Interpersonal Communication*, *Character and Civic Literacy*, *Basic and Professional Knowledge*, and *Self-directed Learning*.

Three items in the second quadrant mean that they are not essential but cultivated: "Capacity for second language", "Open vision" and "Respect for cultural diversity", all belonging to the domain of *Global and International Perspective*.

Items located in the third quadrant mean that they are neither essential nor adequately cultivated. These items are "Imagination", "Creativity", "Adventurous spirit", "Familiar with international affairs", "Concept of global village", "Humanities and art appreciation", "Keen observation", "Attitude for innovation and change", "Self-potential development", "Practise democracy and justice", and "Capacity for IT application", mostly in the domains of *Creativity and Problem solving*, *Global and International Perspective* and *Self-directed L*earning.

There are four items in the fourth quadrant indicating they are important but not adequately cultivated competencies: "Ability to manage emotion", "Respect human rights and freedom", "Empathy and moral standards" and "Decision making". Two of these belong to the domain

of *Character and Civic Literacy*, one is in the domain of *Interpersonal Communication*, and another is in the domain of *Basic and Professional Knowledge*.

4.4.3 Relationship between Students' Perceptions on the Possession and Adequacy Subscales

Figure 4.9 demonstrates the relationship between the Possession and Adequacy Subscales. The horizontal axis denotes the extent of possessing the competencies according to students' self-rating, while the vertical axis represents the perceived adequacy of university education in developing these competencies. The horizontal and vertical dash lines divide the competencies into four quadrants: better possessed and cultivated, better possessed but not adequately cultivated, cultivated but not sufficiently possessed, and not sufficiently possessed and not adequately cultivated.

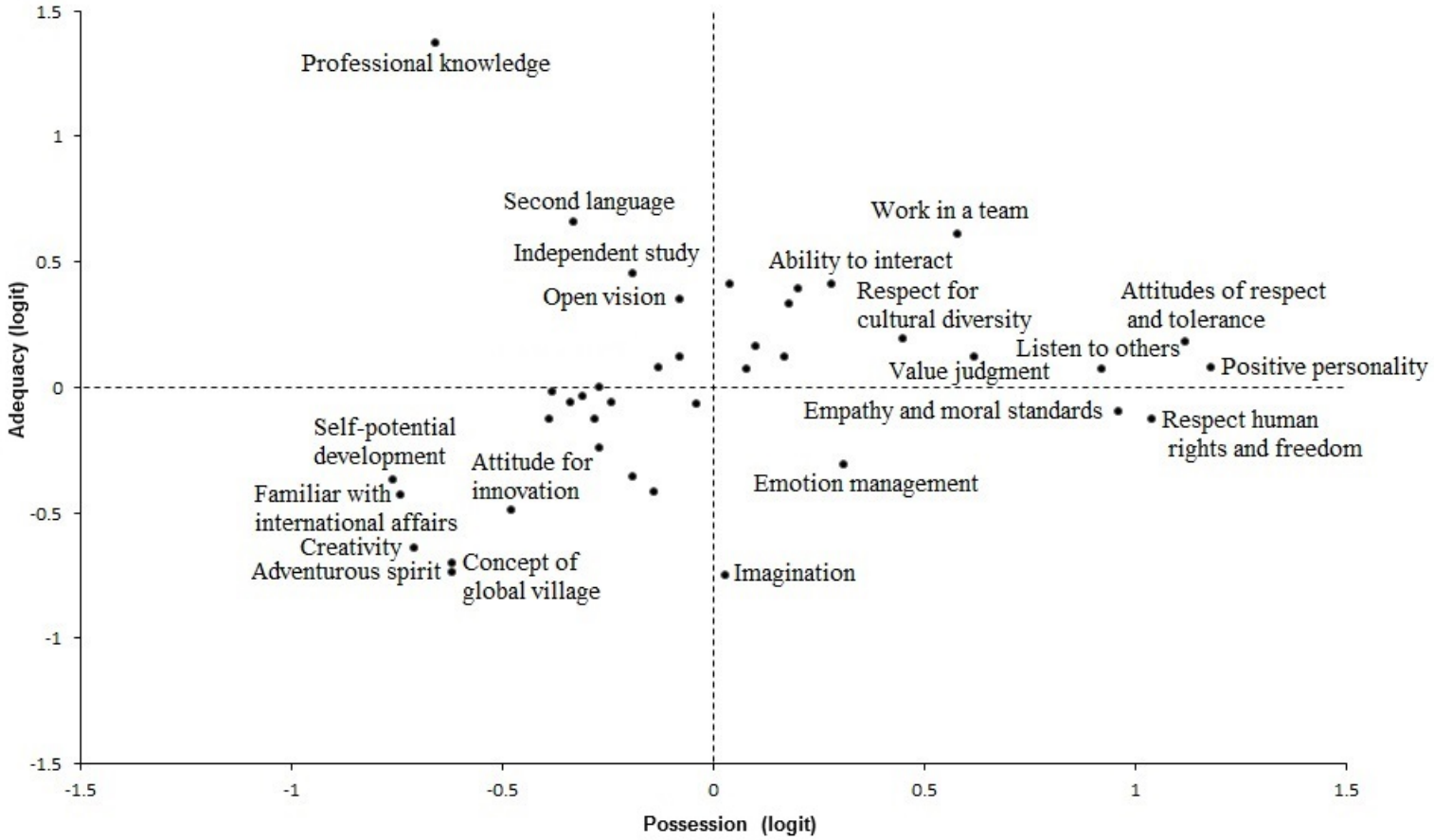


Figure 4.9. Relationship between the Possession and Adequacy Subscales.

Note. The horizontal/vertical dash lines denote the mean of item difficulty on the Possession/Adequacy Subscale.

Items considered as better possessed and cultivated are located in the first quadrant (see Figure 4.9). They are “Attitudes of respect and tolerance”, “Verbal ability”, “Ability to listen to others”, “Ability to work in a team”, “Ability to interact”, “Problem-solving skills”, “Positive personality”, “Ability for value judgments”, “Ability for social participation”, “Respect for cultural diversity”, “Ability for critical thinking”, and “Ability to use learning resources”. Most of them are in the domains of *Interpersonal Communication* and *Character and Civic Literacy*. There are six competencies situated in the second quadrant denoting they are cultivated by the university, but not sufficiently possessed by the students. They are “Professional knowledge” and “Ability to express in writing” in the domain of *Basic and Professional Knowledge*, “Capacity for independent study” and “Set learning goals and strategies” in the domain of *Self-directed Learning*, and “Open vision” and “Capacity for second language” in the domain of *Global and International Perspective*.

Items in the third quadrant imply these are neither better possessed nor adequately cultivated competencies, such as “Creativity”, “Self-potential development”, “Attitude for innovation and change”, “Adventurous spirit”, “Familiar with international affairs”, “Concept of global village”, “Capacity for empirical deduction”, “Capacity for IC application”, “Reflect on learning effectiveness”, “Manage learning environment”, “Decision making”, “Ability to assess learning outcomes”, “Humanities and art appreciation” and “Practise democracy and justice”, mostly in the domains of *Creativity and Problem solving*, *Self-directed Learning*, *Global and International Perspective*, *Character and Civic Literacy*, and *Basic and Professional Knowledge*.

Competencies in the fourth quadrant are those regarded as better possessed but not adequately cultivated, including items of “Empathy and moral standards”, “Respect human

rights and freedom", "Ability to manage emotions", and "Imagination". Two are in the domain of *Character and Civic Literacy*, while two others belong to the domains of *Interpersonal Communication* and *Creativity and Problem solving*, respectively.

4.5 Gender, Grade and Location Differences in University Students' Perspectives on Core Competencies for the Twenty-first Century

This section aims to respond to RQ5, "Are there any differences in the perspectives of university students of different genders, grades and locations?" A three-way ANOVA, including gender, grade and location as independent variables, was conducted, with the purpose of evaluating the differences in students' perceptions of core competencies for the twenty-first century, namely, importance, possession and adequacy. The three-way ANOVA was conducted three times, on the dependent variables of "importance", "possession" and "adequacy", respectively, each time with gender, grade and location as independent variables. The dependent variable of "importance" is a Rasch measure on the Importance Subscale, while the other two dependent variables are Rasch measures on the Possession Subscale and the Adequacy Subscale accordingly.

4.5.1 Gender, Grade and Location Differences in Students' Perceptions of "Importance"

Table 4.6 shows the descriptive data for students' perceptions of importance of core competencies in Rasch measures by grade, gender and location. The three-way ANOVA was run to examine the differences between grades (year 1 to year 4), genders (female and male) and locations (Zhejiang and Macau) in university students' perceptions of "importance". These results are presented in Table 4.7.

Table 4.6

Means (logit), Standard Deviations (logit) and Sample Size for "Importance"

		Zhejiang		Macau	
Grade		Female	Male	Female	Male
Year 1	Mean	1.85	1.62	1.58	1.70
	SD	1.39	1.45	1.32	1.56
	N	1395	630	149	90
Year 2	Mean	1.57	1.48	1.71	1.32
	SD	1.39	1.43	1.42	1.12
	N	528	362	171	103
Year 3	Mean	1.55	1.59	1.64	1.60
	SD	1.24	1.45	1.29	1.17
	N	429	239	220	84
Year 4	Mean	1.47	1.37	1.58	1.56
	SD	1.23	1.24	1.30	1.27
	N	227	172	108	88

Table 4.7

ANOVA Results on "Importance"

Source	Sum of squares	df	Mean square	*F*-value	Sig.	Partial η^2
grade	16.25	3	5.42	2.90	0.034	0.002
location	0.43	1	0.43	0.23	0.632	0.000
gender	4.85	1	4.85	2.60	0.107	0.001
grade*location	4.92	3	1.64	0.88	0.452	0.001
grade*gender	6.16	3	2.05	1.10	0.348	0.001
location*gender	0.01	1	0.01	0.01	0.941	0.000
grade*location*gender	10.91	3	3.64	1.94	0.120	0.001
Error	9309.70	4979	1.87			

As shown in Table 4.7, there is no significant main effect or interaction effect concerning grade, location and gender, except significant grade effect ($F = 2.90$, $p < 0.05$, partial $\eta^2 = 0.002$). Although the significant *F*-value denotes that students in different year levels may have different endorsements of important core competencies, the small partial η^2 value (Cohen, 1988) suggests that it is more reasonable to consider it as statistical significance

caused by the large sample size. Practically, there are no substantially significant differences in terms of gender, grade and location in the students' perceptions of importance subscale.

4.5.2 Gender, Grade and Location Differences in Students' Perceptions of "Possession"

Table 4.8 shows the descriptive data for students' perceptions of their possession of core competencies in Rasch measures by grade, gender and location. The three-way ANOVA was run to examine the differences between grades (year 1 to year 4), genders (female and male) and locations (Zhejiang and Macau) in university students' perceived "possession". The results are presented in Table 4.9.

Table 4.8

Means (logit), Standard Deviations (logit) and Sample Size for "Possession"

		Zhejiang		Macau	
Grade		Female	Male	Female	Male
Year 1	Mean	1.18	1.26	1.40	1.08
	SD	1.23	1.34	1.22	0.90
	N	1393	627	149	90
Year 2	Mean	1.42	1.14	1.65	1.62
	SD	1.30	1.55	1.14	1.35
	N	525	359	172	103
Year 3	Mean	1.35	1.29	1.70	1.69
	SD	1.24	1.35	1.18	1.23
	N	429	238	219	84
Year 4	Mean	1.59	1.62	1.71	1.61
	SD	1.09	1.17	1.10	0.91
	N	227	172	108	88

Table 4.9

ANOVA Results on "Possession"

Source	Sum of squares	df	Mean square	*F*-value	Sig.	Partial η^2
grade	57.98	3	19.33	12.16	0.000	0.007
location	27.60	1	27.60	17.37	0.000	0.003
gender	5.25	1	5.25	3.30	0.069	0.001
grade*location	19.05	3	6.35	4.00	0.007	0.002
grade*gender	1.81	3	0.60	0.38	0.768	0.000
location*gender	0.47	1	0.47	0.30	0.586	0.000
grade*location*gender	10.80	3	3.60	2.27	0.079	0.001
Error	7894.33	4967	1.59			

As shown in Table 4.9, there is a significant grade effect ($F = 12.16$, $p < 0.01$, partial $\eta^2 = 0.007$) and a location effect ($F = 17.37$, $p < 0.01$, partial $\eta^2 = 0.003$) in the main effects, and a significant interaction effect of the grade by the location interaction ($F = 4$, $p < 0.01$, partial $\eta^2 = 0.002$) in the interaction effects. The interaction indicates that the differences in perceived possession of core competencies among year 1 to year 4 students are not the same for Zhejiang and Macau students. The comparisons are illustrated in Figure 4.10. For Zhejiang students, the scores of perceived possession gradually increased in the first three year levels, followed by a sharp increase in the last year. For Macau students, there is a sharp increase from year 1 to year 2, a slight increase in year 3, then a slight decrease in year 4. The differences between Macau and Zhejiang students are much larger in year 2 and year 3 students than in year 1 and year 4 students. Since all these effects have small partial η^2 values (Cohen, 1988), the significant effects are considered statistically significant, and caused by the large sample size. This indicates that there are no substantially significant differences in terms of gender, grade and location in the students' perceptions of the possession of core competencies for the twenty-first century.

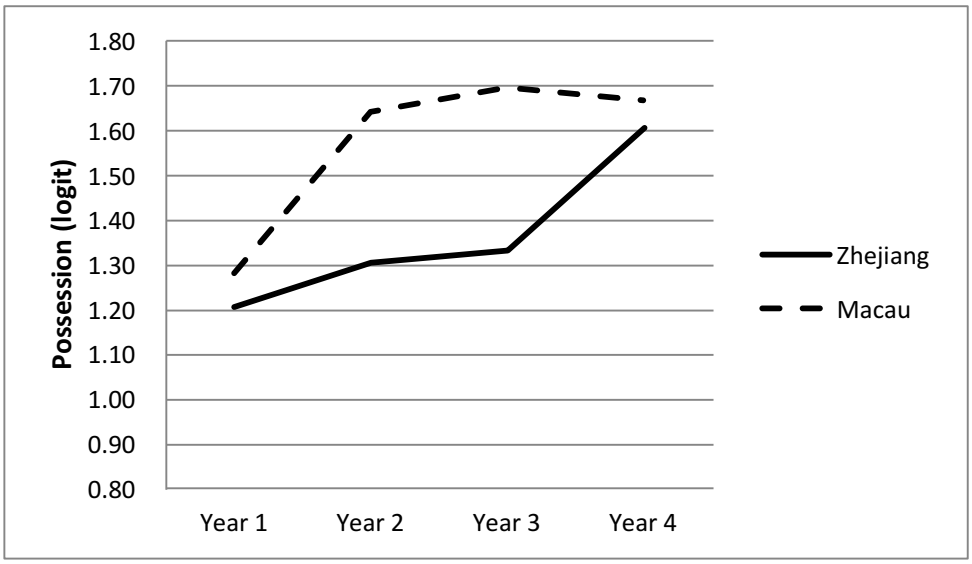


Figure 4.10. Compare "Possession" by grade and location

4.5.3 Gender, Grade and Location Differences in Students' Perceptions of "Adequacy"

Table 4.10 shows the descriptive data for students' perceptions of "adequacy" in Rasch measures by grade, gender and location. The three-way ANOVA was run to examine the differences between grades (year 1 to year 4), genders (female and male) and locations (Zhejiang and Macau) in university students' perceived adequacy of university education. The results are presented in Table 4.11.

Table 4.10

Means (logit), Standard Deviations (logit), and Sample Size for "Adequacy"

		Zhejiang		Macau	
Grade		Female	Male	Female	Male
Year 1	Mean	1.52	1.49	1.17	1.12
	SD	1.69	1.78	1.31	1.46
	N	1389	628	149	89
Year 2	Mean	1.49	1.00	1.19	1.00
	SD	1.87	1.75	1.18	1.70
	N	525	359	171	103
Year 3	Mean	1.05	1.07	1.16	0.47
	SD	1.61	1.71	1.49	1.62
	N	427	238	219	84
Year 4	Mean	1.20	1.08	1.14	0.83
	SD	1.53	1.56	1.38	1.26
	N	226	172	108	87

Table 4.11

ANOVA Results on "Adequacy"

Source	Sum of squares	df	Mean square	*F*-value	Sig.	Partial η^2
grade	60.31	3	20.10	7.32	0.000	0.004
location	34.88	1	34.88	12.70	0.000	0.003
gender	36.67	1	36.67	13.35	0.000	0.003
grade*location	5.33	3	1.78	0.65	0.585	0.000
grade*gender	11.66	3	3.89	1.41	0.237	0.001
location*gender	4.21	1	4.21	1.53	0.216	0.000
grade*location*gender	24.06	3	8.02	2.92	0.033	0.002
Error	13620.62	4958	2.75			

As shown in Table 4.11, there are significant main effects including grade effect ($F = 7.32$, $p < 0.01$, partial $\eta^2 = 0.004$), location effect ($F = 12.7$, $p < 0.01$, partial $\eta^2 = 0.003$), and gender effect ($F = 13.35$, $p < 0.01$, partial $\eta^2 = 0.003$). There is no significant interaction effect except

for the grade by the location by the gender interaction ($F = 2.92$, $p < 0.05$, partial $\eta^2 = 0.002$). Similar to the previous results, the partial η^2 value of each effect is small (Cohen, 1988), which suggests that the significant statistical differences are caused by the large sample size. It is reasonable to establish that there are no substantial differences in perceived adequacy of university education among university students of different grades, locations and genders.

4.6 Summary

In summary, this section has explored university students' perceptions on the importance of core competencies for the twenty-first century, the possession of these core competencies, the perceived adequacy of university education in developing these core competencies, the relationships of these three aspects of students' perceptions, and the differences in terms of gender, grade, and location on these three aspects, respectively. Analysis on the quantitative data found that students attached great importance to core competencies listed in the 21CCCUE scale, perceived themselves as having possessed most of these competencies to some extent, and showed a certain extent of recognition that their university education cultivated these competencies in their graduates. The qualitative interviews with university students and teachers have provided more detail to deepen the understanding of the quantitative survey. Students' perceptions on the importance of core competencies have moderate correlations with the self-ratings on possession and the perceived adequacy of university education (0.76 and 0.62, respectively), while the possession and the perceived adequacy have low associations (0.24). Specific competencies under these three relationships were reported. There were no substantial differences in terms of gender, grade and location in students' perceptions on the above three aspects. A discussion and conclusions are presented in the following chapter.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

The current study used surveys and focus group interviews to investigate university students' perceptions of core competencies for twenty-first century university education. The investigation comprises three main components, namely, the importance of core competencies, the self-rating of possessing core competencies, and the perceived adequacy of university education in developing core competencies. Then, the relationships of students' perceptions on the above three aspects were summarised, and the impact of gender, grade and location differences on the students' perceptions of these three aspects were reported. Explorations of the five research questions worked together to provide a relatively holistic and comprehensive picture of students' perceptions of core competencies for twenty-first century university education. Based on the explorations, several implications are particularly meaningful and are discussed below.

5.1 Students' Role in Determining the Development of Core Competencies in Themselves

One of the features in the current study is exploring the core competencies of university graduates in the twenty-first century from the students' perspective. It has been widely criticised that, in China, neglect of the principal status of students made them miss out on several opportunities to improve their abilities and caused inefficient education (Yao, 2010; Zheng, 2013). Similarly, the lack of a common understanding of target competencies between universities and their students will inevitably lead to unfavourable results. This study tried to take students' viewpoints into account, not only because university students are capable of

actively participating in any decision-making on their own development, but also because students' perceptions are an important supplement to the institutional system.

5.1.1 Students' Identity: Participants versus Onlookers

For long time in Chinese university education, the target competencies, as well as other educational objectives such as graduate attributes, have been determined by academic staff but unknown to students, and in some ways, they eventually turned out to be a mere formality. It is unreasonable to consider developing competencies in students when the students know little about what competencies are going to be developed in them. The students' lack of understanding and identifying the target competencies has been recognised as one of the main causes leading to inefficient development of these competencies within them (Green, Hammer, & Star, 2009). Gaps exist between different perspectives of institutional systems and individual students (Haigh & Clifford, 2011).

Although taking the academic experts' perspectives is currently dominant in Chinese universities, it is inappropriate that graduate competencies are solely determined by the institutional system. "The student as active agent" has been highlighted in the relationships students have with their learning environment (Chang & Strauss, 2010; McKenzie, 2003); however, it remains merely a slogan in many educational situations. Students rarely develop their competencies which are wholly identified and operated by exterior systems or experts (Su, 2014). University education should turn its focus to an agenda that encompasses the student's personal responsibility for the betterment of authentic development of core competencies, which can only be fulfilled when students assume the role of active

participants rather than onlookers. This study aims to collect information from a grassroots perspective which is necessary and important supplement for university authority.

5.1.2 Students' Perspective: Important Supplement to the Institutional System

The students' perspective is very important because students are the key stakeholders of education. Filling the gap in the literature on the "missing perspective" (Tymon, 2013, p. 849) of tertiary students regarding core competencies for the twenty-first century is one of the foci of this study. When university students assume the active participant role in their competency development, their perspectives will be important supplements to the institutional system in setting relevant educational objectives, curricula and pedagogical strategies. In the current study, the investigation of students' perspectives on core competencies for the twenty-first century provided important information about how they perceived these competencies and whether they have been well-prepared by their universities for the challenging future in a new era, which can also serve as factual basis for relevant institutional policy-making and instructional planning and implementation.

5.1.2.1 Information from Students' Perceptions of Core Competencies for Twenty-first Century University Education

In this study, students showed their concern about core competencies for the new era. First, in general, university students attached high importance to all six domains of core competencies that have been highly recommended in the literature (Binkley et al., 2012; Delors et al., 1996; OECD, 2010; Rychen & Salganik, 2003; Stein, 2000; Wiek et al., 2011). This can also be seen in the qualitative results. Competencies proposed by student interviewers were mainly

located in the above six domains. The students' agreement on the importance of core competencies in this study confirms the predictions in RQ1 (see Section 2.11.2) and indicates that they have the ability to reach a consensus on identifying important competencies with top researchers and educators. It is also solid evidence of the appropriation of students' being participants in determining their own educational targets and relevant events. Meanwhile, students perceived themselves as having acquired most of the competencies to some extent, but their evaluation of university education in developing core competencies was less positive. It should not be too optimistic about the high self-rating scores on each competency, since the evidence shows that self-assessment generally tends to overestimate (Breidert & Fite, 2009; Mattheos, Nattestad, Falk-Nilsson, & Attstrom, 2004). Nevertheless, students' discontent about the effectiveness of university education in developing certain amount of core competencies is consistent with the negative comments on the quality of university students from experts and the public (Yang & Lin, 2014). More effort should be made to develop core competencies in graduates through university education, which will be elaborated in subsequent sections.

Second, students considered competencies in the domains of *Interpersonal Communication* and *Character and Civic Literacy* as most important, while they rated themselves the best candidates in possessing these competencies than other competencies such as *Basic and Professional Knowledge*, *Self-directed Learning*, *Creativity and Problem Solving*, and *Global and International Perspective*. As studies reported, communication competencies are extensively regarded as a necessary and essential factor to succeed in school and career (Koponen, Pyörälä, & Isotalus, 2010; Troth, Jordan, & Lawrence, 2012), and positively related to an individual's emotional intelligence, collaborative conflict resolution and social cohesion (Jordan & Troth, 2004; Troth, Jordan, & Lawrence, 2012). Character and civic

competencies are also considered major goals of education (Berkowitz, 2012) and related to merits such as positive personality, morality, humanity, honesty and justice (Lickona, 2001; Sessink, Toon, & Wesley, 2010). These two domains of competencies are highly valued as indicators for twenty-first century core competencies by countries and organisations (Binkley et al., 2012; Delors et al., 1996; Rychen & Salganik, 2003; Wiek et al., 2011). Surveys done in Hong Kong (Education Bureau, 2010) and mainland China (Xiao, Liu, & Dai, 2008) also reported the similar findings from the perspective of employers. It is comforting that, in China, the long-cherished traditional virtues such as good character and moral standards are still valued by today's university students, and are even regarded as the most important competencies. In addition, competencies such as "Attitudes of respect and tolerance", "Ability to work in a team", "Humanities and art appreciation", "Verbal ability", "Empathy and moral standards", "Ability for value judgments" and "Sense of responsibility" are highly valued, which implies that contemporary students generally have high interpersonal awareness and moral civil consciousness. This result is not only in line with the previous research, but also meets the social expectation for high quality graduates with all-round development in China (Yang, 2013; Zhang et al., 2012).

Third, students gave high (but not the most) importance to the competence groups of *Basic and Professional Knowledge* and *Self-directed Learning* and rated themselves at the medium level of mastery. These two domains of competencies are also highly recommended as indicators for twenty-first century core competencies (Binkley et al., 2012; Delors et al., 1996; Rychen & Salganik, 2003; Wiek et al., 2011). Students' ratings show that modern university students still pay attention to knowledge and scientific learning methods, which conforms to the demands of the new era requiring graduates to possess sufficient knowledge and adopt life-long learning. It is encouraging to see that university students give priority to

character and morality over knowledge. For a long time, the classical Confucian saying "a good scholar will make an official career (學而優則仕)" has encouraged generations of young people to invest their energy in study, to gain as much book knowledge as possible. The traditional teaching model in China has emphasised the accession of knowledge and ignored other aspects of talent cultivation (Guo & Nie, 2014; Ma, 2006; Zheng, 2013). The university is compared to the temple of knowledge, in which knowledge accumulation and sharing is the top priority. Recently, there has been increasing criticism of the traditional overemphasis on subject knowledge within the area of university education. Concerns arise about the quality of university students, and educational reforms are planned and practised under the government's support (MOE, 2012). As young university students in the twenty-first century, they should integrate new psychological and ideological changes caused by the new era and present new features of quality valued by society.

Fourth, the relatively low importance (perceived as desirable, but not essential) was given to the competence domains of *Creativity and Problem Solving* and *Global and International Perspective*, and these two domains were also rated as the lowest level of mastery among the six domains. It is not surprising that creativity and problem solving, which have been widely accepted as essential competencies for modern society (Chaudhry & Rasool, 2012; Pellegrino & Hilton, 2012) and may be one of the most popular research and education reform topics in recent decades in China, ranks lower than some core competencies such as basic and professional knowledge. Since in Chinese university, the excessive emphasis on subject knowledge has caused the ignorance of other aspects of students' development (Ma, 2006; Yao, 2010; Zheng, 2013). Although there are studies and education reform concerning students' creativity and problem solving skills, maybe the emphases from researchers and educators have not turned into students' needs. It echoes the view that there are gaps between

perspectives of the institutional systems and those of individual students (Haigh & Clifford, 2011). Another obvious reason, mentioned earlier in this chapter, is that all six domains of competence are highly valued and recommended according to the existing literature. That is to say, although creativity and problem solving competencies are very important core competencies for twenty-first century university education, it is possible that other competency domains may be perceived as more important. The same reason could be used to explain why the global and international perspective is in last place. In addition, although the competencies of globalisation and internationalisation have attracted worldwide attention and affected national politics, economy and culture (Brodin, 2010; Li, 2013), they may have little effect on university campuses and students because of the exclusivity of the university. Another explanation is provided by one of our teacher interviewees who remarked that students are too short-sighted to realise the importance of the global and international perspective because they live in a small and affluent place. No matter what the exact reason is, educators in university education should pay more attention to those competencies the students underestimated and that are lesser-developed, but which they consider more important than their students.

Fifth, when asked about the adequacy of university education in developing these competencies, students ranked the competence group of *Basic and Professional Knowledge* as the most appropriately cultivated competency. This is in line with the traditional image of the university as a seat of learning, in which knowledge accumulation and sharing is the top priority. Nevertheless, it also reflects the problem of paying too much attention to theoretical knowledge imparted at the cost of ignoring other aspects of education, such as *Creativity and Problem Solving*, which was ranked as the less-developed competence group in this study. The far below average score of this competence domain reflects the imperfect university

education system in China in which their graduates have been criticised as lower quality (Ma, 2006; Yao, 2010; Yang & Lin, 2014). The *Character and Civic Literacy* competencies, which have been challenged and attacked as another drawback of university education, were also rated as one of the less-developed competence group in this study. Though character and civic education have been considered as major goals of education (Berkowitz, 2012) and especially valued by Chinese traditional culture, they are often overlooked in university education (Zheng, 2013).

Finally, some new competencies were suggested by interviewees as important for twenty-first century university education, which would inform the institutional system when doing and reflecting on the conceptual work of core competencies. For example, physical fitness was emphasised by both student and teacher interviewees. Considering the increasing number of pampered single children because of China's one-child policy, it is insightful to suggest that more attention should be given to building a strong body.

5.1.2.2 Information from the Relationship between Students' Perceptions

This study also reported on the relationship between students' perceptions on the importance of competencies and self-rating, the relationship between students' perceptions on the importance of competencies and university education, and the relationship between students' perceptions on self-rating and university education. These relationships showed the specific location of each individual competency listed in the 21CCCUE scale, representing a holistic picture of the status quo of these competencies from the university students' perspective, which could be used to guide and reflect university education and instruction on the development of core competencies.

Three types of competence are noticeable: competencies perceived as important but not sufficiently possessed, competencies perceived as important but not adequately developed, and competencies perceived as neither sufficiently possessed nor adequately developed. The first type of competence indicates the insufficiency of university students which should be the main matter of concern. In this study, competencies including “Professional knowledge”, “Capacity for independent study”, “Set learning goals and strategies” and “Open vision” belong to this type. It is surprising to see that “Professional knowledge” was perceived as the most important but not sufficiently possessed competency among these four competencies. Different from the external comments, such as those from university teachers and employers (e.g., Cheng et al., 2011; Xiao et al., 2008), university students might not seem too confident about their knowledge. Cheng et al. (2011) also reported similar findings: Professional knowledge was perceived as one of the most required but lacking competencies. An explanation for this phenomenon may be that students tend to gradually realise their inadequacy as their professional knowledge increases.

The second type of competence reflects certain negligence of university education. As Bok (2006) criticised, university education has done little to increase the effectiveness of teaching and learning, and neglected the development of mind and character of their students. In this study, competencies including “Ability to manage emotion”, “Respect human rights and freedom”, “Empathy and moral standards” and “Decision making” are in this type. This is a reminder that universities should take responsibility for cultivating their students’ character and competencies of interpersonal communication.

The third type of competence represents those competencies that students are not good at, but may be crucial to their life. As young adults, students may underestimate the importance of certain competencies. Therefore, competencies located in this type should not be ignored. In this study, such competencies includes “Creativity”, “Self-potential development”, “Attitude for innovation and change”, “Adventurous spirit”, “Familiar with international affairs”, “Concept of global village”, “Capacity for empirical deduction”, “Capacity for IC application”, “Reflect on learning effectiveness”, “Manage learning environment”, “Decision making”, “Ability to assess learning outcomes”, “Humanities and art appreciation” and “Practise democracy and justice”.

5.1.2.3 Information from Differences in Terms of Gender, Grade and Location in Students’ Perceptions

The detection of gender, grade and location differences in university students’ perspectives on core competencies for twenty-first century university education suggested that there were no substantially significant differences, indicating that university students of different genders and in different grades and locations hold similar attitudes towards core competencies of twenty-first century university education.

The similar attitudes between the two genders may suggest that, along with the increasing gender equality in society, male and female undergraduates who received a similar education produce similar ideas and attitudes towards core competencies of twenty-first century university education.

Different from the prediction in RQ5 (see Section 2.11.2), there are no substantially significant differences in locations. This may suggest that both Zhejiang and Macau are prosperous coastal places in China and their university students have a certain degree of homogeneity, at least in their attitudes towards core competencies of twenty-first century university education.

As for the similar attitudes between different grades, it is possible that students in different grades attach similar importance to certain competencies and perceive their university education similarly in developing core competencies. Nevertheless, different from the prediction in RQ5 (see Section 2.11.2), it is unreasonable that students in different grades have similar scores in the assessment of possessing the competencies. If there is no difference in mastering core competencies in different grades, what is the effectiveness of university education? A defensive claim is that self-assessment may lead to biases (Leach, 2012). For example, students in lower grades may overestimate their competencies because of immaturity, and senior students may underestimate their competencies along with their increasing knowledge and social experiences. Therefore, there could be no significant differences in grades after taking the average. Regardless, there is the possibility that the effectiveness of university education is not as good as expected.

In conclusion, in this study, students' perceptions on core competencies for twenty-first century university education provided a wealth of valuable information which should not be neglected when relevant educational objectives, curricula and pedagogical strategies are determined by the institutional system. Certainly, it is true that the students' perspectives may have some limitations and even biases; however, that is precisely why the students' perspectives serve as supplements to the institutional system, rather than being considered the

primary viewpoint. Even with limitations and biases, the information is still meaningful and helpful for institutional systems to gain insight into the real situation of their educational objectives and to take action accordingly.

5.2 Implications for Selecting and Developing Core Competencies of Twenty-first Century University Education in China

The graduates' competencies are one of the core concerns of every nation's university education. In order to give our youth a stake in the promise and future of our country, it is imperative to set high standards for twenty-first century university education. A rational framework of core competencies provides a solid conceptual underpinning for educational efforts to cultivate and assess the competencies of graduates. In this research, based on Bronfenbrenner's (1994) ecological theory of human development and the existing literature on core competency frameworks for university students and adults (Ananiadou & Claro, 2009; Binkley et al., 2012; Delors et al., 1996; OECD, 2010), a framework including six domains of core competencies under developmental and ecological perspectives was developed. It is a beneficial attempt to explore core competencies for twenty-first century university education.

5.2.1 The Principles and Ways to Select Core Competencies for Twenty-first Century University Education in China

Selecting appropriate competencies to construct a viable competency framework is important but difficult. There is no fixed set of competencies which can be applied to all universities at all times, especially in the ever-changing era of the twenty-first century. The importance of

competencies may vary from time and place, but relatively, certain competencies may be of prime importance for a successful life and a well-functioning society (Rychen & Salganik, 2003). With regard to selecting competencies to construct an appropriate core competence framework for twenty-first century university education, it is necessary to make the following proposals of principles and ways.

The first is the principle of comprehensiveness. There are several meanings in elaborating this principle. First, it relates to the concept of competence. In the context of university education, a competency means the ability to perform successfully in a particular context through intentional cognitive and/or non-cognitive interactions. Four characteristics have been summarised in this research (see Section 2.2), including integration, intentionality, situationality and learnability. Here, the characteristic of integration means that competence always appears as an integrated set of knowledge, skills and attitudes, including both cognitive and non-cognitive. It embodies the comprehensive understanding of competence. Second, it relates to the comprehensiveness of the representativeness of selected competencies. An ideal competency framework should have adequate and accurate coverage of important competencies for university graduates' current academic success, personal excellence, and future social contributions. The comprehensiveness principle does not mean including every competency which may be important in certain fields of life; however, it indicates a relatively complete set of core competencies underpinned by a certain solid theoretical framework. Moreover, according to the real situation of each university, the institutional system can make adjustments by adding or removing certain competency domains. In this study, the six domains of core competencies ranging from basic knowledge to the global perspective have represented a holistic set of indicators of the current research. Because there were several universities included in the study, the character of each individual

university was not considered. Actually, according to the interviews with university teachers and students in this study, the university can add the competence group of physical fitness as one of the important competencies if the university authorities consider that physical fitness has been severely ignored by today's youth.

The second is the principle of feasibility. This principle can be viewed from two aspects. First, it relates to the characteristics of the concept of competence, just as the comprehensiveness principle does. One of the characteristics of the concept of competence is learnability, which means the competency selected for university education is suitable for teaching and learning. That is to say, it is feasible for university education to encourage students to study and teachers to teach to develop target core competencies. In addition, the feasibility principle is also reified in selecting competencies from a practical standpoint based on the development of individuals and society. It requires university authorities to have a full understanding of their students, as well as the needs of society, and moreover, to stick to its own ideas and transfer them into daily teaching. On the one hand, a target core competency should be addressed as specific and observable learning outcomes from the reality of the student learning experience. On the other hand, each competency should be measurable in the assessment of learning outcomes as well as the progress students make. The feasibility principle carries through the whole process of core competency selection and cultivation, involving many complex technical problems in curriculum and instruction. It is difficult to implement and to evaluate the effect, and further studies are needed to fulfil efficient practices of this principle.

The third is the orientation principle. The aims of university education in developing graduates' core competencies are to prepare university students for their present and potential

success in study and life, as well as in their future work. Universities should be forward-looking and thoughtful in selecting core competencies, ensuring that the selected target competencies will play an active leading role in their students' potential development. It also requires university authorities to have a full understanding of their students, as well as the needs of society, and what is more, to stick to its own ideas and refuse to drift blindly with the current. In this research, three identification criteria of core competencies for university education have been adopted (see Section 2.3).The criteria suggest that graduate students with core competencies should: (1) have good survivability and sustainability; (2) be capable of making significant contributions to human society; and (3) have their own characteristics and unique values. These criteria could serve as positive guidance for universities to select core competencies for their students. Besides, the Bronfenbrenner's model (1994) revealed the nature of the individual-environmental relationship. Different competencies should be emphasised in different stages of life. The conceptual framework of this study also provided conceptual guidance for selecting and considering the list of competencies for the twenty-first century undergraduates.

5.2.2 Implications for Developing Core Competencies in Twenty-first Century Chinese University Students

After selecting appropriate core competencies for twenty-first century university education, ultimately the concern turns to the development of core competencies in university students. Chinese society needs our universities to expand their single emphasis on subject-matter knowledge to include more personality-driven competencies, which is just as our teacher and student interviewees suggested in the current study. In this research, the overall evaluation of the adequacy of university education in developing core competencies in their graduates is

not very encouraging. Among 40 items listed in the 21CCCUE scale, only 19 got the above average score, which means university education is "reasonably helpful" and "very helpful" in developing these competencies. Even the highly-appraised item, for example, "Ability to work in a team", is quite disputable for surveys showed disagreements from contemporary employers (Guo, Guo, & Li, 2014; Jin & Zhang, 2014) and university educators (Li, 2011; Shen et al., 2006). It is an undeniable fact that competencies such as "Imagination", "Adventurous spirit" and "Creativity", which have been rated as the least-developed competencies in university education, are difficult to cultivate under the routine university curriculum, for the pattern of university courses is singular, while theory is separate from practice (Liu & Lv, 2013). To achieve more holistic and broad humanistic goals with a real-life orientation (Rychen & Salganik, 2003), university authorities should develop students' competencies not from an individual and static perspective, but an ecological and developmental perspective.

The conceptual framework of this study provided such an ecological and developmental perspective. In the ecological model of competence development, students acquire and develop each core competency through interaction with different environmental settings, from the microsystems such as family, peer group and university, to the mesosystems where the microsystems interact with each other, to the exosystems which include wider contexts such as different kinds of community and societal influences, to the macrosystem which represents influences at the national and international levels. The development of core competencies is facilitated by these environmental settings and their interactions, and is limited by these environmental settings at the same time. For example, if students have little interaction with the environment outside their microsystems, their corresponding competencies dealing with these environmental settings may not be well-developed, and even

the importance of these competencies will be underestimated. In this study, among the six domains of core competencies, students rated the global and international perspective as least important. From the ecological and developmental perspective, this can be explained by our university campuses being too isolated to allow students to contact the world outside. Students lack the opportunities to become familiar with international affairs, to exercise their foreign language, and to learn about other cultures. The ecological and developmental perspective can also explain why student interviewees would propose competencies such as "Physical fitness", "Ability to maintain a family" and "Drive skills" as important core competencies for the twenty-first century. Obviously, these competencies are all related to students' personal concerns, locating in the close and direct ecological systems.

Developing core competencies must be viewed as an important educational objective, whereby universities should provide opportunities and a learning environment conducive to the development of new competencies and the exercise of old competencies. Universities should also encourage their students to take the initiative to engage in voluntary work, public events and social activities, which provide opportunities for students to interact with outside ecological subsystems and gain more experiences. In the process of developing core competencies, the characteristics of the concept of competence should be taken into account. Integration and learnability, two of these, have been illustrated in the above section when talking about the principles and ways to select core competencies to construct a rational framework. The remaining two, intentionality and situationality, are related to the cultivation of core competencies. Intentionality denotes that students should learn and apply competencies purposively, and it also refers to intentional teaching in which the development of competencies is expected and designed by university teachers. Therefore, in the curriculum reforms of university education, it can be a guideline for curriculum design and

implementation. Situationality means that the demonstration of competencies is context-dependent (Kim et al., 2007). A specific context is indispensable when a competency performs its function. Accordingly, this suggests that when developing a new competency in students, or exercising an old one, it is imperative to include an appropriate situation. The development of competencies cannot be activated by any rote learning; instead, they need intentional mental practice combined with a specific situation.

Such a perspective is inconsistent with Bandura's social cognitive theory (Bandura, 1986, p. 23–26; 1992), in which three determinants, namely, behaviour, personal characteristics, and environmental influences, constitute triadic reciprocal causation and interact with each other. In the development of students' competencies, students' characteristics such as beliefs, expectations, emotional inclinations, knowledge and skills create the social environment and are also developed and modified by social influence. The students' behaviour, which changes the environment and is also altered by changing environmental conditions, influences their development of competencies directly and indirectly. Since the individual-environmental interactions play a key role in competence acquisition and development, universities should enhance their function of environment building, including the "hardware" (for example, the number of multifunction classrooms, the venue for sports activities, and the accessibility of the library system) and the "software" (for example, effective teaching methods, positive interactions between teachers and students, and a good learning atmosphere). In Chinese universities, the building of the "hardware" environment is much easier when the community is affluent and the development of university education is highly valued. However, the building of the "software" environment are long-term goals involving various efforts.

5.3 Limitations and Implications for Further Research

In this study, several limitations warrant attention. First, the study focuses on several public universities in Zhejiang Province and Macau. Macau and the selected cities in Zhejiang Province are all affluent cities with high economic development. Their public universities are at the upper levels in the whole country. Although the sample size of the study is relatively large and the participants, to a certain extent, represent the students at selected universities, caution should be paid when generalising the results to other types of universities or in different regions. Second, this study adopted a self-report questionnaire in order to gain comprehensive opinions from the students' perspectives. One of the main advantages of this method is saving time and labour, while the cost is a lack of precision and accuracy. For example, the self-report bias is often observed (Donaldson & Grant-Vallone, 2002; Mattheos et al., 2004). Although a psychometric approach, such as performance testing, is regarded as more objective and precise, it is unfeasible when a large number of competencies are tested simultaneously. Not to mention that the existence of acknowledged instruments for some of these competencies are lacking, such as "creativity". Thus, another challenge in practice is to design appropriate measures for different assessment goals. In addition, another methodological issue is the use of Likert-type items. Since all 40 items listed in the 21CCCUE scale are very important competencies according to the existing literature, most of these received the highest scores when university students were asked to rate the importance of each competency. Consequently, the importance subscale demonstrated high ceiling effects in university students. To make up for the disadvantages caused by the instrument, this study adopted a mixed methods research design to include in-depth interviews with the university students and teachers, and the Rasch rating scale model to analyse the data. The Rasch model allows for the estimates of personal ability and item difficulty to be compared (Embretson,

2006), which leads to objective assessments. However, care should be taken in interpreting these results, and further efforts are needed to develop more effective measures with high validity and reliability.

5.4 Conclusion

In the ever-changing society of the twenty-first century, a holistic and deep understanding of the development of graduates' competencies in university education is imperative to grasp the international situation and enable more appropriate and effective university education to bridge the gap between the present and the future. This study aimed to explore university students' perceptions on core competencies for the twenty-first century, including their perceptions on the importance of the core competencies, their self-ratings of possessing the core competencies, and the perceived adequacy of university education in equipping their students with the core competencies. A mixed methods research design was adopted, in which a cross-sectional survey research using a self-report questionnaire involving 40 Likert-type items was used to collect data from 5,042 public university students in China, and four focus-group interviews with university students and eight face-to-face interviews with university teachers were conducted. All participants in this study participated voluntarily.

Analysis with the Rasch rating scale model found that in each subscale, the data fit the Rasch model well, the reliability of the scale was good, and substantial differential item functioning items were detected by gender and location, respectively. The analysis gave a profile of university students' standpoints on the importance of competencies for the twenty-first century, self-ratings on these competencies, the perceived adequacy of university education in cultivating these competencies, and the relationships between these three aspects of students'

perceptions. The results found that students attached great importance to almost all the core competencies listed in the questionnaire, perceived themselves as having acquired many of these competencies to some extent, and considered their universities to be only mildly effective in developing most of the competencies explored in this study. The qualitative interviews with university students and teachers supported the quantitative survey. No substantial differences were found in the above three aspects of the university students' perspectives in terms of the students' different genders, grades and locations. Based on these findings, some discussions were conducted, in which the importance of the students' role was emphasised in determining the development of core competencies in the students themselves, and implications of how to select and develop core competencies for twenty-first century university education in Chinese university students were suggested. The major findings and implications for practice should contribute to the theoretical research and policy making to enhance the quality of university students. Finally, the study's limitations and recommendations for further research were suggested.

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Appendix: 21CCCUE Questionnaire

21 世纪本科教育核心素质之调查研究量表【大学生】

亲爱的同学：您好！

本问卷内容是为了解您对大学本科学生的「核心素质」所持态度的意见调查，本问卷并没有特定的答案，调查结果仅供学术研究及提供课程建议参考，请您根据实际情况和真实感受逐题填答。问卷上不必具名，请放心填答。

您的宝贵意见将对本研究帮助很大，在此谢谢您的合作。

敬祝

学安

香港教育学院
评估研究中心联席总监
莫慕贞教授　敬上
2011年9月

填答说明：请依序(1)、(2)、(3)栏，在适合您状况的选项打✓作答，并请不要遗漏任何题目。謝謝！

1. 以下哪些是大学生应具备的核心能力与素养？					2.您认为目前自己有没有具备以下的核心能力与素养？				3.本大学的课程能否帮助学生发展以下的核心能力与素养？			
可有可无	有会更佳	应该具有	非有不可	核心能力与素养	绝大部份没有	一般都沒有	一般都具备	絕大部份具备	沒有帮助	帮助很小	有点帮助	帮助很大
				1. 基础及专业能力								
☐	☐	☐	☐	a. 专业学识	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	b. 文字表达的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	c. 实证推理的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	d. 信息技术的应用	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	e. 逻辑分析的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	f. 批判思考的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	g. 决策判断的能力	☐	☐	☐	☐	☐	☐	☐	☐
				2. 创意与问题解决								
☐	☐	☐	☐	a. 创造力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	b. 自我潜能的开发	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	c. 想像力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	d. 敏锐的觉察力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	e. 求新求变的态度	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	f. 冒险挑战的精神	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	g. 问题解决的能力	☐	☐	☐	☐	☐	☐	☐	☐
				3. 人际沟通								
☐	☐	☐	☐	a. 尊重与接纳的态度	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	b. 口语表达的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	c. 聆听的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	d. 情绪管理的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	e. 团队合作的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	f. 领导协调的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	g. 人际互动的能力	☐	☐	☐	☐	☐	☐	☐	☐

1. 以下哪些是大学生应具备的核心能力与素养？					2.您认为目前自己有没有具备以下的核心能力与素养？				3.本大学的课程能否帮助学生发展以下的核心能力与素养？			
可有可无	有会更佳	应该具有	非有不可	核心能力与素养	绝大部份没有	一般都沒有	一般都具备	絕大部份具备	沒有帮助	帮助很小	有点帮助	帮助很大
				4. 品格与公民素养								
☐	☐	☐	☐	a. 正向的人格特质	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	b. 人文素养与艺术鉴赏力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	c. 同理心与道德观	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	d. 尊重人权与自由	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	e. 民主与法治的实践	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	f. 社会参与的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	g. 价值判断的能力	☐	☐	☐	☐	☐	☐	☐	☐
				5. 国际视野								
☐	☐	☐	☐	a. 外语的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	b. 开放的视野	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	c. 尊重多元文化	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	d. 熟悉国际时事	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	e. 地球村的概念	☐	☐	☐	☐	☐	☐	☐	☐
				6. 自主学习								
☐	☐	☐	☐	a. 独立研究的能力	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	b. 订定学习目标及策略	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	c. 掌控调整学习历程	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	d. 管理学习环境	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	e. 运用学习资源	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	f. 反思学习效益	☐	☐	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	g. 评估学习成果	☐	☐	☐	☐	☐	☐	☐	☐

第二部分：个人背景资料

填答说明：敬请在符合您实际状况的选项前方，打☑作答，并<u>请不要遗漏任何一个题目</u>。

1. 性别：☐ 男 Male　　☐ 女 Female

2. 您目前所属的院系

- ❑ 工商管理/财务企业/会计 Administration/Management/Business/Finance
- ❑ 艺术/视艺/新闻 Arts / Media
- ❑ 电脑/科学/科技 Computing / Science / Technology
- ❑ 教育 Education
- ❑ 工程 Engineering
- ❑ 农业/渔业/林业 Farming/ Fishing/ Forestry
- ❑ 语文 Languages
- ❑ 法律 Law
- ❑ 医药 Medicine
- ❑ 护士/护理 Nurse / Healthcare
- ❑ 心理 Psychology
- ❑ 服务/招待 Service / Hospitality
- ❑ 社会科学 Social Sciences
- ❑ 运输/材料搬运 Transportation / Material Moving
- ❑ 其他 Other: _____

3. 就读的年级别

- ❑ 大四 Undergraduate Year 4
- ❑ 大三 Undergraduate Year 3
- ❑ 大二 Undergraduate Year 2
- ❑ 大一 Undergraduate Year 1

谢谢您宝贵的意见！