Factors Contributing to Effective On-line Learning in a Hong Kong Higher Education Institution

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Abstract

Inspired by the difference between the findings of Wong (2008) and many other previous findings, the researcher adopted Creswell's (2009) sequential explanatory design of mixed methods, in which a quantitative phase was followed by a qualitative phase, to explore the factors which influence the learning effectiveness of the students taking an on-line introductory information technology course in a higher education institution in Hong Kong. Since the students using on-line education mainly learn by themselves through reading the on-line materials and discussing in the on-line discussion forums, the researcher was interested in exploring whether and how students' on-line learning performance is influenced by the three variables related to students' proficiency in English, the medium of instruction in Hong Kong higher education, for self-learning and discussion in on-line education system, namely (1) student's English proficiency, (2) instructor's guidance in on-line discussion forum and (3) peer students' collaboration in on-line discussion forum. In the first quantitative phase, correlation and multiple regression analyses were used in an analytical survey to examine the relationship between these three variables and students' learning performance as reflected by their test scores and explore how these variables interact. As a follow-up to have a better understanding of the quantitative findings, twenty-four participants were interviewed in the second qualitative phase. Interview transcripts were analysed by different coders and their findings were used in triangulating with quantitative results, together with inter-coder reliability testing and member checking in order to ensure the validity and reliability of the study. The results of both phases revealed these three variables have effect on students' on-line learning, with students' English proficiency being the most influential. These results were supported by students' perception and used to relate to suggestions for on-line education improvements.

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List of Acronyms and Abbreviations

×	By
√	The Highest Score Mark
| |	Symbol for Absolute Value e.g. |0.7| is the absolute value of both +0.7 and −0.7
[ ]	Symbol for Memos in Interview Transcripts
α	Cronbach's Coefficient Alpha or Krippendorff's Alpha
ANOVA	Analysis of Variance
β	Standardized Regression Coefficient
BEI	British Education Index
CMDS	Classical Multidimensional Scaling
CoI	Community of Inquiry
df	Degree of Freedom
ERIC	Education Resources Information Centre
HKALE	Hong Kong Advanced Level Examination
HKCEE	Hong Kong Certificate of Education Examination
IELTS	International English Language Testing System
IGC	Instructors' Guidance in On-line Discussion Forum
IT	Information Technology
MDS	Multidimensional Scaling
N	Sample Size
NUD*IST	Non-numerical, Unstructured Data * Indexing, Structuring, Theorizing
P-P	Probability Plot
r	Pearson Product Moment Correlation Coefficient
R^2	R Square

ΔR^2	Change in R Square
s	The Lowest Score Mark
SCD	Students' Collaboration in On-line Discussion Forum
SEP	Students' English Proficiency
SPSS	Statistical Package for the Social Sciences
SxTy	The Student x in Teaching Method y
v	The Number of Predictor Variables
VIF	Variance Inflation Factor
χ^2	Chi-square

Chapter 1

Introduction

1.1 Purpose of the Study

The students taking the on-line introductory information technology (IT) course offered by a Hong Kong higher education college (in short, the college) mainly learn by themselves through reading the materials in a medium of instruction (English) which may be less familiar to them as they usually use their mother tongue (Chinese) in their daily lives. Also, the students using this on-line course mainly construct knowledge by discussing in the college's on-line discussion forum. In these regards, the researcher was interested to see how the variables related to the students' proficiency in English and discussion in on-line education influence students' learning performance in on-line education.

The purpose of this study was to explore the impact of the three variables: (1) the students' English proficiency (SEP), (2) the instructors' guidance in an on-line discussion forum (IGD) and (3) the students' collaboration with one another in an on-line discussion forum (SCD) on the students' learning effectiveness in the on-line introductory IT course offered by the college. By understanding the impact, the researcher aimed to investigate how to develop effective learning in on-line education for the college.

1.2 Background of the Study

The emergence of the Internet in the 1990s led to the development of on-line education systems that facilitate distance learning. On-line education (or Web-based learning) involves using Internet technology to deliver contents to the learners. In a broader sense, on-line education is not only a Web-based content delivery but also encompasses all teaching and learning activities that take place via the Internet including on-line interactions among instructors and learners (e.g. sending and receiving emails, writing and reading blogs, posting messages in on-line discussion forums and meetings in real-time video conferencing).

The launch of on-line education affects different educational stakeholders. On the one hand, there are views against on-line education concerning, among other things, the role change between teachers and students and the new on-line education technologies. In on-line education, teachers assume the role of facilitators in helping students to take a more active role in developing their own learning process (Kim and Bonk, 2006). Students' active learning in on-line education is not only built through the help of facilitators, but also through the on-line discussion among students themselves (Esnault, 2008; King, 2001; Romiszowski and Ravitz, 1997; Williams et al, 2001). Also, the fast-advancing technology and innovation for on-line education systems including the Internet (e.g. Web browsing, Internet search engines, uploading and downloading between clients and Web servers, …), modern modes of communications (e.g. email, instant messaging, discussion forum, newsgroup, file sharing, …), Web 2.0 (e.g. information sharing through building and accessing blogs, youtube, wikis, …) and software technologies (e.g. simulations, animations, translation, …) increase the costs of on-line education system development (Schank, 2002) and challenge both teachers and students as they have to learn and keep up with the IT knowledge and skills constantly. Besides, there is no class interaction in on-line education which could make on-line education boring and ineffective, in that it is difficult to provide hands-on practice to students (Henderson, 2003), and it is not appropriate for laboratory exercises that require equipment, instruments and any necessary hardware and is not conducive to significant face-to-face exercises such as negotiating and sales training (van Dam, 2004).

On the other hand, there are opinions supporting on-line education because of its benefits of reducing the management costs in education (D'Angelo, 2003; Whalen and Wright, 2000) through, for instance, on-line registration, payment and enquiry, and rendering convenience and flexibility for students by way of easier access to on-line education system at any time, place and pace (e.g. Arbaugh and Duray, 2001; Henderson, 2003; Maki et al, 2000; Piccoli et al, 2001). The flexibility of study provided by on-line education attracts and encourages working adults to further their studies or take training in their own time.

No matter one is in support of or against on-line education, many surveys (e.g. Allen and Seaman, 2005; 2006; Fredericksen et al, 2000; Johnson and Aragon, 2003; Waits

and Lewis, 2003) have found that on-line courses and enrollments have proliferated in the last decade. Moreover, many researchers (e.g. Allen and Seaman, 2007; McCarthy and Samors, 2009) expect that on-line courses and enrollments will continue to accelerate.

There are many reasons for rapid increase in on-line courses. First, on-line courses can lead to reduced teaching and administrative costs as bona fide on-line courses should no longer warrant the employment and deployment of teachers and classrooms (Whalen and Wright, 2000). Second, these courses attract students around the world and increase student enrollment (Witkowsky, 2008). Third, they make the management of educational processes more efficient and streamline management processes through remotely distributing and accessing teaching materials (Keeton et al, 2002; Mayes and de Freitas, 2004). Because of the advantages of on-line education, the college has decided to implement on-line education for some courses in a pilot phase. The on-line introductory IT course was first lauched in 2005.

1.2.1 The College

The college was established in 2001 under the auspices of a university in Hong Kong. It is a self-financed post-secondary institution offering 2-year Associate Degree and 2-year Higher Diploma programmes. The college offers a wide variety of programmes available in domains including arts, accounting and finance, business management, marketing, hospitality management, financial and investment planning, psychology, social welfare, translation and interpretation, language and culture, engineering, information technology, science, health studies and design. The college's target students are predominantly form 7 graduates from secondary schools.

In Hong Kong higher education, the medium of instruction in classroom teaching and on-line education is mainly English, which may be less familiar to most students as they are typically native Chinese speakers (Gibbons, 1987). In accordance with Johnson et al (1993), there are two main recommendations for bilingual education, which is learning through a language that is not the learners' first language (or mother tongue), in the context of Hong Kong higher education. First, the Hong Kong Government believes that a high standard of English helps to maintain the international trading power in

Hong Kong and using English as the medium of instruction helps to keep the local standard of English high (Education Commission, 1996; 1999). Second, students can grasp the primary significant studies in many disciplines, mostly written in English, if they are proficient in English and conducting their education in English can lead to their English proficiency (Li et al, 2001). In view of these recommendations, the college students use English as the primary language for learning. In the college, barring programmes focusing on languages other than English, the medium of instruction used in lectures is English and the teaching materials including on-line notes and books are written in English.

1.2.2 The Course

As a compulsory subject for many programmes, most of the college students are required to take the introductory IT course, which the college offers in two semesters every academic year, with each semester lasting for 14 weeks. The college students can take the introductory IT course in either semester 1 or semester 2 in the first year of their studies.

The topics of this introductory IT course emcompass six areas, namely “Introduction to Information Technology”, “Hardware Technology”, “Software Technology”, “Communications Technology”, “End-User Computing Skills” and “Information Systems in Daily Life”. The topic “Introduction to Information Technology” involves concepts of data and information processing, an overview of computer technology as well as associated concepts such as data versus information, binary operations and encoding schemes, and classification of computer systems. “Hardware Technology” introduces processing technology, storage technology, input technology and output technology whereas “Software Technology” covers software like operating system, utilities, application software and its classification as well as distribution. “Communications Technology” covers the essentials of networking, networking-related hardware and software, Internet features and resources, World Wide Web and browsers. In “End-User Computing Skills”, this introductory IT course discusses word-processing, spreadsheet processing, file processing and database handling, and working with presentation software. “Information Systems in Daily Life” covers the concepts of information systems and different types of information systems.

This introductory IT course aims to help students to obtain IT knowledge and apply IT concepts, use and develop end-user computing skills in their daily lives and workplaces. Upon successful completion of this course, students should be able to understand and evaluate the IT concepts and applications, analyse the requirements of IT for different activities and use current information technologies necessary for daily life and workplace application. Students' academic performance on this course reflects their competence in developing knowledge-building skills and practical skills.

1.2.3 The Teaching Approach

Before September 2005, the teaching approach for the introductory IT course in the college was only classroom teaching in which IT concepts were delivered by lecturers to students in lectures and students' technical competence and practical skills were developed under the supervision of tutors in tutorials through hands-on practice in the computer laboratories and related exercises in real-life applications.

Since September 2005, the on-line education has been implemented for this introductory IT course. In the academic year 2005-2006, which started in early September 2005 and ended in mid-June 2006, the introductory IT course materials were transferred to the college's on-line education system. With the college's on-line education system, students taking this course could easily browse through the Internet and assess the college's on-line education system to read and obtain the learning materials about this course. These materials included lecture notes, tutorial notes, in-class and self-test questions, tutorial exercises, projects and assignments.

Both asynchronous and synchronous on-line education modes are available for the introductory IT course in the college. In asynchronous on-line education, there is no simultaneous interfacing between instructors and students. The college students taking this asynchronous mode have to read the learning materials in the on-line education system and learn by themselves. In the college's asynchronous on-line education, there are no lectures or tutorials. In other words, the asynchronous on-line education provides students with limited instructors' guidance in classrooms.

In addition to reading on-line materials, the college students taking synchronous on-line

education can meet and discuss with the instructors through scheduled tutorials in classrooms or via on-line video conferencing, instant messaging or other real-time communication tools. The students using this mode do not attend lectures, but they are required to read on-line materials posted in the college's on-line education system and have instructors' guidance in tutorial sessions.

1.2.4 The Quasi-experiment

The college as well as other educational organisations and faculties (e.g. Johnson et al, 2000) were concerned about whether students could learn more effectively, less effectively or equally effectively in on-line education in comparison to classroom teaching. Linquist (2006) remarks:

> "*The outcomes of learners in blended learning (synchronous on-line education), as well as those who complete their program exclusively in the two component delivery systems, classroom and online, provide a research opportunity to assess the comparative learning among the three deliveries of learning*."

At the request of the college director, I carried out a quasi-experiment for the four semesters in the years 2006 to 2008. The analytical results indicated that the average test score of the introductory IT course among students in classroom teaching (teaching method 1) is close to that among those taking the synchronous on-line introductory IT course with instructors' guidance in tutorials (teaching method 3) while the students' average test score in either teaching method 1 or teaching method 3 is significantly higher than that in the teaching method where students using on-line introductory IT course attended neither lectures nor tutorials (teaching method 2) (Wong, 2008). The students using teaching method 1 had to attend both lectures and tutorials while those using teaching method 2 mainly learnt through viewing the materials in the college's on-line education system by themselves but could discuss with other students and instructors in the discussion forum in the on-line education system. They did not attend lectures or tutorials in classrooms. The students using teaching method 3 were required to attend tutorials only and read through the materials posted in the college's on-line education system. They were not required to attend lectures.

1.3 Research Problem

Some findings of my previous study in Wong (2008) are consistent with some previous findings (e.g. Edmonds, 2006; Hurlburt, 2001; Johnson, 2002), but different from many other previous findings (e.g. Aberson et al, 2000; Banks, 2004; Bartini, 2008; Grimstad and Grabe, 2004; Jackson, 2000; Johnson et al, 2000; Lim et al, 2008; Schulman and Sims, 1999; Wang and Newlin, 2000; Warren and Holloman, 2005). These different findings in different studies had given me an insight that the students can learn effectively in on-line education under certain conditions but not others. In this regard, there might be factors influencing students' learning effectiveness in synchronous and asynchronous on-line education. The problem was what these factors are.

The main point that differentiates the study by Wong (2008) from the other comparative studies is the use of a less familiar language, English, by the students for learning. In that study, the students having classroom teaching might perform better because of the teachers' sufficient explanation in Chinese. In on-line education, students have to learn by themselves with the less familiar English language. The study in a similar cultural context in Singapore noticed that Asian students are generally more willing to participate in on-line discussion (Chin et al, 2000). Their willingness may be ascribable to non-obligatory instant response in English and even communications in their familiar Chinese language in the discussion forum. Tham and Werner (2005) explained that on-line discussion forum aims to break down communication barriers as it provides a non-threatening environment for students, especially Asian students who are viewed as shy in classroom teaching. Moreover, in the Hong Kong context, it is noticed that different Chinese translations for the same IT terms may confuse students in their discussions, so instructors' clarification and guidance in the discussion forum can be helpful to the students' on-line learning.

From these conceptual perspectives, I, as the researcher, hypothesised that there is relationship between the students' English proficiency and their on-line learning performance. The researcher also hypothesised that the students' learning effectiveness is attributable to the amount of interaction among students and instructors in on-line discussion. This interaction among the students and instructors can be operationalised by their viewed relevant messages posted in the college's on-line discussion forum.

Other communications media such as email, chat rooms, messaging on mobile phones also provide environments for interactivity among learners but those messages were not used in the study because it was impractical to capture and investigate collaboration in such systems that contain private messages.

In these regards, the three variables SEP, IGD and SCD in the rectangular boxes in Figure 1.1 are the potential factors that contribute to the student's on-line learning. The researcher also considered many other potential factors such as IT literacy, motivation and learning strategies, but selected the three variables SEP, IGD and SCD in this study because they represent the characteristics of on-line education in the Hong Kong higher education institution and their effects on the students' on-line learning might help to explain the difference between the findings of Wong (2008) and the findings of many other comparative studies.

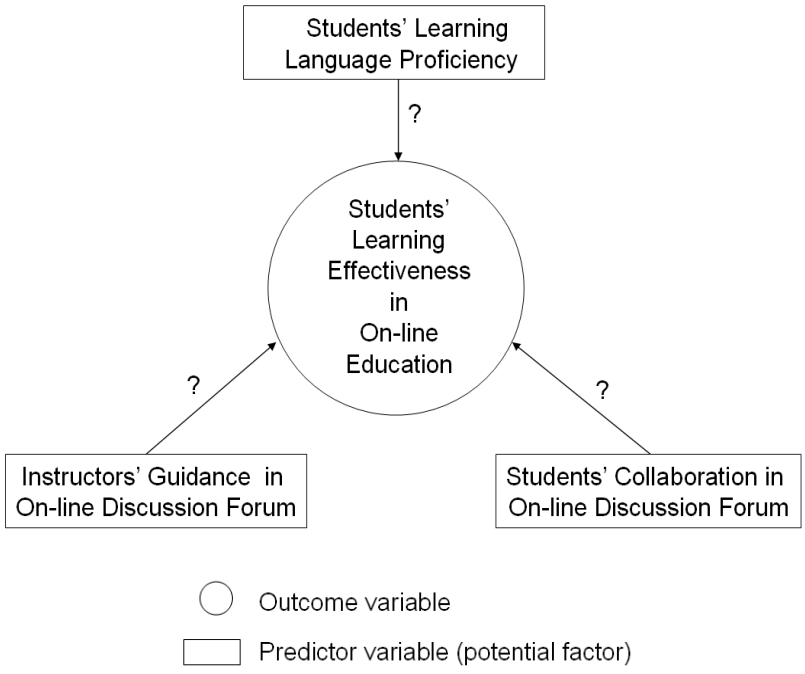


Figure 1.1: Potential Factors that have
Impact on Learning Effectiveness of On-line Education

Figure 1.1 can be understood in four components – three independent (or predictor) variables (or potential factors) and one dependent (or outcome) variable. The outcome

of students' learning effectiveness is represented by the circular shape in the middle of Figure 1.1. The question-marked arrows pointing from the rectangular boxes to the central circle indicate that it is unknown at this stage whether or not SEP, IGD and SCD influence the students' learning effectiveness in on-line education.

To operationalise the outcome of the college students' learning effectiveness, the researcher used the students' test scores of the introductory IT course in Wong's (2008) quasi-experiment. To operationalise the SEP, IGD and SCD**,** the researcher made them measurable in form of quantitative variables. The SEP was measured by the SEP marks. These proficiency marks were based on Hong Kong Examinations and Assessment Authority's (2008) survey results on the equivalence between Hong Kong public English examination grades and the scores of the International English Language Testing System. The SEP was converted from the highest grades or scores of the students' public English examination results. The IGD was operationalised by the number of relevant guidance messages posted by the instructors and viewed by the students in the discussion forum. The SCD was operationalised by the number of the peer students' posted relevant guidance messages read by the students in the discussion forum. As the college's on-line education system recorded which forum messages were read by a system user, the student could log in the user account and check the number of the forum messages viewed by him or her.

With respect to the college students taking the on-line introductory IT course in the context of Hong Kong higher education, the proposed research explores how the three variables SEP, IGD and SCD influence the students' on-line learning, how these variables interact and how they can be manipulated to help improve the students' on-line learning.

1.4 Rationale behind the Study

The decision to explore the factors fostering the learning effectiveness in on-line education came from my personal and professional rationale developed through working with teachers and administrators for on-line education and awareness of the need for pedagogical change for on-line education. In classroom teaching, teachers are often involved in direct teaching and have face-to-face interaction with students in

classrooms. Teachers may also incorporate IT media such as using software tools for presentation and animation into their teaching materials. A positive relationship between students' English competency and their learning performance in classroom teaching in the Hong Kong context was found in many studies (e.g. Graham, 1987; Ho and Spinks, 1985). For the other two factors, studies found a positive relationship between interaction and learning performance in classroom settings (e.g. Powers and Rossman, 1985). In addition, Reynard (2007) observed that there is increased learning autonomy for which self-learning skills are required in on-line education. Therefore, in on-line education, there is a shift from classroom pedagogy, which is teacher-oriented, to on-line learning, which is more student-oriented and based on constructivist approach (Resnick, 1989) through participation, interaction, collaboration and discussion among students to construct knowledge. The main reason for such a shift is that face-to-face interaction between teachers and students is lessened when the two parties using on-line education no longer have to meet in a classroom. In asynchronous on-line education, students view the teaching materials independently at any time for a course period through the educational Web sites without face-to-face interaction with teachers and other students; they may interact with each other through telephone, email, discussion forums and instant messaging systems on the educational Web sites and other communication tools. In synchronous on-line education, teachers become facilitators who help the students to take an active role in their own learning (Appana, 2008; Davidson-Shivers and Rasmussen, 2006; Kim and Bonk, 2006; Thurmond and Wambach, 2004) and teacher-centred approach is required to shift to a student-centred approach (Hirumi, 2002).

Also, the impetus to explore these factors arose from the theories of learning. According to Piaget in Campbell (2006), human beings' cognitive capabilities progress in an orderly way as they grow up because certain ways of thinking must be mastered and built up as a foundation for later stages. Heiens and Hulse (1996) suggested that distance learning, which is also applicable to on-line education, is more appropriate for older students. Therefore, the researcher in this study regarded that the college students at the ages of around 18 to 21 have the self-learning ability in on-line education. Piaget's cognitive constructivism proposes that an individual cannot actually understand what he or she is given immediately (like that in the teaching method 1); rather, the individual actively constructs knowledge through experience and engagement in

artifacts (Clark, 1999) such as educational software, videos, animations, exercises and solutions. In this cognitive constructivist model, individuals learn better when they are provided with an environment that allows them to discover or construct knowledge by themselves rather than when they are instructed or transmitted with knowledge. On-line education provides opportunities for the students to explore the technologies which support individual constructivist learning. Piaget regards that cognitive capabilities are acquired by assimilation and accommodation. Assimilation refers to making associations between new knowledge and what is already known. For example, a child knows that is a cat in a pet shop because it has similar characteristics in the appearance as his pet cat at home. Accommodation refers to changing the current knowledge when this knowledge is inadequate for solving a problem. For example, a child sees a "big cat" in a zoo as it has similar characteristics in the appearance as the child's tame pet cat at home but it is much bigger. Then, the child asks his parents what it is and what it is like and changes his knowledge that "big cat" is not as tame as his pet cat at home as it is fierce and builds the new knowledge that is a tiger and dangerous. Piaget regards that the knowledge assimilated and accommodated is the foundation for later stages. According to Piaget's cognitive constructivism, human beings build their knowledge through experience in assimilation and accommodation process. As opposed to cognitive constructivism, the perspective of Vygotsky's (1978) social constructivism extends individual constructivist learning to social environment. In the social constructivist model, knowledge is constructed through discussion and information sharing. Participation in discussion and information sharing are critical to social constructivist learning and prior knowledge is essential for the social constructivist learners to contribute to discussion and sharing. The researcher regarded that on-line education, either teaching method 2 or 3, provides the discussion forum with which students can engage in the social-constructivist process of generating ideas and knowledge and interacting with others. Vygotsky (1978) adds that the process of engagement with instructors' guidance enables the students to refine their thinking to make their learning more effective. In line with Vygotsky's (1978) theory, the researcher regarded that teaching method 2 with instructors' guidance in on-line discussion and the teaching method 3 with instructors' guidance in tutorials can lead the students to the right track of constructing knowledge through reflection, clarification, learners' motivation and a co-operative attitude to achieve cognitive goals in the on-line discussion. A conceptual model proposed by Garrison et al (2000) can be based on

cognitive constructivism which is about how an individual learner understands things in terms of developmental stages and learning styles and social constructivism which is about how meanings and understandings are constructed from social encounters. This research study supports this model, as detailed in section 2.3.2.3, by investigating how an individual student's own SEP and how IGD and SCD help his or her on-line learning.

Besides, the awareness of the importance of quality in on-line education has aroused my interest in exploring the potential factors influencing on-line learning effectiveness. While reviewing the literature on the quality of on-line education, it was discovered that substantial amounts of studies work on measuring and improving the Sloan Consortium's five pillars (or areas) of quality framework for on-line education programme (Lorenzo and Moore, 2002), as shown in Table 1.1. These five pillars, namely learning effectiveness, student satisfaction, faculty satisfaction, cost effectiveness and access, provide the areas of on-line education for researchers to investigate.

Pillar	***Description***
Learning Effectiveness	Studying how learning effectiveness in on-line education can be made as good as or even in some cases better than classroom learning
Student Satisfaction	Focusing on how students taking on-line education are satisfied with on-line education learning environments and support, as well as what and how they learn through on-line education system
Faculty Satisfaction	Exploring how the technology of on-line education can increase teaching effectiveness not only on-line but also in classroom teaching
Cost Effectiveness	Investigating how on-line education can provide cost-effective teaching and learning environment with the use of technology, with the costs to be addressed including labour costs, development costs, teaching costs and management costs
Access	Looking for the means to reduce all barriers to on-line education and making on-line education easily accessible to teachers and students

Table 1.1: Sloan Consortium's Five Pillars of Quality Framework for On-line Education Programme

Shank's (2003) measures can be used to evaluate these five pillars and the difference between my findings (Wong, 2008) and many previous findings in the literature have inspired me to explore the important pedagogical quality of on-line education by investigating the factors on Shank's (2003) learner measure. To explain the different comparative results, these factors have to be identified and investigated. With respect to the cultural context in Hong Kong higher education, the potential factors in mind include the three variables SEP, IGD and SCD shown in Figure 1.1.

1.5 Research Aims and Questions

The proposed research aimed to investigate whether and how the variables SEP, IGD and SCD affect or contribute to the college students' learning in on-line education. It also explored how these variables interact and the perceived views on how to improve the implementation of on-line education system. For these research aims, the following research questions were addressed:

1. How is each of the variables SEP, IGD and SCD correlated with the students' learning (Figure 1.1) as reflected by their test scores through teaching methods 1, 2 and 3?
2. How well do the variables SEP, IGD and SCD predict the students' learning as reflected by their test scores through teaching methods 1, 2 and 3? How much variance in the students' learning can be explained by these variables SEP, IGD and SCD through teaching methods 1, 2 and 3?
3. What is the distribution of the students' views on comparing the learning effectiveness of the three teaching methods and comparing the importance of the variables SEP, IGD and SCD?
4. How can the results of the correlation analysis obtained for research question 1 be explained? Is there any perceived cause-effect relationship between any of the variables SEP, IGD and SCD and the students' test scores through the three teaching methods?
5. How can the statistical results obtained for research question 2 be explained? Are there any perceived reasons why the variables SEP, IGD and SCD predict or do not predict the students' test scores through the three teaching methods? What is the relative significant effect of each of these variables on the other variables or the students' learning via the three teaching methods?
6. How can the distribution obtained for research question 3 be explained? Are there any perceived reasons for the challenges and benefits related to the use of SEP, IGD and SCD the students have when experiencing on-line education? Based on the factors found from research questions 4 and 5 together with these perceived challenges and benefits of using on-line education, how can teachers and students help develop effective learning in on-line education?

1.6 Significance of the Study

The proposed research is important for many reasons. First, there has been growing importance of pedagogical quality in on-line education (Allen and Seaman, 2005). The rapid increase in on-line education systems usually concerns Shank's (2003) course and business measures, like decreasing organisational costs of education (Whalen and Wright, 2000) and increasing student intake (Witkowsky, 2008), rather than the quality; a responsible educational organisation should consider Shank's (2003) learner measure such as measuring the pedagogical quality of on-line education (Mari et al, 2008). Therefore, the proposed research investigated this important quality issue.

Second, in on-line education, there is a shift from teacher-oriented classroom pedagogy to student-oriented on-line learning (Reynard, 2007), so students' perspectives on what affects their on-line learning can provide ideas on what quality on-line education should be. Students' perspectives on the factors affecting their on-line learning for this research are needed as "*it (learning from pupils' perspectives) can help us to understand the effects and evaluate the effectiveness of provision and intervention*" (Cooper, 1993a:129). On-line education reduces face-to-face interaction between teachers and students because they do not need to meet in a classroom. Teachers become facilitators who help students to take an active role in their own learning in on-line education (Kim and Bonk, 2006). The pedagogical theories, frameworks and models used in classroom teaching to achieve quality teaching may not be applicable to on-line education. For this reason, the proposed research attempted to explore how quality on-line education can be developed.

Third, this research impinges on the attention leaders of the higher education institution pay to what affects students' on-line learning and how to enhance learning effectiveness in on-line education in the context of Hong Kong higher education. The implications arising from this research are extendable to on-line education in similar cultural contexts such as multi-lingual Singapore and institutions offering on-line education internationally in which the medium of instruction is different from the students' mother tongue. As pointed out by Dimmock (2002), "*since culture permeates all levels of society, it provides rich opportunities for researchers to explore the interrelationships between schools and their micro- and macro-environments*" (31). In this study, it would

be interesting to know how SEP and the students' on-line learning environments are related. Also, the students' and teachers' experiences of using on-line education together with the factors found in the proposed research could suggest ways to improve on-line education, especially for the multi-language environments in which students use one language in their studies and another language in their daily lives.

Last, this research is necessary as the factors in Figure 1.1 need to be addressed in order for the college to develop effective learning in on-line education. Although many studies (e.g. Graham, 1987; Ho and Spinks,1985) found that students' learning depends on SEP in classroom settings, the researcher was not aware of studies in literature that explored SEP as the potential factor that affect students' on-line learning. There is insufficient knowledge of how SEP is related to their learning effectiveness in on-line education. Besides, the proposed research adds to the research on the factors previously mentioned such as IGD (e.g. Fredericksen et al, 2000) and SCD (e.g. Ellis and Calvo, 2006; Hwang and Arbaugh, 2009; Swan, 2001). This research furthered the understanding of these factors in relation to the discussion forum in the college's on-line education system.

1.7 Role of the Researcher

The researcher is an insider in this study as he is a lecturer and has been involved in designing and tutoring for the on-line introductory IT course in the college. He has, therefore, the academic, administrative and cultural knowledge to understand the case studied. Throughout this research, the researcher had the privilege of easy access to the participant students, helping him to understand the factors in the pedagogical dimension that have an impact on the students' academic performance in on-line education. However, a disadvantage for insider research is that the researcher may be biased or add his own subjective views when grounding interpretation and analysis on the data collected. An account of how the researcher resolved the potential problems associated with insider research is discussed in more details in Section 3.6 of Chapter 3.

1.8 Outline of the Thesis

The remainder of this thesis is organised as follows. Chapter 2 presents the

representative summary of the literature on the comparative studies, theoretical issues and studies on factors influencing students' on-line learning. Chapter 3 aims to provide a review of the relevant principles of research design. Also, different educational research perspectives and paradigms, methodologies and approaches are critically reviewed, compared and evaluated. Then, the choice of research design options are discussed and justified. Consideration of the ethical issues and trustworthiness of this research study is also presented in this chapter. Chapter 4 states the quantitative data collection and analyses in the first phase of this study. The quantitative findings from the survey concerned with the correlation and multiple regression between the variables SEP, IGD and SCD and the students' learning effectiveness are also shown in this chapter. Chapter 5 describes the qualitative data collection and analysis in the second phase of this study. It shows the qualitative data presentation and analysis of the data collected from the interviews in the case study. The content analysis of the interview transcripts, computing inter-coder reliability and the qualitative findings are presented in this chapter. Chapter 6 discusses both quantitative and qualitative findings in relation to literature, research questions and hypotheses. Triangulated results of these quantitative and qualitative findings are explained in this chapter. Finally, concluding remarks with a discussion of the limitations of this study as well as suggested future work are presented in chapter 7.

Chapter 2

Literature Review

The proposed study was an extension of Wong's (2008) quasi-experiment whereas inconsistency exists between the findings of Wong (2008) and those of other comparative studies. The researcher looked into the comparative studies in the literature and explored the theoretical issues that had been identified. The proposed study extended the quasi-experiment by examining whether or not to accept the hypotheses, as presented in section 1.3, that the variables SEP, IGD and SCD are contributing factors to the college students' learning effectiveness in synchronous and asynchronous on-line education, extrapolating explanations of why or why not these variables contribute to the students' on-line learning and based on the findings, investigating how to develop effective learning in on-line education in the case college.

To understand how these variables SEP, IGD and SCD had been addressed in the existing literature relating to students' learning effectiveness in on-line education, the researcher reviewed the relevant literature. The purpose of the literature review was not to exhaustively search for an account of all perceived variables influencing students' learning effectiveness in on-line education, but to identify and categorize the key theoretical issues concerning each or a combined effect of the variables SEP, IGD and SCD on students' on-line learning and to critically analyse the previous research studies. In other words, the researcher reviewed the literature in order to know what effects SEP, IGD and SCD had been found to have and to identify the strengths and weaknesses of the previous research. These identified issues in the literature review helped to suggest approaches for extending or enhancing the existing literature and refined the research design for the proposed study.

This chapter begins with the inclusion and exlusion criteria. It shows the search terms and the search methods used to find the relevant articles in the literature, presents the findings in the literature and then talks about the strengths and weaknesses in the literature. This chapter concludes with implications for extending and enhancing the literature.

2.1 Inclusion and Exclusion Criteria

When performing the literature review, the researcher decided which articles to be included in the review process by determining the inclusion criteria. The studies which did not meet the inclusion criteria were excluded. For example, the proposed research focused on on-line education which refers to the courses offered with the use of Internet media, so studies on the courses offered through media other than Internet media (e.g. distance learning with television broadcasting, video and audio media) were excluded.

The studies were included in the review process if they met any of the following inclusion criteria:

1. Empirical studies comparing students' learning effectiveness reflected by either the formative assessment results such as students' test or examination scores or the students' perceived learning performance in synchronous or asynchronous on-line education with that in classroom teaching.
2. Studies about theories, models or frameworks related to students' learning effectiveness in on-line education.
3. Studies reporting the relationship (e.g. correlation, regression, multiple regression) between students' learning and at least one of the following independent variables: SEP, IGD and SCD.
4. Studies explaining the relationship in 3.
5. Studies which explored how to improve on-line education based on factors such as SEP, IGD and SCD.
6. Any studies where findings based on the data used in one study were not the same as the findings based on the same data used in another study.
7. When studies using the same findings based on the same data were found (e.g. a dissertation and a journal article by the same author reporting the same findings based on the same set of data), the study with the most detailed reporting (e.g. the dissertation) was included to avoid redundant reviewing.
8. The quality of the study was evaluated by peer-review, high impact factor journals, references from the articles or articles of credential academic or research organisations.

2.2 Review Methodology

The literature review methodology included two stages. The first stage was identification of the search terms. These search terms were derived from the following aspects identified from the inclusion criteria:

(1) comparative studies on students' learning between classroom teaching and on-line education
(2) theories, models or frameworks related to students' learning in on-line education
(3) the independent variables: SEP, IGD and SCD
(4) the relationship between any of SEP, IGD and SCD and students' on-line learning
(5) explanations for the relationship in (4)
(6) improvements on on-line education based on explanations in (5)

The second stage was to use the search terms to search for the relevant articles in the literature. When performing the search, the researcher found inconsistency on the use of some terms in the literature. For example, the term "on-line education" could mean a course offered with the use of Internet technology to supplement or completely replace classroom face-to-face teaching. The researcher had to use synonymous or similar descriptors or keywords for synchronous and asynchronous on-line education. The synchronous on-line education is also referred to as blended learning (e.g. Allen et al, 2007; Bliuc et al, 2007; Bonk and Graham, 2006; Garrison and Kanuka, 2004; Gerber et al, 2007), hybrid learning (e.g. El-Gayar and Dennis, 2005; Reynard, 2007) or mixed mode learning (e.g. Campbell et al, 2005; Gray et al, 2004). The descriptors "blended learning", "hybrid learning" and "mixed mode learning" refer to a mix of classroom teaching and e-learning in some texts. E-learning includes all forms of learning with electronic media (Munro, 2005) such as on-line education, interactive whiteboards, video and audio playing in classrooms and educational software in a computer. In this dissertation, the descriptor "on-line education" is used instead of "e-learning" to mean learning and teaching activities via the Internet and exclude teaching and learning with other electronic media.

The search for literature was performed in four ways. First, the researcher searched through the college libraries. Relevant books and articles from high impact journals

were found. The researcher read through the tables of contents and parts of the chapters on the books, abstracts of the journal articles to ensure all relevant articles were captured. Second, the researcher used the search engines in the Internet to conduct a comprehensive literature search. These search engines included British Education Index (BEI) (http://www.bei.ac.uk/index.html), Education Resources Information Centre (ERIC) (http://www.eric.ed.gov/), Educational Research Abstracts Online (http://www.informaworld.com/), Google search engine (http://www.google.com) and ProQuest (http://www.proquest.com). Third, references from the books and journal papers provided recursive literature search that identified the relevant studies missed by the previous two ways. Some references indicated articles for a literature review on the relevant topics. Using this fourth method the researcher identified four articles of relevance to this literature review – one on on-line teaching (Tallent-Runnels et al, 2006), one on blended learning (Bliuc et al, 2007) and two on a framework related to students' on-line learning called community of inquiry (CoI) (Garrison and Arbaugh, 2007; Swan, 2004).

2.3 Review Findings and Analysis

After a comprehensive search on the literature, followed by review of the articles that met the inclusion criteria, three areas in the literature on students' learning effectiveness in on-line education were organised: (1) comparative studies, (2) theoretical issues and (3) effects of SEP, IGD and SCD.

2.3.1 Comparative Studies

2.3.1.1 The Findings of the Quasi-experiment

In Wong's (2008) quasi-experiment, 300 participants were selected at random from the classes of the students who had registered for this IT course and divided into three independent groups in accordance with the three teaching methods, as shown in Table 2.1. The same introductory IT course content was delivered to all these three groups. The college's on-line education system and on-line discussion forum were available for these three groups. One group of 100 students, as a control group, was assigned to classroom teaching (teaching method 1). The other two groups were the experimental

groups - a group of 100 students used asynchronous on-line education with limited IGD (teaching method 2) and the remaining group of 100 students used synchronous on-line education with instructors' guidance in tutorial sessions (teaching method 3).

Issues	*Teaching Method*		
	1	***2***	***3***
Role of Teacher and Student	Traditional classroom teaching – students attend both lectures and tutorials. Teachers take an active role in teaching while students take a passive role in learning.	Students learn independently through on-line materials by themselves. They may read instructor's messages in discussion forum. Students take an active role in learning.	Students learn through on-line materials. The students do not need to attend lectures. The students have instructor's guidance in tutorial sessions. Teachers take a passive role in teaching while students take an active role in learning.
Teacher-Student and Student-Student Interaction	Students have face-to-face interaction with teachers and classmates in classroom teaching. In addition to face-to-face contact, the students can occasionally access an on-line discussion forum and view messages posted by teachers and other peer students.	Students have no face-to-face interaction with teacher and other peer students. They learn by themselves via on-line modules and discussion forum. The students and instructors can discuss through an on-line discussion forum.	Students have no face-to-face interaction with teachers and other students when learning through the on-line modules. However, they are given opportunities to talk with instructors and other students in tutorials. The students can also use an on-line discussion forum.
Flexibility of Provision	Students have less flexibility in learning because the lectures and tutorials are scheduled at particular time. The students have to attend lectures and tutorials at specified time and location – they cannot learn at any time, any where and any pace.	Since lectures and tutorials are conducted and available for browsing at any time in the on-line education system, students have more flexibility in learning as they read through on-line modules at any time, any where and any pace.	Students have flexibility in learning as they read on-line modules at any time, any where and any pace. They also need to attend tutorials at fixed time in order to have discussion with and obtain support from instructors and other students.
Teaching Materials for the Module	Teachers mainly provide, prepare and present the teaching materials in classrooms.	On-line module providers and teachers design the teaching materials and post them to an on-line education system for the students to read.	Teaching materials are posted to an on-line education system by the module designers with the help from teachers.
Formative Feedback	In most cases, teacher may interact with students instantly through asking questions, answering questions, providing feedback and giving support in classroom. Students and teachers can occasionally feedback through the on-line discussion forum.	The on-line module system provides a discussion forum for the students to discuss among themselves. Unlike teaching method 1, the discussion forum does not give instant feedback.	An instructor is assigned to help students in tutorials. Students can also discuss through a discussion forum. Unlike teaching methods 1 and 2, the discussion forum does not give instant feedback but the students can attend tutorials to get instant feedback from the instructor and other students.

Table 2.1: Comparison among Teaching Methods 1, 2 and 3

Thirteen lecturers in the teaching team of this introductory IT course were assigned to hold the lectures and tutorials in classroom teaching (teaching method 1). In addition to holding the lectures and tutorials in teaching method 1, three of the lecturers also guided the college students using on-line education system in teaching method 3. The control group contained the condition of face-to-face student-teacher contact and guidance in the classrooms which was completely omitted or lessened in the experimental groups.

In order not to interfere with the normal running of the introductory IT course, this exploratory quasi-experiment was carried out in the first three weeks of a semester in an academic year. The participating students' academic performance assessments on this introductory IT course were collected at the end of the week 3 of the semester. Comparison and analysis of their performance were then conducted. The participating students in the three teaching methods were scheduled to take the same test on the same day in each semester. The test answer scripts and question papers were collected at the end of the test and those test questions were not released to the students after the test as most of the questions were used again in the coming semesters for this quasi-experiment. After the quasi-experiment, the participating students restored their original preference of teaching method for this introductory IT course.

Fisher's one-way ANOVA and Tukey multiple-comparison methods were used to compare the average test scores in these three teaching methods. The analytical results indicated that teaching method 1 and teaching method 3 had no statistically significant difference on learning effectiveness while these two teaching methods were more effective than the teaching method 2 in learning (Wong, 2008).

2.3.1.2 The Learning Effectiveness

A student's learning effectiveness has been measured in terms of the student's performance and satisfaction in many studies. For Web-based learning environments, Piccoli et al (2001) add computer self-efficacy as a learning effectiveness dimension because it is relevant to IT skills development. Self-efficacy represents:

> "*…people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not*

with skills one has but with judgments of what one can do with whatever one possesses." (Bandura, 1986:391, quoted in Piccoli et al, 2001:410)

Piccoli et al (2001) state "*self-efficacy refers to individuals' own belief in their ability to successfully perform a specific behavior*" (410). However, self-efficacy and satisfaction are hardly rated in an objective way, and they may not accurately reflect students' actual learning. Students' performance can be objectively rated by a test or examination, so this method was used to reflect students' learning effectiveness in Wong's (2008) quasi-experiment.

In the quasi-experiment, the learners completed the tests, as shown in Appendices 1 and 2, independently and individually at the end of the quasi-experiment period in different semesters from 2006 to 2008. These tests, though slightly different, were similar and comparable. The main reason for the slight difference was that the test used in the academic year 2006 to 2007 was modified slightly to indicate updated IT information. The change of test questions is shown in Appendix 2. Because of the similarity and comparability of the corresponding tests, the different samples in the different semesters could be grouped together in accordance with their teaching methods and their test scores collected from these three teaching methods could be used for comparison in the analysis of this study.

This research study focused on Shank's (2003) learner measure by using Level 2 of Kirkpatrick's (1959) Evaluation Model for measuring the learning effectiveness. Shank (2003) determined three measures in her survey. These three measures are learner measure, course measure and business measure. Learner measure refers to evaluating learning effectiveness as reflected by leaner's gain and performance in on-line education through quizzes, tests, surveys and performance goals. Course measure involves measuring student satisfaction, faculty satisfaction and access such as participants' satisfaction with specific on-line courses, on-line course enrollments and completion rates, and increased demand for on-line courses. Business measure links with cost effectiveness by measuring the on-line education business on reduced training and processing time, reduced training cost, increased sales and increased customer job satisfaction and performance. Kirkpatrick's (1959) Evaluation Model contains four levels of evaluation, as shown in Table 2.2. In this model, the lower level provides the

information for an upper level for evaluation. The levels 1 up to 3 are related to learner measure while the level 4 is linked to course and business measures. Level 2 was used because it is an objective approach to measure whether or not a student actually learn. Level 1 was not used as the data obtained in this level are about student satisfaction with the course settings such as classroom, atmosphere and instructor performance. This level cannot indicate students' actual learning. Level 3 was not used in this study because it was not feasible to implement a workplace-like environment for students in the college and it required further investigation time and resources to observe and evaluate students' performance. Level 4 was not used as the researcher's concern was not on course and business measures.

Level	***Description***
4 Business results	Level 4 is to evaluate how well the business runs due to training. This level looks for increased sales, reduced costs, improved performance, improved quality and other improved business variables as a result of training for an organisation.
3 Students' performance	Level 3 evaluations attempt to measure how well students can perform the learnt skills in the workplace. That is to use on-the-job observations, self-assessments and tests to measure the change that has occurred in students' behaviour as a result of learning.
2 Students' learning	This level measures how well students actually learnt. At this level, tests including pre-tests and post-tests, performance observations, interviews and self-assessments are the tools used to measure students' achievement as a result of their learning.
1 Students' reaction	This level is sometimes called "smilesheet" because they are used to measure how well students liked the training. In accordance with Kirkpatrick, a survey should be designed to evaluate at this level in order to obtain the feedback from students and improve the training programme.

Table 2.2: Kirkpatrick's (1959) Four-Level Evaluation Model

As pointed out by Steinkuehler and Derry (2001), thoughtfully designed and carefully implemented tests can be used to measure students' learning effectiveness and provide evidence about it. In the study by Wong (2008), thirteen participating teachers, who had expertise in IT area, moderated the tests. They reviewed the test questions, their marking schemes and quality. They also reviewed how the teachers marked the tests. They confirmed that the tests were up to the standards and valid. They also confirmed the tests could be used to assess some learning outcomes of the course and the quality of the tests. As explained in section 2.3.1.1, Wong's (2008) quasi-experiment was carried out for the first three weeks of each 14-week course period. For these three weeks, the topics about some IT concepts were covered but the practical skills for IT applications were not covered. Therefore, the tests, as shown in Appendices 1 and 2, were designed to access the students' competency in understanding and evaluating the IT concepts

covered in the first three weeks of the course period. So for this research, the learning effectiveness of the college students' understanding and evaluating the IT concepts in the introductory IT course was reflected by their test scores.

2.3.1.3 Comparison of the Findings

Some findings of Wong (2008) are consistent with some previous findings. For example, Johnson (2002) compared the students' test and presentation scores, as well as their final letter grades between pre-hybrid (teaching method 1) and hybrid (teaching method 3) formats, and found no significant differences. Hurlburt (2001) found that the classroom teaching and Web streamed-audio teaching synchronized to an interactive text–graphics display (similar to the teaching method 3) on an introductory statistics course had no statistically significant difference on learning effectiveness. Also, Edmonds (2006) showed that students taking classroom teaching (teaching method 1) perform better in the examination than the students using the on-line course without instructors' guidance for a general psychology course.

On the other hand, some findings of Wong (2008) conflict with the findings of many other studies. For example, Wang and Newlin (2000) documented in their comparative study on statistical methods in psychology course that the students in conventional classes (teaching method 1) have higher final examination scores and higher course grades than the students in Web-based sections (similar to teaching method 3). Johnson et al (2000) found that there is no difference between the classroom teaching (teaching method 1) and on-line format of a graduate course without direct face-to-face contact between the instructor and the students (teaching method 2) in learning outcomes. The data generated by Bartini (2008) in the study of a psychology course indicated that the students in the Web-enhanced section (similar to teaching method 3) have significantly higher examination scores than those in classroom teaching (teaching method 1). Also, Grimstad and Grabe (2004) found that the students using an on-line introductory psychology course in addition to classroom teaching had significantly improved examination performance. Besides, the students taking an on-line version of the statistics course outscore their counterparts taking classroom teaching by an average of 20 percent in the examinations (Schuttle in McCollum, 1997). Some findings indicated that there are no significant differences in the students' final test or examination scores

using classroom teaching and pure on-line education (e.g. Aberson et al, 2000; Alghazo, 2005; Jackson, 2000; Schulman and Sims, 1999; Warren and Holloman, 2005). All these studies focused on two teaching methods. Some other previous studies (e.g. Banks, 2004; Lim et al, 2008) are more comparable to Wong's (2008) study as the three teaching methods were compared. Unlike the findings of Wong (2008), Lim et al (2008) reported that the students in on-line instruction and the combined mode have statistically significant higher levels of achievement than students in classroom teaching. Another comparable study is statistical analysis by Banks (2004) on the performance of the working adults in classroom, pure on-line and blended learning. Surprisingly, Banks (2004) indicated that pure on-line learning has improved reaction from participants by comparison with that of classroom and blended learning while there is no significant difference between classroom and blended learning.

2.3.2 Theoretical Issues in the Literature

To perform the proposed research study, the researcher was involved in the Clark-Kozma debate on on-line education media research. The Clark-Kozma debate is about whether media including on-line education influences learning. Clark (1983) stated media do not influence learning under any conditions while Kozma (1994) contended that media can influence learning under certain conditions. This debate requires empirical evidence to support one side or the other. As the researcher's proposed research study was to explore the effect of SEP, IGD and SCD pertaining to on-line education media on learning, its findings could provide this support. Also, the fast-advancing media technology for education nowadays used in the proposed study renders a better position to resolve this debate. The following sub-section shows the standpoint of the researcher in the Clark-Kozma debate in detail. Besides, the researcher reviewed research into the factors influencing students' on-line learning and these factors are related to three types of interaction (Moore, 1989) or CoI framework (Garrison et al, 2000) in Khan's (2001) pedagogical dimension. The coming sub-sections discuss these theoretical issues.

2.3.2.1 Standpoint of Clark-Kozma Debate

During the 1990s, literature concerned with learning from media such as on-line

education was involved in the Clark-Kozma debate. Some investigators (e.g. Clark, 1983; Fleming and Levie, 1993) took the position that media (i.e. use of colours, use of font types, audio, video, animation, simulation, multimedia, educational technology like on-line education system) used to deliver a course content do not contribute to students' learning. Clark (1983) used the metaphor of a delivery vehicle to describe how media do not affect students' learning:

> "*The best current evidence is that media are mere vehicles that deliver instruction but do not influence student achievement any more than the truck that delivers our groceries causes changes in our nutrition. Basically, the choice of vehicle might influence the cost or extent of distributing instruction, but only the content of the vehicle can influence achievement.*" (445)

Clark's (1983) arguments were supported with some assertions. For example, Levie and Dickie (1973) and Schramm (1977) claimed that learning is influenced by content and instructional method rather than by the type of media used for teaching. Therefore, Clark (1983) would not recommend any research on how media affect students' learning or comparison of media effects on students' learning.

From another point of view, media contribute to students' learning. Kozma (1991:179) argued that studies suggest different media influence learning differently because of the advantages of the media capabilities in conjunction with teaching or learning methods. Kozma (1991) further stated that a learner can take advantage of the characteristics of media which can help the learner to learn a specific skill or knowledge and the characteristics of media refer to "*the mechanical and electronic aspects that determine its function and… other physical features*" (180). A medium can be a radio or a Web server. The characteristic of a radio is different from that of a Web server. Radio broadcasts audio course content only at a specific time to students while a Web server handles students' login requests at any time and sends the Web pages containing a course content to the students at their requested time.

These different assertions gave rise to the Clark-Kozma debate in the 1990s. Clark (1994) insisted that media are "*mere vehicles that deliver instruction but do not influence student achievement…*" (22) and responded that educational media are used as

methods for teaching and the methods rather than media actually influence student learning. However, as commented by Cunningham (1986), Clark's (1983; 1994) claim that media do not influence learning is a hypothesis. That claim requires empirical evidence. On the other hand, Kozma's (1991) arguments were supported with empirical evidence like the studies on the factors in media that affect learning. These studies can be classified into Khan's (2001) dimensions as detailed in section 2.3.2.2. Salomon (1978, quoted in Kozma, 1994:11) regarded that media can be analysed in terms of the learners' cognitively relevant capabilities or attributes. "*These (the learners' cognitively relevant capabilities or attributes) include a medium's technology, symbol systems, and processing capabilities*" (Kozma, 1994:11). Symbol systems are a set of elements such as words, text, picture components, diagrams, and so on, and processing capabilities refer to the power of media to process data of symbol systems into useful and meaning information (Kozma, 1991). He used a computer's processing capabilities as an example of media power:

> "*A learner can type in printed text, and a computer (a medium) with a voice synthesizer can transform it into speech. The computer can take equations, numerical values, or analog signals and transform them into graphs.*" (195)

I understood that Clark's (1983) analysis of media's influence on learning was conducted at the time (late 1970s to early 1980s) when personal computers and the Internet were not widely available around the world. Educational media at that time lacked interactive functions. For example, video cassette players were used to play educational videos to students in classrooms. Educational media at that time looked like Clark's (1983) "delivery vehicle" to deliver content in one way to students. Koumi (1994) asserted that with the technological limitations of the educational media and some practical problems like lack of experience, time and budgets, the previous research studies showed no media effect.

Despite the criticisms by Clark (1983), comparative studies about the effect of media on learning have proliferated since the mid-1990s when educational media technology had advanced dramatically and advanced interactive multimedia on-line education systems were developed. By the early 1990s, as pointed out by Hastings and Tracey (2005), there was an enormous increase in the use of computers and the Internet was launched

to the general public. At that time, computer technology advanced very fast. Computer memories and storage capacities were enlarged tremendously, computer processing speeds and data transfer rates increased rapidly. Processing capabilities were much enhanced with the new media such as computers and the Internet which brought communications channels (e.g. email, on-line discussion forum, blog, instant messaging and video conferencing), multimedia instructions and interactive functions via the Web to students. With these new features, educational media can support teaching and learning in interactive ways – in addition to course content delivery to students, students can, for example, feedback through email or on-line discussion forums, students and teachers are able to interact with multimedia educational Web pages by responding to questions, clicking hyperlinks to get reference Web sites and chatting with each other via a real-time communications board.

By the mid-1990s, because of the communicability, multimedia support and interactivity features of the educational media such as on-line education, the Clark-Kozma debate of "learning influenced by media" was restructured to "learning with the support of media". Jonassen et al (1994:31) suggested that the Clark-Kozma debate should focus less on whether media influence learning, but more on how media support learning instead. To understand the capabilities of media and the needs of students in order to apply the appropriate media as teaching methods to support students' effective learning is a challenge that requires more research focus. Kozma (2000) emphasized that teaching methods supported with technology does influence educational outcomes. The researcher's standpoint was to investigate "learning with the support of media". The researcher took this standpoint to focus on how media support learning by exploring the potential factors SEP, IGD and SCD related to the capabilities of students and on-line education media.

2.3.2.2 Pedagogical Dimension

Most of the previous studies on exploring the factors affecting the learning effectiveness of on-line education can be classified into some of Khan's (2001) dimensions - assessment, technological, interface design, management, pedagogical, institutional and resource support. The assessment dimension contains both assessment of on-line education learners and evaluation of the on-line instruction environment. The

technological dimension is related to issues of technology infrastructure in on-line education systems. The interface design dimension provides a way on-line education users interact with an on-line education system. This encompasses design of on-line education Web pages, content, navigation and usability. The management dimension refers to how on-line education systems are managed such as delivery of on-line course content, scheduling and maintenance of the on-line education environment. The pedagogical dimension refers to learning and teaching activities in on-line education. The institutional dimension is concerned with instructional development such as academic and student support services related to on-line learning. The resource support dimension examines on-line support services such as counseling support and technical support and resources required to support the on-line education environment.

There is exhaustive listing of a great many previous studies exploring the factors that affect the learning effectiveness in on-line education in Khan's (2001) dimensions, but a representative summary of these studies is shown in this sub-section. In assessment dimension, studies (e.g. Klecker, 2007; Wang, 2007) found that students have better learning effectiveness if they are given formative assessments in on-line course. In the study by Klecker (2007), identical course materials and the same instructor were assigned to the two on-line sections. One on-line section was given multiple-choice formative tests every week while the formative tests were not available in the other on-line section. At the end of the semester, the same final examination was given to the students in these two on-line sections. The statistical analysis indicated that the students in the section with formative tests had statistically significantly higher final examination scores than the students in the other section. Wang (2007) developed a formative assessment module to overcome the problem specified by Buchanan (2000). The problem is the teachers face practical constraints such as limited time and a heavy workload if providing formative assessment feedback to large numbers of students. The findings of Wang (2007) showed that students using that formative assessment module in a on-line course achieved better learning effectiveness.

In technological dimension, some studies claimed that IT literacy is the critical factor for student success in on-line education. For example, Ternus and Shuster (2008) identified the different IT literacy levels of the students at different periods of time. More than half of the participating students surveyed in the study by Kirkwood (2006)

identified IT skill areas as those needing the most skill development. These areas include creating and manipulating images, finding and using information effectively, using electronic resources, using a computer for studying, and getting information from the Internet. Osika and Sharp (2002) found that many students in their study did not possess the required technical IT skills for on-line learning.

In interface design dimension, Chang et al (2008) found that a well-designed user interface of on-line education system enhances interactions and participation by learners. Their study explored the effects of user interface elements of an on-line education system on the students' interaction processes. Their study also investigated the impacts of these processes on the students' social and technical attitudes which in turn affect the students' perceived learning and satisfaction with the learning processes.

For management dimension, some studies (e.g. Grabe and Christopherson, 2007; Grabe and Sigler, 2001) investigated how students manage and use lecture notes and other related lecture materials in an on-line education system. Grabe and Christopherson (2007) found a statistically significant positive relationship - the students' use of on-line lecture notes and their examination performance were positively related. Chou and Liu (2005) found that learner control, which refers to how a learner controls and decides the flow, path and events of instruction (Hannafin, 1984; Williams, 1996), is associated with how students manage their learning and affects their learning.

For pedagogical dimension, Soong et al (2001) believed that students' and educators' mindsets are key factors for on-line learning and stated:

> "*If we perceive learning to be essentially knowledge absorption rather than knowledge construction, we would simply "sit still and absorb", rather than participate and contribute. On the other hand, if learning were perceived to be knowledge construction, then contribution and participation levels would be much higher since it is by this contribution and participation process that knowledge is constructed.*" (106-107)

Davies (2006) indicated that students' intention to learn is a significant factor for actual learning in on-line education. Other researchers (e.g. Harrington, 2002) found that

on-line discussions can increase student interaction which in turn promotes cognitive growth among students (Yanes et al, 2006). Many studies (e.g. Ellis and Calvo, 2006; Ellis et al, 2006; Hwang and Arbaugh, 2009; Rovai and Barnum, 2003; Swan, 2001; Wang et al, 2001; Wang and Newlin, 2000) identified an association between the students' involvement in on-line discussion and their learning performance. Picciano (2002) found that the students involved in at a high interactivity level, as reflected by a large number of student and instructor messages, have higher scores in the written assignment. Fredericksen et al (2000) reported that teacher's guidance for students taking on-line course improves their learning. They also suggested a comprehensive strategy which emphasizes the importance of discussions among all stakeholders including faculty, academic top management, IT professionals, librarians, student representatives and teaching staff representatives to make the asynchronous learning environment in on-line education successful. Farrington and Bronack (2001) claimed that socialization skills gained through interaction among students are important for on-line learning success.

For institutional and resource support dimensions, Twigg (2003) proposed the on-line models for improving the quality of learning while reducing the cost of instruction. These models include supplemental, replacement, emporium, fully on-line and buffet models. These models have their own characteristics and are implemented in accordance with different students' needs. The supplemental model retains classroom teaching, but it adds technology-based and out-of-class activities to facilitate and encourage students' learning. The replacement model reduces classroom teaching time and replaces it with on-line learning activities for students. The emporium model allows students to select when to access learning materials in accordance with their needs with the support of sophisticated instructional software and on-line help. This model eliminates all classroom teaching activities and replaces them with a learning resource centre. In the learning resource centre, students can learn by accessing on-line learning materials and on-demand personalized assistance. The fully on-line model provides real-time interactions between instructors and students. These interactions include answering inquiries, comments or discussions. Immediate feedback to students is available in this model. The buffet model customizes the learning environment for each student. The educational institutes using this model offer students an assortment of offerings that can be customized to fit their individual learning styles and abilities.

The proposed research study focused on Khan's (2001) pedagogical dimension by investigating the effects of SEP, IGD and SCD on students' on-line learning. In this dimension, many researchers (e.g. Rovai, 2001; Verduin and Clark, 1991) believed that learning and teaching at a distance like those in on-line education can be as effective as classroom teaching provided that appropriate interaction with content, interaction with instructors and interaction among students are applied. This proposed study looked into these three types of interaction which are termed (1) learner-content interaction, (2) leaner-instructor interaction and (3) student-student interaction by Moore (1989). Investigation on how SEP influences the students' on-line learning involved the process of intellectual learner-content interaction. The proposed study also explored how IGD influences the students' on-line learning which is related to learners' interaction with instructors. Besides, the exploration by the proposed study on how SCD contributes to the students' on-line learning is linked to students' interaction with other students in learning. In this sense, the proposed study viewed that Vygotsky's (1978) social constructivist learning takes place within a community through interaction in on-line education, as specified in community of inquiry (CoI) framework which was first introduced by Garrison et al (2000).

2.3.2.3 Community of Inquiry Framework

According to Garrison et al (2000), CoI framework is a conceptual model which identifies three elements, namely (1) social presence, (2) cognitive presence and (3) teaching presence as crucial pre-requisites for a successful higher educational experience. Social presence refers to the participants' ability in a CoI such as a class to communicate and develop relationships within the community by projecting their individual personalities. Social presence involves interaction with students and teachers. Cognitive presence is linked to interaction with content. Cognitive presence is "*the extent to which the learners are able to construct and confirm meaning through sustained reflection and discourse*" (Garrison et al, 2001). Teaching presence is related to students' interaction with teachers and it is "*the design, facilitation and direction of cognitive and social processes for the purpose of realizing personally meaningful and educationally worthwhile learning outcomes*" (Anderson et al, 2001). The CoI framework is based on the work by Dewey (1933; 1938; 1959). Dewey's (1933) construction of practical inquiry and critical thinking and Dewey's (1938) reflective

thinking and inquiry inspired for operationalising cognitive presence in the model (Garrison and Archer, 2000; Garrison et al, 2000) and Dewey's (1959) collaborative constructivist perspective on teaching and learning activities are consistent with social and teaching presences in this model (Garrison and Anderson, 2003; Garrison et al, 2000). For example, Garrison et al (2000) devised a practical inquiry model for cognitive presence. That model is based on Dewey's (1933) ideas and conception of practical inquiry in which there is a transformation from pre-reflection to reflection, then from reflection to post-reflection. Pre-reflection is a state when someone is aware of something, then he or she builds hypothesis or plunges into situation of dilemma or confusion, then perplexity, hesitation and doubt. Reflection involves an act of search or investigation directed towards the knowledge. The method of inquiry is used in reflection and is based on experience. It emerges through practice. Post-reflection is the state of reaching knowledge to corroborate or nullify the hypothesis or to resolve the dilemma or confusion. Based on this model, Garrison formulated a model of practical inquiry in which a learner moves through an iterative process of critical thinking that consists of triggering event, then exploration, then integration and finally resolution. Critical thinking is not only a reflective process internal to one's mind. It is iterative and reciprocal relationship between personal and shared worlds in a community. This is based on Dewey's (1955) social aspect of learning experience that involves personal relationship in other presences social presence and teaching presence in CoI model proposed by Garrison et al (2000).

Some examples of the previous studies on exploring the on-line learning factors which are related to the CoI framework are shown as follows. Picciano (2002) examined the relationship between the students' perceptions of social presence and their learning performance operationalised by written assignment scores. Hwang and Arbaugh (2006) examined how students' feedback-seeking behaviours were related to their grade performance measured by multiple-choice tests. Arbaugh (2005) and Williams et al (2006) investigated a relationship between social presence and students' perceived learning. Arbaugh (2005) operationalised social presence by interactions between course participants and group-oriented assessments. Williams et al (2006) operationalised it by teamwork orientation which is the level of collectivism an individual holds and group cohesiveness which refers to the strength of an individual's willingness to remain in a team. Arbaugh (2005) also examined an association between

the interaction with course content through perceived usefulness and the ease of use of course software and students' perceived learning and satisfaction. Arbaugh (2008) examined whether and to what extent the three presences in the CoI framework are asscociated with perceived learning in on-line education environments. Swan (2001) explored the three factors influencing students' satisfaction and perceived learning in asynchronous on-line courses. She equated the factor interaction with instructors with teaching presence while the other factor was interaction among course participants with social presence. She equated the relationship between course design clarity and students' learning with cognitive presence.

The proposed research is mainly based on this CoI framework by attempting to examine the relationship between the elements of the CoI framework and on-line learning outcomes in higher education. In the proposed research, examination of the effect of SEP on the students' on-line learning was to examine the relationship between cognitive presence and the students' on-line learning. The cognitive presence involved in this study contained the students' English ability to interact with the contents posted in an on-line education system. Also, the proposed research examined the effect of IGD on the students' on-line learning. That was to examine the relationship between teaching presence and the students' on-line learning. Besides, the proposed research examined the relationship between social presence and the students' on-line learning by examining the effect of SCD on the students' on-line learning. When examining the effect of SCD, the researcher focused on the interaction among the students in relation to course content or medium of instruction topics.

2.3.3 Medium of Instruction and On-line Discussion

After the literature search with the goal of identifying the research most related to the proposed study, an unexplored area of the effect of SEP on students' on-line learning was determined. Among the previous studies that match the inclusion criteria, the researcher was not aware of any studies that explored how SEP influences students' on-line learning. However, there are previous studies examining the effect of instructor-student interaction like IGD and student-student interaction like SCD on students' learning effectiveness in on-line education. As noticed by Chin et al (2000) and Tham and Werner (2005), Asian students are more willing to discuss in on-line

discussion forum than in classroom, therefore it would be interesting in the proposed study to see how IGD and SCD contribute to student learning in the Hong Kong higher education context. It would also be interesting to explore the explanation for their greater willingness to discuss in on-line discussion and how IGD and SCD influence their on-line learning.

Some of the previous studies used students' perceived learning as a learning effectiveness indicator. For example, Arbaugh (2008) carried out a large-scale survey on teaching presence (course design and organisation, facilitating discourse and direct instruction), social presence based on measures designed by Richardson and Swan (2003) and cognitive presence based on measures designed by Garrison et al (2001) and Shea et al (2003) for fifty-five on-line business courses from 2004 to 2006. Arbaugh (2008) reported that teaching presence and cognitive presence are highly correlated with students' perceived learning. In another large-scale survey on nineteen on-line graduate courses about education and leadership, Rovai and Barnum (2003) found a statistically significant correlation between students' perceived learning and active interaction operationalised by the number of messages posted to the on-line education systems' discussion boards by the students per week. Swan (2001) conducted a large-scale survey on the students' interaction with a university's on-line courses, interaction among the students and interaction with the instructors for the on-line courses. Her statistical results indicated that the higher the students rate their level of activity for their interaction with the on-line course content, the higher the level of the students' satisfaction with their learning and the higher the level of perceived learning the students have. She also found that the students who rate their level of interaction with instructors as high are more satisfied with their on-line learning and perceived on-line learning. Also, her statistical analyses confirmed that the students who rate their level of interaction with other peer students as high reported that they are more satisfied with their on-line learning and have a higher level of perceived learning. Swan (2001) found correlations between each of the variables: interaction with on-line courses, interaction with instructors and interaction among course participants and the students' satisfaction with learning and perceived learning. A previous study by Swan and her collegeaues using a large-scale survey at the same university reported that students perceive a high level of learning if they have greater interaction with other students (Fredericksen et al, 2000). Jiang and Ting (2000) conducted a survey of small samples of nineteen on-line

courses. Their analytical results showed that two instructor behaviour variables, grades for discussion and requirements for discussion, are significantly and positively correlated with students' perceived learning. The implications of these results are that if an instructor gives a high percent of grade weight to students' on-line discussion and clearly states the quality and quantity requirements of the students' contributions in on-line discussion, the students achieve better on-line learning. They found that the more a student participates in on-line discussion, the better the student learns. Picciano (2002) conducted a small-scale survey on the perceived and actual interaction among students operationalised by the number of student postings to the discussion board, students' perceptions of the social presence, their perceived learning and their learning performance operationalised by examination score and written assignment score. His analysis provided statistically significant results that students' perceptions of their interaction in the discussion board correlate with their perceived learning. However, his analysis provided no statistically significant results that the actual interaction among students correlates with their written assignment score.

2.4 Limitations of the Literature

Some previous findings on students' learning are debatable because subjective ratings for students' own learning performance were used as evaluations in these studies. For example, Fredericksen et al (2000) used a survey and quantitative analysis to examine the factors that significantly contribute to the students' perceived learning and learner satisfaction reported by the students. Rovai and Barnum (2003) argued that using course grades for graduate courses in their study is not appropriate as they tend to have restricted ranges. They also argued that grades are affected by students' prerequisite knowledge and other aspects not related to students' learning such as class participation, late submission of assignments, students' attendance, inconsistent grading by different teachers or even the same teacher over time. Arbaugh (2008) argued that course grades are not appropriate to indicate students' learning because they are subject to the limitations of inconsistent assignments across courses and instructors in the study. However, using students' perceived learning as a learning effectiveness indicator may not accurately reveal how the students actually learn because the students' perceptions on how they learn are subjective and there is no empirical evidence to show that students can accurately assess or reflect their learning effectiveness.

Many previous studies used an objective method to find the association between a quantitative variable and comparable and measurable test or examination results. For example, Hwang and Arbaugh (2009) used the students' multiple-choice test results as measurable learning outcome and investigated the effect of the students' participation on the discussion forum on their learning outcomes for seven undergraduate hybrid courses (similar to teaching method 3) spanning business, management and training. Their analytical results showed that the participation on the discussion forum, operationalised by the number of topical forums in which a student participated, predicts multiple-choice test results. Their previous study found that students' competitive attitude directed at preventing others from getting ahead of them and at personal diligence to get ahead of others are related to the students' feedback-seeking behaviours in discussion forums and the feedback-seeking behaviours in discussion forums influence their learning performance as measured by multiple-choice tests (Hwang and Arbaugh, 2006). Grabe and Christopherson (2007) obtained data from the on-line education Web server's log file to generate the quantitative variables such as the proportion of the on-line education Web resource pages accessed at certain periods and used statistical methods to analyse how this log-generated use of on-line resources which include lecture outlines, lecture summaries and lecture audio recordings in the on-line education system is related to students' examination performance. This study discovered the phenomenon that the students' use of on-line resources and their learning effectiveness as reflected by their examination performance are related. Gerber et al (2007) examined the relationship between the students' examination results and the number of messages posted by them in on-line communication as well as the type of communication in terms of content-related, interpersonal and organisational messages. They found that tutors' interpersonal, and students' own content-related and interpersonal messages have an impact on the students' learning performance in a blended learning scenario (similar to teaching method 3). Some findings of Wang and Newlin (2000) on on-line statistical methods in psychology course showed that the total number of forum postings read and written by students positively correlate with their final grades in the Web classes which are similar to teaching method 3. Their later study with another researcher on the same course revealed that students' collaboration in electronic chat room discussions, operationalised by counting the number of messages in discourse analysis categories such as student responses to a problem or example given in a lecture and the total number of student comments, correlate with their final

grades in the Web class which is similar to teaching method 3 in this study (Wang et al, 2001). Ellis and Calvo (2006) identified different learning approaches through students' on-line discussions for e-commerce subject offered in a learning environment similar to teaching method 3. One of their findings indicated the on-line surface approach, with which there is no real intent to understand meaning through on-line discussions, is negatively associated with students' learning performance reflected by their final marks. Ellis et al (2006) found that the students using on-line deep approaches, with which there is underlying intention to understand meaning through on-line discussions, have higher final marks than the students using surface approaches for psychology for social work course offered in a learning environment similar to teaching method 3. However, the students' actual learning might not be accurately reflected by the final marks in the studies by Ellis and Calvo (2006) and Ellis et al (2006) because the students' participation in discussions was part of the assessment components of the final marks.

Most of the previous studies (e.g. Swan et al, 2000) examined the amount of interaction like the quantities of student and instructor messages posted in on-line discussion but neglected the relevancy of the messages. The accuracy of these data collected from the participants is questionable and therefore it is regarded that the previous findings based on these data are speculative rather than confirmative. Whether the messages posted in on-line discussion are relevant to content or topics for students' learning or just socialization messages like greetings or administrative messages have to be considered. As mentioned by Rovai and Barnum (2003), the researcher should take into account the actual nature of student-student and student-instructor activities. Gerber et al (2007) considered the relevancy of the messages in on-line communication and tested the students' learning performance, as reflected by their examination results, on the number of messages posted in on-line communication, as well as the type of messages in terms of content-related, interpersonal and organisational messages. Content-related messages are directly linked to students' learning. These messages include information, clarification and explanation about the course content or topics. The interpersonal messages are used in social process to initiate, facilitate and maintain group discussion. This message type does not concern course content and administration. It refers to greetings (e.g. "how are you?"), informal communication, personal matters (e.g. "I have difficulty in finding references on the topic of computer processor"), jokes or small talk. The organisational messages are those related to administration of the course such as

messages about assignment submission (e.g. “what is the deadline of submitting assignment 1”), test arrangement (e.g. “the coming test covers hardware and software topics”) and technical settings (e.g. “how can I connect to the college’s on-line education system?”).

Many of the previous studies on investigating the factors affecting students’ learning effectiveness in on-line education took the form of exploratory case studies, perhaps because this research field was new at the period of their research, and many of these studies reviewed focused on one or a few aspects. For example, Fredericksen et al (2000) used a survey and quantitative analysis to examine the factors that significantly contribute to the students’ perceived learning. This study focused on the students’ perceptions on how they learnt, it lacked an objective empirical approach to assess students’ learning and required further work such as qualitative in-depth interview with the students to confirm the factors. Also, in order to have a holistic view in the study by Grabe and Christopherson (2007), a qualitative approach such as in-depth interview with or observation of the participating students is needed. The participating students’ views and explanation on how they used the on-line resources would give a better understanding of the phenomenon discovered by Grabe and Christopherson (2007). Klecker (2007) examined the impact of the feedback from the formative tests on the students’ final examination scores and the findings of this examination provide further understanding of how formative assessment influences students’ learning.

2.5 Implications for the Proposed Research

The identified unexplored area in the literature and the limitations of the previous studies suggested directions to explore, complement and extend the previous work for further investigation in the proposed research. There were five areas worthy of extension or further investigation in the proposed research. First, to accurately reflect how students learn, the proposed research followed the objective way to use the comparable and measurable test scores. To overcome the limitations mentioned by Arbaugh (2008) and Rovai and Barnum (2003), the researcher used the test scores of similar and comparable tests which were reviewed by the moderators in Wong’s (2008) quasi-experiment to reflect the students’ learning. These test scores did not account for aspects not related to students’ learning such as class participation, students’

participation in on-line discussion, late submission of assignments and students' attendance. In the quasi-experiment, how the tests were marked by the instructors was reviewed by the moderators to ensure consistent marking. Also, the problem mentioned by Rovai and Barnum (2003) that grades are affected by students' prerequisite knowledge was not the problem in this study. This study used Wong's (2008) college students' test scores of the introductory on-line IT course. There are no prerequisites for this course. The course contents had not been covered in any secondary school IT or IT-related courses taken by the college students before they came in the college. The proposed study investigated how SEP, IGD and SCD affect the students' academic performance, as reflected by their test scores of the introductory on-line IT course.

Second, some previous studies (e.g. Picianno, 2002) linked the interaction among students and instructors with students' actual learning performance. Would this phenomenon be different in on-line education in the Hong Kong higher education context? The proposed research attempted to explore this phenomenon in the Hong Kong higher education context.

Third, the proposed research attempted to explore SEP as a potential factor in on-line education in the bilingual learning environment in Hong Kong higher education. Investigating how SEP affects students' on-line learning is an area unexplored in the literature. Much work has been done in attempting to find the impact of SEP on students' learning in classroom teaching in Hong Kong higher education level, mainly because most of these students are not proficient in English (e.g. Graham, 1987; Ho and Spinks,1985). There was no enough knowledge on how SEP affects students' learning in on-line education. As on-line education can be a tool that attracts and brings convenience to international students, students' language proficiency is a major concern in such a multi-language environment, like that in Hong Kong higher education.

Fourth, since the previous studies (e.g. Swan et al, 2000) had the problem of neglecting the relevancy of the messages posted in on-line discussion, the proposed research considered the relevancy of the messages posted in on-line discussion. Gerber et al (2007) considered the relevancy of the messages in on-line communication in terms of content-related, interpersonal and organisational messages. In addition to these message types, for the Hong Kong higher education context, the researcher had to consider the

relevancy of language-related messages such as IT terms translated into Chinese terms, and Chinese explanations of course content. In the proposed research, the researcher based the interaction among students and instructors on the discussion forum's content-related and language-related messages most relevant to the college students' on-line learning.

The fifth area is that the proposed research adopted a comparatively more holistic approach. In recognition of the limitations of the previous studies (e.g. Fredericksen et al, 2000; Grabe and Christopherson, 2007; Klecker, 2007) which focused on one or a few aspects and lacked an objective empirical approach to assess students' learning, it was decided to conduct a more holistic approach in the proposed study. In the proposed approach, measurable and comparable tests were conducted in Wong's (2008) quasi-experiment, an analytical survey was carried out to extend the quasi-experiment to find the association between the three predictor variables (SEP, IGD and SCD) and the college students' test scores, and, as a follow-up to have an explanation and better understanding, the participating students' views were collected and analysed to support the notion that SEP, IGD and SCD are the factors affecting the college students' test scores. With a more holistic approach, a more complete picture of how the factors contribute to students' on-line learning is achievable.

Chapter 3

Research Design

The proposed research extended Wong's (2008) quasi-experiment in two ways – one way was to discover the quantitative relationship between the predictor variables (SEP, IGD and SCD) and students' learning while the other way was to explain these quantitative findings. In designing a research study, theoretical perspectives or paradigms need to be explored. Based on the theoretical perspectives, the research methodologies such as experiment, quasi-experiment, survey research and case study can be chosen; in turn, research methods which include sampling, data collection and analysis methods can be chosen in accordance with the developed research methodologies (Crotty, 1998). The following sub-sections discuss these relevant options and explain the choice of paradigms, research methodologies and research methods suitable for the proposed research.

3.1 Principles of Research Design

Crotty (1998) suggests a relationship between the theoretical stances adopted by researchers, their research methodologies and methods, as shown in Figure 3.1. The arrow in Figure 3.1 going from epistemology to theoretical perspectives means that the researcher's view of epistemology influences the theoretical perspectives to be adopted by the researcher. Then, the adopted theoretical perspectives influence the research methodologies which in turn influence the choice of research methods.

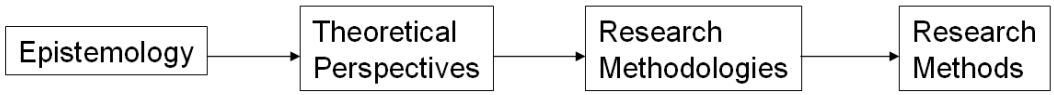


Figure 3.1: Crotty's (1998) Link from Epistemology to Research Methods

Epistemology is a theory of knowledge which is concerned with the nature and scope of knowing the meaning of ontology. Ontology is the study of being, existence or reality. Ontology includes understanding what is, while epistemology embodies understanding what it means to know (Gray, 2009:17). To conduct research, researchers make certain philosophical assumptions about both epistemology and ontology.

3.2 Research Paradigms

Theoretical perspectives refer to the paradigms which researchers hold about a way of looking at the world (Lincoln and Guba, 2000) or philosophical assumptions (Crotty, 1998). The research paradigm commonly used in quantitative research is positivism, as opposed to interpretivism. Positivism is closely linked to the objectivist epistemology in which authentic knowledge of reality comes from a scientific or empirical approach using quantitative methods. Cohen et al (2007) state that positivists view reality "*like the world of natural phenomena, as being hard, real and external to the individual*" (8). Gray (2009) states "*for positivists, then, both the natural and social worlds operated within a strict set of laws, which science had to discover through empirical inquiry*" (19). Positivists attempt to use an empirical approach to discover the laws that govern universal behaviour.

Interpretivism is one of the dominant research paradigms used in qualitative research. Interpretivism is an anti-positivist and anti-postpositivist perspective which usually uses qualitative methods. Epistemologically, interpretivism is closely linked to constructivism in which meaning is constructed by individuals and captured through qualitative methods. Constructivism asserts that knowledge is obtained through understanding meanings constructed by the interplay between subjects and the world in which they live. Bell (1993) states *"researchers adopting a qualitative perspective are more concerned to understand individuals' perceptions of the world. They seek insight rather than statistical analysis"* (5). Interpretivists look for *"culturally derived and historically situated interpretations of the social life-world"* (Crotty, 1998:67).

Since the proposed research aimed to discover the quantitative relationship between the predictor variables (SEP, IGD and SCD) and students' learning, the phenomenon investigated was external to the participants. The proposed research also aimed to explain the quantitative findings, and these perceptions were the individuals' internal thoughts and views ontologically. In the proposed research, the researcher began with knowledge obtained through an empirical approach, then was critical of the known reality gained from the empirical approach and developed more views to have better understanding reality. In this regard, epistemologically, the researcher was a post-positivist critical realist. According to Trochim (2006):

> "*Post-positivist critical realist recognizes that all observation is fallible and has error and that all theory is revisable… Because all measurement is fallible, the post-positivist emphasizes the importance of multiple measures…*"

For the proposed research, the researcher considered using the quantitative approach in the first phase to discover the relationships between the variables and the qualitative approach in the second phase to establish explanations. The quantitative approach aims to measure things (Berg, 2009) while the qualitative approach attempts to capture informants' meanings, definitions and descriptions of events (Minichiello et al, 1995). Then, the question is what research paradigm is appropriate for this kind of mixing quantitative and qualitative approaches (or, mixed methods).

Three stances about research paradigms for mixed methods have been discussed in the literature. The first stance is pragmatism. The second stance is mixed paradigms. The third stance is the paradigm depending on the design of the mixed methods. Examples of the first stance include Tashakkori and Teddlie's (2003) argument that the pragmatism paradigm, with which inductive and deductive approaches are used to explore and value both objective and subjective knowledge (Dewey, 1933), fits researches using mixed methods. Of the research paradigms, pragmatism, which has been proposed by many philosophers including Dewey (1933), James (1907) and Peirce (1905), is appropriate for the researchers who focus on the research outcomes rather than antecedent conditions and methods (Creswell, 2007:22). Pragmatists are free to choose and even mix methods that best lead to the research outcomes (Cherryholmes, 1992; Murphy, 1990; Tashakkaori and Teddlie, 2003). Similarly, researchers supporting pragmatism may look for mixed methods which may include quantitative and qualitative methods to collect and analyse data. Objective knowledge refers to the situation that the objectivists do research to build up knowledge by discovering objective truths. For subjectivist knowledge, meanings do not come from the interplay between subjects, but depend solely on one's own subjective awareness such as one's own dreams, beliefs, experiences, perceptions and opinions. In this stance, both objective and subjective knowledge are developed with the mixture of inductive and deductive research approaches. If the research starts with a theory, a deductive research approach is used; in contrast if the research ends up with a theory, an inductive research approach is used (Crotty, 1998). In the deductive approach, a universal view of the

subject is examined to form a hypothesis, which is then tested through empirical observation or experimentation. In other words, a deductive research approach moves from a universal view to particulars. In contrast, an inductive approach moves from particulars and connects them to a universal view. In the inductive approach, the researcher collects data from particulars, analyses them and generalizes to establish a universal view of the examined subject. This understanding of deductive and inductive research approaches is conceptualized in Figure 3.2.

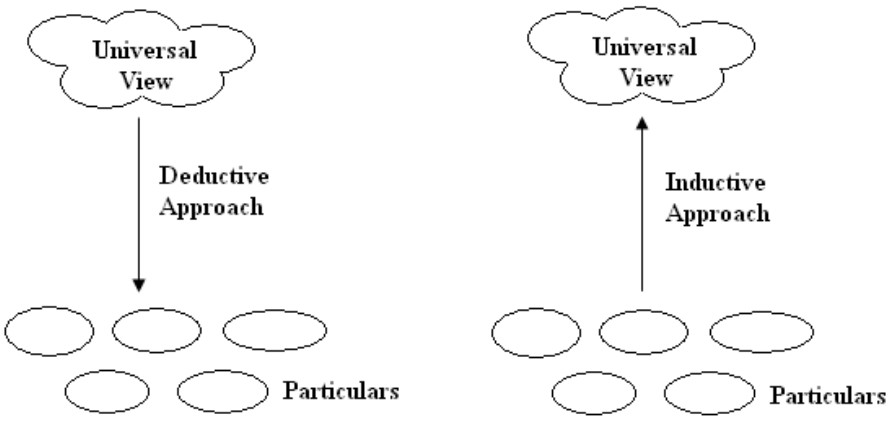


Figure 3.2: Deductive and Inductive Research Approaches

A deductive approach provides objective ways to measure data or observe facts which in turn gives strong evidence for supporting and building theory. However, a deductive approach is not appropriate for understanding and explaining behaviour. Therefore, an inductive approach is used for generalizing the patterns found from the analysis of the collected data. By using this approach, the researcher moves towards discovering patterns, consistencies and meanings of behaviour. However, subjective opinions might not be avoided in an inductive approach. Therefore, the researcher usually uses multiple inductive methods or cases and uses triangulation to ensure a high degree of reliability of study. By using mixed methods, researchers can test the hypothesis with quantitative methods (e.g. quasi-experiment and survey) and apply the generated results to individuals via deduction while developing theory using qualitative methods (e.g. interview) to obtain views, facts and data from individuals in an inductive approach. An overview of this process using mixed methods is presented in Figure 3.3.

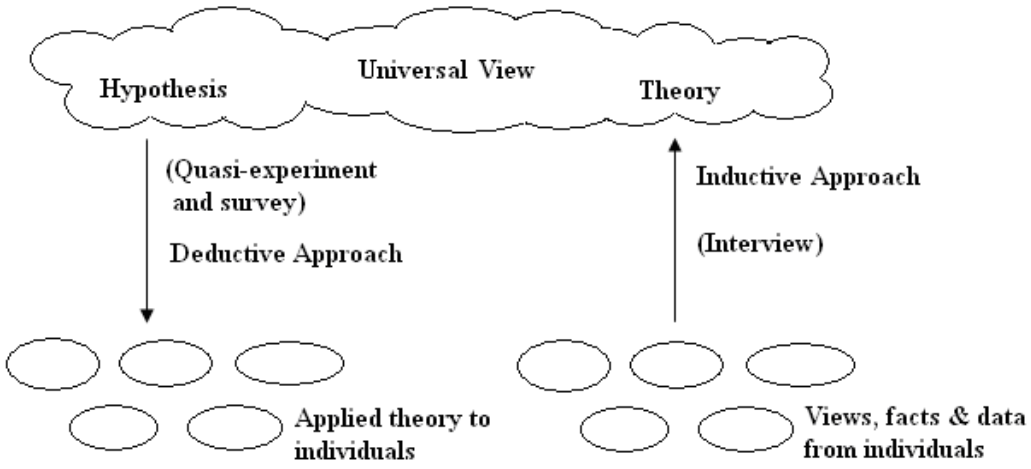


Figure 3.3: Deductive and Inductive Research Approaches in Mixed Methods of Research Study

The second stance represents:

> "*…multiple ways of seeing and hearing, multiple ways of making sense of the social world, and multiple standpoins on what is important and to be valued and cherished.*" (Greene, 2007:20)

Greene and Caracelli (1997; 2003) claim that researchers can use multiple paradigms in mixed methods even though the different paradigms may give rise to contradictory ideas and contested arguments as they reflect the features of research that are to be honoured but cannot be reconciled and reflect different ways of knowing the social world. Greene and Hall (2010) argue that the different paradigms juxtaposed in mixed methods explore differences of the social world and can lead to more generative, insightful understandings of inherent complexities and multifacets of human phenomena.

In the third stance, Creswell and Plano Clark (2007), et al advocate that the research paradigm used depends on the type of design in mixed methods. For example, in Creswell and Plano Clark's (2007) design of mixed methods called the convergence model of the triangulation design of mixed methods, as shown in Figure 3.4, quantitative and qualitative data are collected and analysed independently and concurrently on the same phenomenon, then converged by comparing and contrasting

the quantitative and qualitative findings. The primary purpose of this model is triangulation through comparing and validating the quantitative and qualitative results, therefore pragmatism is the research paradigm for this model (Creswell and Plano Clark, 2007).

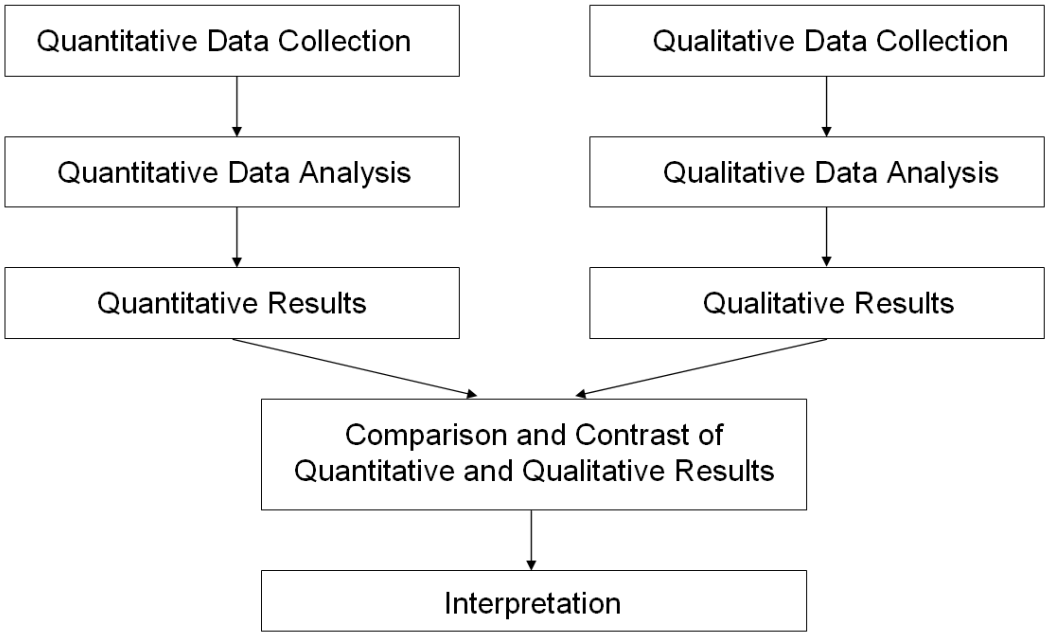


Figure 3.4: Creswell and Plano Clark's (2007) Convergence Model of the Triangulation Design of Mixed Methods

For another example, Creswell and Plano Clark's (2007) follow-up explanations model of the explanatory design of mixing methods, as presented in Figure 3.5, follows Creswell's (2009) sequential explanatory strategy with mixed methods in which the first exploratory quantitative phase is followed by the second explanatory qualitative phase. These quantitative and qualitative approaches in different phases are different but complementary. Plano Clark and Creswell (2010) claim that this model places a priority on the first quantitative phase and needs the second qualitative phase to explain the initial quantitative results and state:

> "*As you read an explanatory mixed methods study, expect the following characteristics… The qualitative data helps the researcher refine the quantitative results by exploring a few typical cases, probing a key result in more detail, or*

following up with outlier or extreme cases. In this way the two phases are connected to each other because the researcher collects the qualitative data to follow up on the quantitative results." (305)

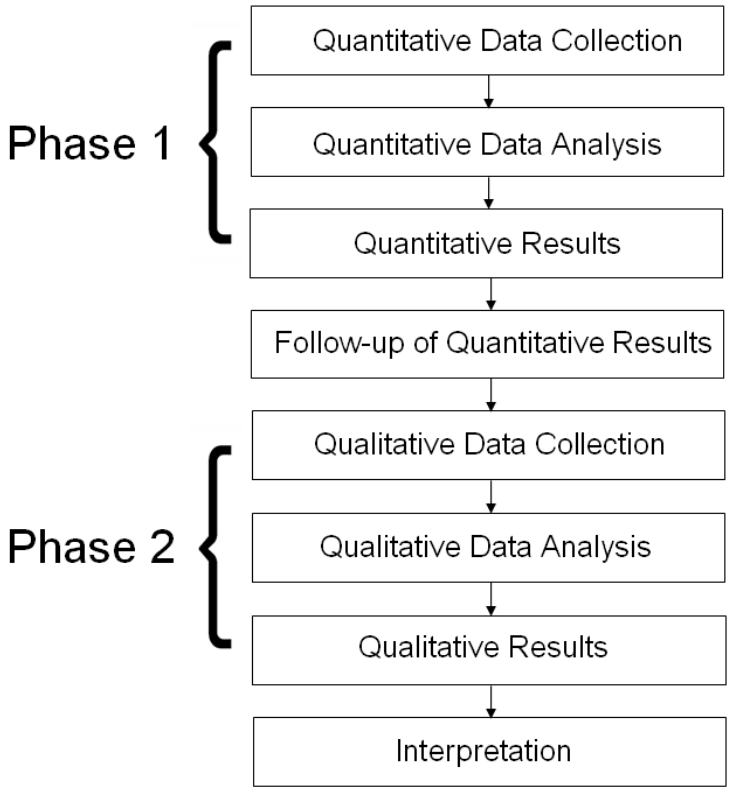


Figure 3.5: Creswell and Plano Clark's (2007) Follow-up Explanations Model of the Explanatory Design of Mixed Methods

Although the mixed methods combine the quantitative approach, which usually supports a positivism paradigm, and qualitative approach, which usually supports an interpretivism paradigm, the emphasis of this design model of the mixed methods is on the quantitative findings (Creswell and Plano Clark, 2007). Because this model of the explanatory design of mixing methods has the quantitative emphasis that calls for an explanation (Plano Clark and Creswell, 2010:66), the paradigm used in this model is post-positivism (Creswell and Plano Clark, 2007). Post-positivism is a modified version of positivism which accepts that studies should take a 'falsificationist' approach; that is, studies do not "prove" that a theory is correct but test a theory. Popper (1968) suggests that multiple studies cannot prove theory since only one instance that refutes the theory

can falsify the theory. For post-positivists, all measurements are fallible and therefore multiple measures are needed to triangulate across multiple fallible perspectives (Trochim, 2006).

As the researcher mainly adopted Creswell and Plano Clark's (2007) follow-up explanations model of the explanatory design of mixed methods to test the theory and refine the quantitative findings if needed through the triangulation process, the researcher held the post-positivist perspective. Epistemologically, positivists' knowledge is to study only what can be measured. One's own thoughts and emotions, for example, which can hardly be measured, are beyond the positivists' epistemology. According to Willis (2007), the main difference between positivism and post-positivism lies in the meaning of data – positivists use data to develop theory while post-positivists take a falsification approach by using data to test theory. The appropriate form of post-positivism that is linked to falsification is critical realism.

3.3 The Mixed Methods - Research Design for the Study

The proposed research design mainly used Creswell and Plano Clark's (2007) follow-up explanations model of the explanatory design of mixing methods, as shown in Figure 3.5, and focused on the triangulation process of Creswell and Plano Clark's (2007) convergence model of the triangulation design of mixed methods, as shown in Figure 3.4, thus developing the research design in Figure 3.6. The main reason for this design was that the second qualitative findings could be used to explain and triangulate with the first quantitative findings. In the first phase, questionnaires, correlation and multiple regression analyses were used in the analytical survey to examine the relationship between the potential factors (independent or predictor variables) in Figure 1.1 and the participating students' learning effectiveness as reflected by their test scores. In the second phase, qualitative semi-structured interviews were used in a case study to explore the causal relationship between these variables and the students' learning and to explain the quantitative findings. The first quantitative phase included my previous quasi-experiment in Wong (2008), as detailed in sections 1.2.4 and 2.3.1.1, and the proposed analytical survey, the second qualitative phase contained the proposed case study. The quantitative findings in phase 1 were identified for further investigation in phase 2. Some of the findings in both phases could be used for triangulation but the

proposed research emphasis was on the explanatory design. In Figure 3.6, the solid arrow lines show the main design flow while the dotted arrow lines indicate the complementary triangulation flow for the proposed research.

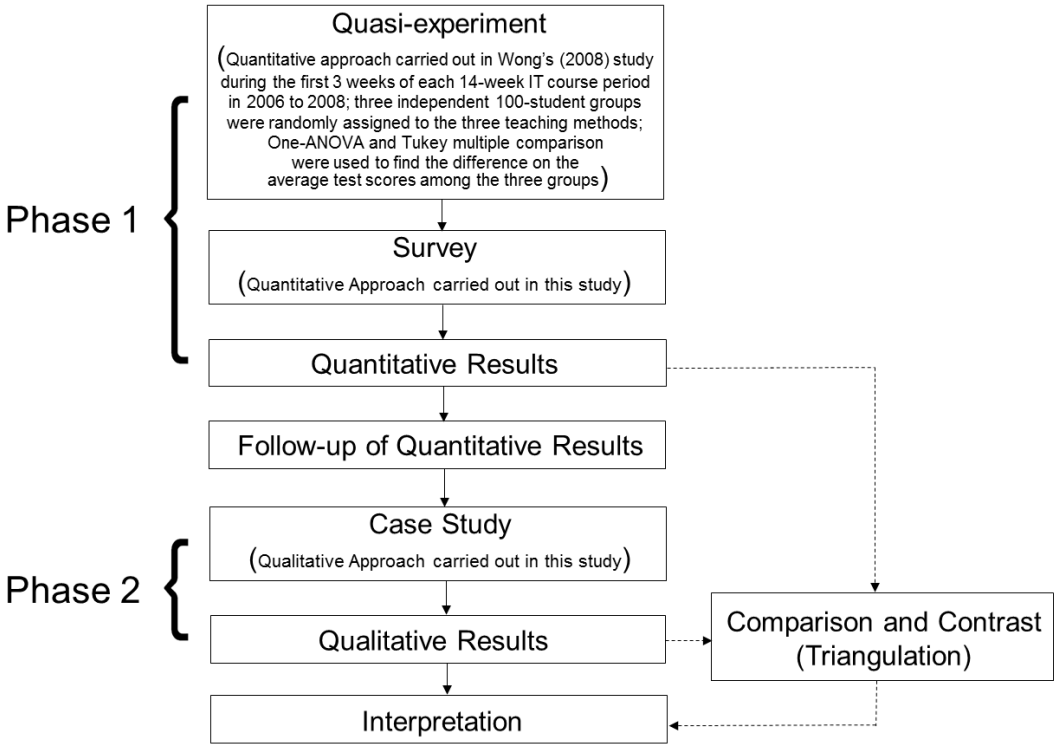


Figure 3.6: Proposed Research Design

The mixed methods suggested for the proposed research were not concurrent execution of the quantitative and qualitative techniques. In the proposed research, the researcher used the quantitative and qualitative techniques sequentially at different phases. This research involved collecting quantitative data and performing quantitative analysis of the collected quantitative data in the first quantitative phase, then identifying the quantitative findings for further investigation in the second qualitative phase. In the second quantitative phase, the researcher collected qualitative data and carried out quantitative and qualitative analyses of the collected qualitative data. Finally, the quantitative and qualitative findings would be integrated for interpretation and triangulation.

The mixed methods in the proposed research involved monodata-multianalysis

(quantitative and qualitative analyses of one data type) (Onwuegbuzie et al, 2007) which in turn projected four types of data analysis – (1) qualitative analysis of qualitative data, (2) qualitative analysis of quantitative data, (3) quantitative analysis of qualitative data and (4) quantitative analysis of quantitative data (Bernard and Ryan, 1996; 2010:4). In the first quantitative phase, the fourth type of data analysis (quantitative analysis of the collected quantitative data) was involved. In this phase, the researcher collected quantitative data using a survey and analysed them with quantitative statistical methods such as correlation and multiple regression analyses. In the second qualitative phase, the researcher used semi-structured interviews to collect qualitative data and then completed an analysis. For the analysis in this second qualitative phase, the researcher did not only use the qualitative type of monodata-monanalysis (that is the first type of data analysis (qualitative analysis of the collected qualitative data)), but also carried out the third type of data analysis (quantitative analysis of the collected qualitative data). The researcher used the first type of data analysis (qualitative analysis of the collected qualitative data) by coding and interpreting the interview transcripts. Johnson and Christensen (2008) regard "*coding is the process of marking segments of data (usually text data) with symbols, descriptive words, or category names*" (534). Miles and Huberman (1994) explain:

> "*Codes are tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study. Codes usually are attached to 'chunks' of varying size – words, phrases, sentences, or whole paragraphs.*" (56)

Then, the researcher used the third type of data analysis (quantitative analysis of the collected qualitative data) by quantifying data. To quantify data, "*qualitative 'themes' are numerically represented, in scores, scales, or clusters, in order more fully to describe and/or interpret a target phenomenon*" (Sandelowski, 2001:231). As cited by Johnson and Christensen (2008), "*this (quantifying data) allows researchers to understand how often various categories or statements occurred*" (554). The quantitative analysis of the collected qualitative data involves searching for the patterns in the qualitative data by quantifying data which includes classic content analysis (Bernard and Ryan, 1996; 2010:4), enumeration (also termed as word or code frequency) (Johnson and Christensen, 2008:541) such as word counts (Bernard and Ryan, 2010:193-195) and analysis using key words in context (Bernard and Ryan,

2010:192-193), multidimensional scaling (MDS) (Bernard and Ryan, 2010:176, 180-183), cluster analysis (Bernard and Ryan, 2010:176-178, 180-183) and semantic network analysis (Bernard and Ryan, 2010:210-220).

3.4 Justification for the Mixed Methods

As pointed out by Razzhavaikina (2007), the sequentially proceeding stages in Creswell and Plano Clark's (2007) follow-up explanations model of the explanatory design of mixing methods is easily implemented by a single researcher who can explore quantitative results in detail and explain unexpected quantitative results; however, it is time-consuming to complete all stages and have feasible resources to collect and analyse both quantitative and qualitative data. Using mixed methods in a research requires a lengthy time scale to complete and brings complexity (Razzhavaikina, 2007), but there are advantages of using mixed methods. Mixed methods can be used to answer different research questions. Gray (2009) states:

> "*In practice, however, it is often the case the multiple methods will be used. One reason is that research projects usually include a number of different research questions, so a research method appropriate for one question may be inappropriate for another.*" (36)

Denzin (1989), Sieber (1973) and Strauss (1987) also argue that the choice of research method depends on the research question asked. The first quantitative phase searched for the answers to the research questions 1 to 3 in section 1.5 while the second qualitative phase, which aimed at answering the research questions 4 to 6 in section 1.5, focused on explaining the findings of the first quantitative phase.

In order to explain, the researchers must be able to find the antecedent conditions that result in the phenomenon and once the antecedent conditions are known, the phenomenon or outcome can be manipulated or controlled by either allowing or not allowing the conditions to exist (Christensen et al, 2011:21). However, attempts to develop experimental controls allowing or not allowing the conditions related to human participants are difficult (Craighead and Nemeroff, 2004:348). Boring (1954) says "*if A is always followed by a and not-A is always followed by not-a, then A is certainly the*

cause of a" (574). If *a* is one of the variables SEP, IGD or SCD in this research, then it can hardly be manipulated or controlled for determining whether it causes the high test scores of the introductory IT course.

Quantitative correlation analysis could be used to answer the research question 1 in section 1.5 as it was used to measure how each variable and a student's test score is correlated. However, correlation analysis cannot confirm that the variable and the student's test score having a high correlation are causally related (Weiss, 2008:731). Therefore, to answer the research question 4, an interview was needed. Multiple regression was used to extend the regression model to include more than one independent (or predictor) variable (Young, 2008) for the research question 2. For the answer to the research question 5, an interview was used to find out if there are any perceived reasons for the relationship between the variables and the students' learning. Interviews can be used in conjunction with surveys to follow up issues (Cohen et al, 2007). In this study, a survey was used to obtain the distribution of the students' views for the research question 3 while interviews could be conducted to obtain the participants' views on their experiences of using on-line education and on how to develop effective learning in on-line education for the research question 6.

Gray (2009) also states:

> "*The second reason for using multiple methods is that it enables… data triangulation as the collecting of data over different times or from different sources. This approach is typical of cross-sectional designs. Methodological triangulation is also possible, with the use of a combination of methods such as case studies, interviews and surveys.*" (36)

In accordance with Bush (2002), triangulation can be done not only through asking the same questions of many different participants, but also through methodological triangulation in which different methods are used to explore the same issue. In the proposed research design in Figure 3.6, triangulation can be achieved by comparing the quantitative and qualitative findings so as to look for convergence and complementarity of quantitative and qualitative results (Kelle and Erzberger, 2004).

Besides, with mixed methods, the quantitative and qualitative methods are combined to counter the weaknesses of each other. As cited in Johnson and Christensen (2008:51), in the research using mixed methods, the resulting mixture or combination of different research methods has complementary strengthens (Brewer and Hunter, 1989; Johnson and Turner, 2003; Webb et al, 1981). Gray (2009) points out:

> "*All methods have their strengths and weaknesses… the use of multiple methods… helps to balance out any of the potential weaknesses in each data collection method*." (36)

According to Cohen et al (2007), "*one advantage, for example, is that it (interview) allows for greater depth than is the case with other methods of data collection*" (352). In-depth understanding involves asking probing questions for which interviews have greater opportunities compared to the use of questionnaires (Cohen et al, 2007). For the proposed research, the use of questionnaires in the quantitative phase has difficulty in asking probing questions while questions posed in an interview in the qualitative phase can be used to obtain in-depth understanding from the participants. As it is difficult to generalize qualitative findings from one case or a few samples, the quantitative survey can be used to find the general characteristics of large samples effectively and efficiently. The weaknesses of quantitative methods include difficulties in obtaining the views of individuals and validity; while those of qualitative methods include difficulties in generalization and reliability. The use of questionnaires in the survey research is useful for finding the characteristics of large samples effectively and efficiently but is difficult to ask probing questions to obtain in-depth understanding from the participants. The quantitative correlation analysis can measure how two variables are correlated but cannot ensure two variables are causally related. The qualitative interview approach can be used to explore this causal relationship. However, it is difficult to generalize qualitative findings from one case or several cases. Table 3.1 presents the main advantages and disadvantages of these research methods.

Research Methodologies	*Research Methods*	*Advantages*	*Disadvantages*
Quasi-experiment (Deductive Approach)	**Statistical Analysis (Quantitative Method)**	• Find universals, provide greater objectivity and accurate measurement and results • Researchers may have control over variables • Provide greater transferability and generalizability – experiment or quasi-experiment can be replicated and applied to other similar cases	• Difficult to measure and understand subjective and real human perception
Survey (Deductive Approach)	**Questionnaires and Statistical Analysis (Quantitative Methods)**	• Find universals – survey is useful in finding characteristics of large samples or population • Large samples or population are feasible and results are statistically significant from large samples or population • Inexpensive administration through mail, email, instant messaging or telephone	• Difficult to ask probing questions • Standardized questions in survey make in-depth understanding difficult • Response rate may be low
Case Study (Inductive Approach)	**Interview (Qualitative Method)**	• Find the complexity and multifaceted dimensions of cases	• Challenging to find suitable cases • Difficult generalization

Table 3.1: The Main Advantages and Disadvantages of the Research Methods for the Proposed Research

3.4.1 Phase 1 - The Quantitative Methods

The researcher used a stratified random sampling method with proportional allocation (Weiss, 2008:22) to sample 75 participating students from each of the three groups in Wong's (2008) quasi-experiment. He invited them to meet in a computer laboratory and asked them to complete the on-line questionnaire (as shown in Appendix 3) there. As multiple regression was used in this phase, the sample size 75 for each stratum was based on the threshold $N > 50 + 8v$ (Tabachnick and Fidell, 2007:123) for the sample size in multiple regression, where v is the number of predictor variables. For the three predictor variables (SEP, IGD and SCD) in this case, the sample size 75 is larger than

the threshold $50 + 8 \times 3 = 74$. Students were sampled from the different strata of teaching methods because the researcher believed that the students having different teaching methods might respond in different ways. Hutton (1990) states:

> "*Survey research is the method of collecting information by asking a set of preformulated questions in a predetermined sequence in a structured questionnaire to a sample of individuals drawn so as to be representative of a defined population.*" (8)

This statement focuses on the use of a questionnaire only as a survey method, but Fogelman (2002) points out that there are some other methods such as semi-structured or unstructured interviews. In the proposed research, questionnaires were used in the survey as they fit the objective of collecting data for finding the characteristic of large samples. Gillham (2007) points out the advantages of using questionnaires which include the following:

- Questionnaires can be processed at relatively low cost in terms of both time and money.
- Questionnaires provide convenient method to collect data as there is no necessary restricted location and time for the respondents to fill the questionnaires.
- Closed questions in questionnaires provide a convenient method to analyse data.
- The ethics of ensuring the respondents' anonymity can be assured with the use of questionnaires.
- Interviewer bias can be avoided with the use of questionnaires.

However, the response rate can be low with the use of questionnaires. To avoid a low response rate, the researcher distributed the questionnaires to the participants, explained the questions if needed to make sure the participants understood them and collected the completed questionnaires in meetings. As advised by Saunders et al (2009), response rates can be improved by calling the respondents to meet, explaining the purpose of collecting data through questionnaires, and getting the questionnaires completed in the meeting. As most of the participating students are Chinese, they had difficulty in understanding the English questions on the questionnaire. The use of English questions on the questionnaire could save translation time. The meetings enabled the researcher to

explain the questions or even supplement with Chinese when needed to ensure the participants' understanding. The researcher checked with the participating students in the meetings and checked with their accounts in the college's on-line education system, which were maintained in the college's Web server, in order to ensure that the participants entered the questionnaires correctly and honestly.

The questions 1 to 7 of the questionnaire, as shown in Appendix 3, were used to obtain the participants' background information. The questions 8 to 11 were used to collect information about the participants in the quasi-experiment. The questions 6 (SEP), 9 (a student's test score), and 11 (the number of viewed messages posted by instructors and students), 15 to 17 and 19 (importance ranking of the variables) were used to collect data for correlation and multiple regression analyses. For the question 6, to reflect a student's English proficiency, the researcher used the SEP marks which were converted from the highest grades or scores from the students' public English examination results such as International English Language Testing System (IELTS), Hong Kong Advanced Level Examination (HKALE) and Hong Kong Certificate of Education Examination (HKCEE) results. To make these different syllabi and grading/scoring systems of the public English examinations applicable for analysis, the researcher referred to Hong Kong Examinations and Assessment Authority's (2007) published equivalence between HKCEE English Language Syllabus A and Syllabus B grades, as indicated in Table 3.2.

HKCEE English Language	
Syllabus A Grade	***Syllabus B Grade***
A	C
B	D
C	E

Table 3.2: Hong Kong Examinations and Assessment Authority's (2007) Equivalence between HKCEE English Language (Syllabus A) and HKCEE English Language (Syllabus B) Grades

From Table 3.2, a grade in syllabus B is two grades below the corresponding grade in syllabus A. For these reasons, D and E grades in syllabus A are equivalent to F and U grades in syllabus B respectively. The researcher also had to refer to Hong Kong Examinations and Assessment Authority's (2008) survey to equate the IELTS band scores, the grades in HKALE Use of English and the grades in HKCEE English

Language (Syllabus B) for analysis, as shown in Table 3.3.

HKALE/HKCEE Grade	***Equivalent Range of Overall IELTS Band Score for HKCEE English Language (Syllabus B)***	***Equivalent Range of Overall IELTS Band Score for HKALE Use of English***
A	6.85 - 8.10	7.41 - 8.30
B	6.41 - 6.84	6.92 - 7.40
C	5.92 - 6.40	6.51 - 6.91
D	5.32 - 5.91	6.03 - 6.50
E	4.50 - 5.31	5.40 - 6.02

Table 3.3: Hong Kong Examinations and Assessment Authority's (2008) Survey Results on the Equivalence among HKAL Use of English Examination Grades, HKCEE English Language (Syllabus B) Examination Grades and IELTS Scores

The questions 12 to 14 and 18 were used to obtain the participants' views on the teaching methods and comparison with the findings in the quasi-experiment.

A positive correlation between a variable and the students' test scores is a criterion for that variable to be a factor for the students' learning. Therefore, the Pearson product moment correlation coefficient was used to measure the correlation. Based on the nominal and ordinal data collected through questionnaires, correlation analysis was used to identify the potential factors by locating the variables that had a positive correlation with the students' academic performance. These quantitative variables, which include students' academic performance, SEP, IGD and SCD, were collected through the questionnaires. As the proposed research involved sampling and the investigator was interested in whether the findings from the drawn samples could represent the characteristics of the population, in the correlation analysis, in addition to using the descriptive statistical tool the Pearson product moment correlation coefficient, the researcher adopted the inferential statistical tool significance level to test the significance of the correlation coefficient and measure the reliability of the findings about the population of the college students based on the data collected from the samples.

To explore the combined effect on the students' test scores (dependent or outcome variable) by the three predictor variables, multiple regression analysis was used. In this study, multiple regression was the generalization of correlation for the case where the

outcome variable (students' academic performance) is related to the three predictor variables (i.e. SEP, IGD and SCD) in on-line education. Correlation analysis was used to explore the correlation between an outcome variable and one predictor variable while multiple regression analysis was used to explore the relationship between the outcome variable and more than one predictor variable.

Both simultaneous multiple regression and sequential (or hierarchical) multiple regression are useful for explanatory research to determine the extent to which the predictor variables influence the outcome variable (Keith, 2006:76-78). By simultaneous multiple regression, for each teaching method, all the three predictor variables were entered into the regression equation simultaneously in order to see the combined effect on the students' test scores. Using sequential multiple regression, each predictor variable was entered into the regression equation in the order specified by importance ranking of the variables (as obtained from the questions 15 to 17 and 19 of the questionnaire in Appendix 3) at a time so as to see the relative effect contributed by each predictor variable.

The statistical tool Statistical Package for the Social Sciences version 17.0 (in short, SPSS) was used for the correlation and multiple regression analyses. SPSS provides reliable statistical analysis. The objective of the correlation and multiple regression analyses was to look for the possible factors that affect the learning effectiveness in on-line education. One important note is that correlation and multiple regression analyses can help to find the significant association between the variables, but it cannot confirm the causal relationship between the variables. However, the correlation and multiple regression analyses are needed because their found correlation and multiple regression are the criteria for the variables to be factors.

3.4.2 Phase 2 - The Qualitative Methods

According to Campbell in Miles and Huberman (1994), "*all research ultimately has a qualitative grounding*" (40). For the qualitative phase, the researcher suggested a case study, which is defined as an approach of examining phenomenon of a single individual case or a few cases with the use of a variety of data collecting and analysing segments which contribute to the application of theory (Berg, 2009; Creswell, 2007; Yin, 2003).

> "*An educational case study is an empirical enquiry which is conducted within a localized boundary of space and time, into interesting aspects of an educational activity, or programme, or institution, or system, … such that sufficient data are collected for the researcher to be able to explore significant features of the case, to create plausible interpretations of what is found, …*" Bassey (1999:58)

In the proposed research, the empirical enquiry involves the quasi-experiment and survey in the first quantitative phase and the interviews for the case study in the second qualitative phase, the localized boundary in the case study is the college students taking the introductory IT course while the aspects of the educational activity are the three teaching methods. The data collected in the case study were used to explore the significant features of the case – the factors affecting the college students' learning effectiveness in on-line education.

In order to probe the participating individuals' views, the statistical methods used in the quasi-experiment and survey in phase 1 were not applicable. In the proposed case study in phase 2, in-depth interviews with the participants in the three teaching methods were organised to obtain their views on how the potential factors (i.e. SEP, IGD and SCD) affect their academic performance and how to develop effective learning in on-line education.

The type of case study used was Yin's (2003) explanatory case study as it is useful for causal study for the proposed research. For this phase, the researcher proposed to use Yin's (2003) type 2 design of case study which is single case and embedded case study - the case students were embedded in the multiple teaching methods. For this case study, the researcher used a stratified purposeful sampling (Gall et al, 2003:179) to sample 8 students in each of the strata of teaching methods for interview. With this sampling, the researcher attempted to develop insights from the characteristics of the students' learning in each teaching method and obtain the variations in the students' learning that may exist across different teaching methods. The sample size in this qualitative phase was different from that in the quantitative phase and "*different sample sizes are common in mixed methods designs because quantitative and qualitative data are usually collected for different purposes*" (Creswell et al, 2008:74). Also, as stated by Creswell

and Plano Clark (2007):

> "*…since the two samples are not being directly compared as in concurrent designs, the sample sizes in a sequential design do not need to be of equal sizes.*"

While the quantitative survey data were collected for identifying the association between some variables and the students' test scores in the large samples (three groups of 75 students), the qualitative data obtained from the interviews with the small samples (three groups of 8 students) provided detailed description and explanation. Then, the issue was whether the same or different participants in the first quantitative phase should be sampled.

> "*If the intent of the study is for the second phase to help explain the first phase (explanatory design), then a strategy would be to select the same or a subset of the participants from the initial, quantitative phase for the second qualitative follow-up phase.*" Creswell et al (2008:76)

Therefore, the researcher sampled 8 participants in each of the teaching methods in the survey of the first quantitative phase.

As commented by Arksey and Knight (1999), "*interviewing is a powerful way of helping people to make explicit things that have hitherto been implicit – to articulate their tacit perceptions, feelings and understandings*" (32). A semi-structured interview was appropriate for the research as it allows for the probing of views and expanding respondents' answers for in-depth understanding. In a semi-structured interview, the interviewer may answer questions raised by the participating interviewee, debrief the interviewee, determine if the interviewee needs assistance and counseling and give explanations or clarify when needed (Berg, 2009). Also, improvisation, such as varying the order of the questions to fit the interview flow and varying the questions by adding interviewers' self into the interview so as to build rapport (Arksey and Knight, 1999), was used as it is probable key to success of obtaining information through semi-structured interview (Gray, 2009:382). The researcher considered focus group meetings as well but they were not appropriate for this research for the reason that there might be difficulty in encouraging the participants to speak freely, honestly and

critically in such a group setting. To save translation time and facilitate transcription and analysis of interview data in English, the interviews were conducted in English. However, the researcher noted that the interviewees might not be comfortable with speaking in English as English is not their familiar language and they usually use Chinese in their daily lives. Therefore, at the beginning of the interview, the researcher gave a brief introduction on the interview purposes, procedure and protocol in Chinese to build rapport and ensure the interviewee understood. Also, the researcher would supplement with Chinese in the interviews in case the researcher found the interviewees could not understand the English interview questions or could not express their ideas clearly in English. In addition to verbal prompting, non-verbal prompting such as nodding and smiling (Gall et al, 2003) was used to encourage the interviewee to speak out in English. As suggested by Robson (2002):

> "*A probe is a device to get interviewees to expand on a response when you intuit that she or he has more to give… There are obvious tactics such as asking 'Anything more?' or 'Could you go over that again?'*." (276)

So, probing was also used in the interpersonal and cognitive processes that took place in the interviews.

Based on the results obtained from the piloted quantitative phase, the interview protocol, as indicated in Appendix 4, had been designed for this phase. The interview protocol contains a list of questions to be asked in the interview so that the interviewer can systematically read the questions from the protocol and record the interviewee's responses (Christensen et al, 2011:337). This interview protocol was designed to explore the perceived reasons and explain the quantitative findings in the first phase. The interview question 1 was used to obtain an interviewee's personal background and the teaching method used by the interviewee for the introductory IT course in the college. The interview questions 2 and 3 were focused on exploring the participants' experiences in using on-line education. The interview question 2 is an open-ended question which was used to explore potentially the participants' difficulties and benefits when using on-line education and to understand how the participants use on-line education. The interview question 3 explicitly explored these difficulties and benefits just in case the participants did not express their difficulties and benefits of using the

on-line education from the interview question 2. The interview question 4 attempted to determine whether SEP is a factor that affects the students' on-line learning and obtain the reasons. Probes might be used for this question to obtain more details from the interviewees. The interview question 5 explored the participants' experiences in using on-line discussion forum and potentially explored whether the on-line discussion forum helped their on-line learning. This question also potentially explored whether IGD and SCD are the factors. The interview questions 6 to 7 explicitly asked if the on-line discussion forum helped the participants to learn and explored whether IGD and SCD are the factors in case these were not found out from the interview question 5. Then, the interview question 8 explored the factors and their ranks in the students' on-line learning. The interview question 9 is a compare-and-contrast question to "*elicit how things are related to each other*" (Bernard and Ryan, 2010:37). It asked the participants to compare the classroom teaching with on-line education and see which one was more effective. The last question 10 asked the participants for any information they believed may make on-line education effective.

To facilitate analysis, the interviews were voice recorded and transcribed. Member checking was used by presenting the transcripts to the interviewees for confirmation. The researcher confirmed with the interviewees in their familiar language Chinese to ensure that the researcher did not misunderstand their English expressions in the interviews. Analysis for transcribed data (qualitative data) involves the process of breaking the data into smaller units which may reveal the characteristics and structure for the findings (Dey, 1999:30). Qualitative data analysis is the process of systematically searching and arranging the qualitative data including interview transcripts for the researcher to come up with qualitative findings (Bogdan and Biklen, 2007:159). Qualitative data analysis "*involves working with the data, organizing them, breaking them into manageable units, coding them, synthesizing them, and searching for patterns*" (Bogdan and Biklen, 2007:159). Qualitative data analysis is defined as consisting of three concurrent processes: (1) data reduction, (2) data display, and (3) conclusions and verification (Miles and Huberman, 1994:10-12). Qualitative data has to be reduced because the collected data are usually more than the researcher actually needs. Although the researcher confines the data to be collected by designing interview protocols, the informants may not be aware of what data are relevant to the research and provide irrelevant data especially when probed by the researcher to give more details.

The researcher has to look for the potential from the data and identify what data is relevant to the research. Berg (2009) states:

> "*Qualitative data need to be reduced and transformed in order to make them more readily accessible, understandable, and to draw out various themes and patterns… It (data reduction) directs attention to the need for focusing, simplifying, and transforming raw data into a more manageable form.*" (54)

Data display is to convey the idea from the reduced data in the formats that facilitate the researcher's understanding and recognizing the patterns in the data. These formats can be tables of data, applied codes, and charts and diagrams for analysis. After the data are analysed, conclusions which comprise the findings from the analysis may emerge. These findings have to be verified through some processes like an inter-coder reliability check - having more than one researcher to independently go through data reduction, data display and analysis procedures, and finally obtain the findings. The researchers check and compare these findings from different researchers, adjust any procedures if necessary when inconsistencies are found, repeat the adjusted procedures and come up with verified reliable findings. Through analysing the interview data, the researcher could go beyond describing the findings in the quasi-experiment and survey by interpreting, understanding and explaining these findings.

Content analysis is an approach for analysing the interview data. Content analysis "*is a careful, detailed, systematic examination and interpretation of a particular body of material in an effort to identify patterns, themes, biases, and meanings*" (Berg, 2009:338). Typically, content analysis is carried out on published newspapers, magazines, photographs, videos and audios, but it can also be performed on interview transcripts. Content analysis in this study involves making inferences about interview data by identifying categories. Categorical indexing which is a systematic application of labeling parts of the interview transcripts was used. Memos, which are field notes about codes and operations (Strauss and Corbin, 2008), were also used to help inference making. A similar analysis approach is grounded theory. Grounded theory, developed by Glaser and Strauss (1967), is in general a qualitative research design or, in some cases (e.g. Glaser, 1992), a quantitative design in which the researcher generates a theory by the actions, interactions, processes and views of the participants who have

experienced the same process (Strauss and Corbin, 2008). Borgatti (2008) states "*grounded theory refers to theory that is developed inductively from a corpus of data*". Grounded theory is more appropriate for inductive research in the beginning exploratory phase. The researcher used content analysis because it was suitable for deduction in this second explanatory phase.

Coding was involved in this phase as "*coding is analysis… involves how you differentiate and combine the data you have retrieved and the reflections you make about this information*" (Miles and Huberman, 1994:56). At the beginning of qualitative analysis, a priori codes, which are "*a provisional "start list" of codes prior to fieldwork*" (Miles and Huberman, 1994:58) were in hand. The a priori codes contained the variables, labels or themes derived from the research questions and findings in the first quantitative phase. To increase the analysis reliability, two other coders were invited to help making inferences and findings were compared. The steps of the qualitative phase are shown in the flow chart in Figure 3.7 and its explanation is presented as follows:

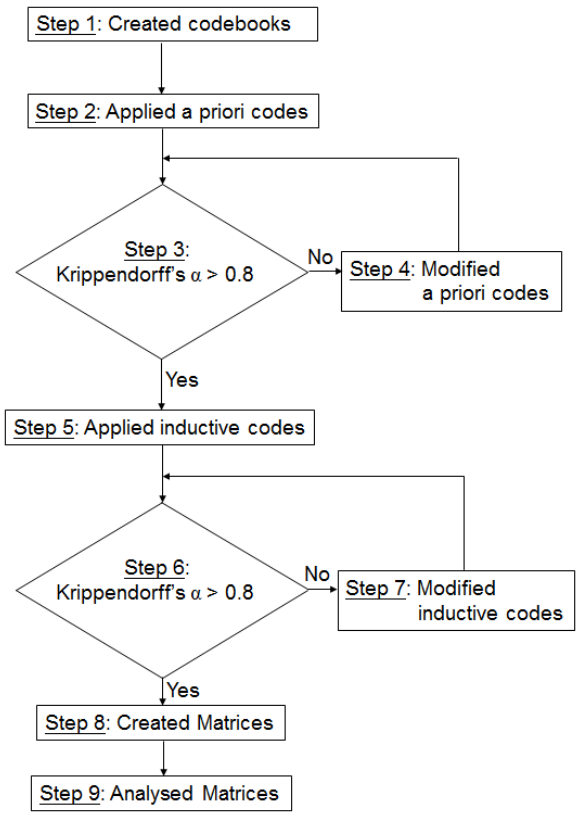


Figure 3.7: Flow Chart showing the Steps of the Qualitative Phase

Step 1

- Created a codebook which contained transcripts and the a priori codes.
- Introduced and explained them to the other two coders.

Step 2

- Applied the a priori codes to some of the interview transcripts.

Step 3

- Compared themes with the other two coders' themes by measuring the inter-coder reliability with Krippendorff's (2004a:221-236; 2004b) alpha.
- If the computed Krippendorff's alpha attained the value of 0.8 or higher, then jumped to step 5.

Step 4

- Modified the a priori codes if necessary in order for all coders to become consistent in coding, then performed step 3.

Step 5

- Applied the a priori codes together with the codes induced from the transcripts (inductive codes (Johnson and Christensen, 2008:538-539)) to all interview transcripts to obtain themes.

Step 6

- Again compared themes with the other two coders' themes by computing Krippendorff's alpha.
- If the computed Krippendorff's alpha attained the value of 0.8 or higher, then jumped to step 8.

Step 7

- Again, modified the inductive codes if necessary for consistent coding, then performed step 6.

Step 8

- Applied the inductive and common codes to all interview transcripts to obtain

themes.

- Created data matrices and similarity matrices from the codes and transcripts if necessary.

Step 9

- Analysed the matrices using the analysis tool UCINET 6.0 (in short, UCINET) to perform multidimensional scaling (MDS) and cluster analysis wherever applicable in semantic network analysis (Borgatti et al, 2004) to search for patterns and obtain qualitative findings.

The macro for computing Krippendorff's alpha in SPSS was available at http://www.comm.ohio-state.edu/ahayes/spss%20programs/kalpha.htm (Hayes and Krippendorff, 2007) and UCINET was available at http://www.analytictech.com.

3.5 Trustworthiness, Validity and Reliability

The basic issue of trustworthiness is evidence of accountability for research validity and reliability. Seale (1999) states "*trustworthiness of a research report lies at the heart of issues conventionally discussed as validity and reliability*" (266). As the proposed research involved both quantitative and qualitative approaches, the validity and reliability of each of these approaches and the setting of mixing these approaches had to be contemplated (Johnson and Christensen, 2008:282). Although the proposed research used mixed methods, its type of mixing quantitative and qualitative techniques was not concurrent mixing. Therefore, most of the types of mixed research validity pertaining to mixing approaches concurrently, as identified by Onwuegbuzie and Johnson (2006), were not applicable to the proposed research. Instead, the researcher used these techniques sequentially and so addressed the validity and reliability of each of these approaches at different phases.

Quantitatively, a questionnaire was used to collect data in the first phase. Therefore, the question is how valid and reliable the questionnaire was. When designing the questions the researcher considered face validity and construct validity. Face validity is "*the extent to which the measured variable appears to be an adequate measure of the conceptual variable*" (Stangor, 2004:95). There was face validity for the question 11 of the

questionnaire (Appendix 3) as an example because students having more guidance from the instructors in a discussion forum were more likely than the students having less guidance from the instructors in that forum to view the instructors' content-related and language-related guidance messages. Instructions are stated in the question 11 of the questionnaire to guide the participating students to count the content-related and language-related guidance messages posted by students and instructors in the discussion forum. In the meetings, when the participating students completed the questionnaires, the researcher explained to and asked the participating students to exclude irrelevant messages such as interpersonal messages (e.g. "Hi, how are you?") and organisational messages (e.g. "How can I submit the assignments?") and count the relevant content-related and language-related guidance messages in the discussion forum. In order to ensure the correct messages were counted, the researcher checked with the participants about the counted messages in the meetings. Using the number of viewed content-related and language-related guidance messages posted by instructors in the discussion forum in the quasi-experiment reflected IGD and using those posted by students in that forum in the quasi-experiment revealed SCD in the quasi-experiment in an objective way. The researcher maintained a covert researcher role when collecting the data about the student-instructor and student-student interactions in an on-line discussion forum in the college's on-line education system because covert research avoids the Hawthorne effect (Berg, 2009:82), which refers to a performance change effected by the participants simply in response to the fact that they are observed or studied (Roethlisberger and Dickson, 1939). The researcher did not inform the participants in the quasi-experiment about the collection of the number of their posted messages and did not use subjective ratings to measure student-instructor and student-student interactions in the on-line discussion forum because they were probably prone to the Hawthorne effect. The participating students might post more or less messages in the discussion forum if they knew that their interactions in the on-line discussion forum were being studied in the quasi-experiment. Their subjective ratings cannot accurately measure their actual interactions. In the survey, the researcher overtly collected the data about the student-instructor and student-student interactions in the on-line discussion forum of the college's education system through the use of the question 11 of the survey questionnaire (as shown in Appendix 3).

Construct validity is based on "*the way a measure relates to other variables within a*

system of theoretical relationships" (Babbie, 1990:134) and it can be evaluated using statistical procedures (Creswell, 2008). The distribution of the participants' different scales of views on the learning effectiveness of teaching methods obtained from the questions 12 to 14 could be used to statistically compare the participants' ranks on the three teaching methods in terms of learning effectiveness in the question 18. The distribution of the participants' different scales of views on the effect of the predictor variables obtained from the questions 15 to 17 could be used to statistically compare the participants' importance ranks in the question 19.

In the quantitative phase, the researcher also considered internal validity which is the "*validity with which we infer that a relationship between two variables is causal*" (Cook and Campbell, 1979:37). The researcher explored whether the criteria for a causal relationship exist between the independent variables and dependent variable. For this research study, although correlation and multiple regression results cannot guarantee the cause-effect relationship, these results provided criteria for further investigation in the second qualitative phase for confirmation of this cause-effect relationship. If two variables like SEP and test scores were not positively correlated, then there was no need for further investigation on whether SEP has an effect on test scores because positive correlation between these two variables is a criterion for SEP to have effect on test scores. The positive correlation between SEP and test scores may be due to a confounding third variable. For example, students' high SEP marks and high test scores may be due to the third variable parents' monitoring. There is still positive correlation between SEP and test scores, but this relationship is caused by the third variable parents' monitoring. This third variable is not confounding variable when it has the same effect on every student or is controlled by holding it as constant across every student in the study. Unfortunately, there may be too many potential confounding variables like students' diligence, hiring private tutors, and so on to be controlled and these lead to very large sample sizes as there are too many variables to be controlled and compared. Therefore, the second qualitative results could help to complement this internal validity and confirm the cause-effect relationship among the variables being investigated.

According to Black (1999), reliability refers to the consistency of two measures. That is the degree to which the results of the survey in this study can be consistently obtained if the survey is repeated in similar cases. The survey is reliable if the scores obtained from

the questionnaire are consistent and reproducible in repeated administrations of collecting scores from the same questionnaire. However, measurements of human beings can seldom be repeated to reveal the inconsistency directly (Thorndike and Thorndike-Christ, 2010:120). Therefore, the researcher measured internal consistency reliability as "*measures of internal consistency are based on a single administration of the measure*" (Streiner and Norman, 2008). Each of the questions 12 to 17 of the questionnaire contained 5 similar items, each of which was responded to on a 7-point Likert scale (Likert, 1932) ranging from "strongly agree" to "strongly disagree" with an additional "not available" point. The wording of the last 2 items was reversed to prevent response bias (or, acquiescent responding (Stangor, 2004:75)). For the first 3 items, the "strongly agree" option scored 7, the "agree" option scored 6, and so on until the "strongly disagree" option scored 1. For the last 2 items, scoring was reversed – the "strongly agree" option scored 1, the "agree" option scored 2, and so on until the "strongly disagree" option scored 7. The "not available" option scored 0 in all 5 items. Internal consistency is similar to data triangulation as it is reflected by similar scores in similar items of a question – a participant who scores above 5 on one item should also consistently score above 5 on all other similar items of a question. To measure the internal consistency reliability, Cronbach's (1951) coefficient alpha was used and should ideally be above 0.7 (DeVellis, 2003; Nunnelly, 1978). The researcher also took Babbie's (1990) straightforward approach for maximizing reliability – "*ask people only questions they are likely to know the answers to, ask about things relevant to them, and be clear in what you're asking*" (133). The participants may not give reliable answers especially when they do not understand the questions. The researcher offered assistance and gave explanation when the participants had difficulty in understanding questions or filling the questionnaire in the meetings.

Qualitatively, an interview was used in the second phase. The researcher achieved interpretive validity, which "*refers to accurately portraying the meaning attached by participants to what is being studied by the researcher*" (Johnson and Christensen, 2008:277), by obtaining the respondent validation of the researcher's interpretations (Pidgeon, 1996:84). The researcher presented the interview transcripts to the interviewees for checking if the recorded and perceived interview conversation was right (participant feedback or member checking), correcting and modifying them if needed and obtaining confirmation. As stated by Cohen et al (2007), "*a disadvantage,*

on the other hand, is that an interview is prone to subjectivity and bias on the part of the interviewer" (352). It is better to go through triangulation by confirming findings with the participants. Confirming the findings with the participants provides a good chance of avoiding bias and gaining the truths and better understanding of cases from interviews. Some of the participants in the first phase were invited for interview, their views were analysed and they would be asked to confirm the findings. The researcher also achieved internal validity, which refers the accuracy of inferring that a causal relationship exists between two variables, by methodological triangulation. The researcher justified this validity by comparing the qualitative interview results with the results obtained from the first quantitative phase and confirming that SEP, IGD and SCD have effect on the test scores.

The reliability of the qualitative analytical results was also achieved by investigator triangulation - having two more experienced coders, cross-checking among the coders, measuring the inter-coder agreement on coding interview transcripts by Krippendorff's (2004a:221-236; 2004b) alpha and modifying the codes in order to have consistent coding among the coders. The researcher invited the two other coders to participate in the qualitative analysis for this research. These two coders are experienced in qualitative analysis in different social science areas – one in history and culture while the other is in the hotel management field. The coders with different backgrounds can help to reduce the effect of researcher bias because their different perspectives can avoid bias towards selective views by a single coder. To measure inter-coder reliability, the researcher also considered the statistics called Cohen's (1960) kappa which measures the agreement between two coders and its variant developed by Fleiss (1971) which can measure agreement for more than two coders. These statistics are available for nominal variables only. Krippendorff's (2004a:221-236; 2004b) alpha was used because it provides versatile measures – it is available for two or more coders, used with nominal, ordinal and interval variables, and corrects for missing data (Bernard and Ryan, 2010: 304). Krippendorff (2004a) recommends an acceptable alpha value of 0.8 or better and between 0.667 and 0.8 for "*drawing tentative conclusions*" (241).

3.6 Ethical Considerations

With the college's permission, the research was conducted at the college. When inviting

the college students to participate in this research and calling for meetings to complete the on-line questionnaires in the first phase of this study, the researcher explained the importance, purpose, features, procedures and scope of the research. The researcher also briefly described the types of questions would be asked in the research to the prospective participating students. The college students willing to participate in this research were requested to give informed consent by completing the consent form (as shown in Appendix 5) before or in the meetings. In a large scale survey, informed consent is eliminated and replaced with implied consent (Berg, 2009:89). The implied consent was indicated by the participating students when they took time to complete the questions about the number of their viewed students' and instructors' posted messages (as shown in question 11 of Appendix 3) in the survey questionnaire. However, for being an interviewee, the participanting students need to complete the consent form.

As an insider in this research, the researcher might be biased. Therefore, in this study, the researcher acted independently as an overt but passive observer to the flow of activities and interactions in a research setting (Berg, 2009; Denzin and Lincoln, 2005; Punch, 2005), and avoided bias by asking the participants to check that the findings correspond to their own meaning, inviting two other coders in the analysis process, comparing the researcher's findings with the other two coders' findings by measuring inter-coder reliability, comparing the findings, and triangulating the findings with those collected through the quantitative approach. As an insider, the researcher may encounter informant bias (Mercer, 2007). The participating students might know that the researcher is an insider and therefore might be more willing to volunteer information, perhaps because they thought that the information given could help their study in the college; or the students might be reluctant to express ideas, because they might fear that the information given could affect their study in the college (Busher, 2002:81). In an attempt to minimize the informant bias, the guarantee of informant anonymity and emphasis of my role as an independent researcher were given to the participating students. Also, as the researcher was aware that there could be an authority relationship between the researcher and the participating students (Cooper, 1993b), he avoided the authority relationship by sampling the students taking the introductory IT course from the classes which were not taught by the researcher.

The researcher in this insider research might also face two ethical dilemmas – first, the

researcher had to consider the issue of what to tell colleagues and second, the researcher needed to think about the issue of obtaining data by chance (Mercer, 2007). For the first issue, the researcher ensured confidentiality by not presenting the participants' personal particulars to the internal staff. The researcher was also careful with data handling. The researcher stored the research data in highly secure computer systems and networks and made sure that the research data were protected with authorization and authentication mechanisms. For the second issue, the researcher did not use the data obtained by chance in the college such as student and staff meetings and internal emails which had not been negotiated and permitted, the researcher merely obtained the data from the quasi-experiment, survey and interviews.

Although no identified physical harm would result from the proposed research, it might impose negative psychological feelings on the participants as they were asked about their personal background, status and experience like academic achievement, ability to learn in on-line education, ability to understand English as the medium of instruction and involvement in on-line discussion forum. The researcher explained these ethical issues to the participants and protected their privacy by keeping their data confidential and using aliases in order for the participants to remain anonymous in any publications and report of this research.

Chapter 4

The First Quantitative Phase

In the first quantitative phase, the researcher used statistical methods to find the relationship between the predictor variables and the students' test scores. This chapter discusses the quantitative data collection, the quantitative analyses of the collected quantitative data and the quantitative results. Finally in this chapter, the implications of the quantitative findings for the second qualitative phase are discussed.

4.1 Quantitative Data Collection

Most of the participating students in Wong's (2008) quasi-experiment were accessible in the college or other local higher educational institutes as many of them had articulated to these institutes for further studies. However, some of them had articulated to overseas educational institutes or their contact information was no longer available. So, selecting students for this quantitative phase was necessary. In this quantitative phase, as explained earlier in section 3.4.1, the researcher used a stratified random sampling method with proportional allocation (Weiss, 2008:22) to sample 75 participating students from each stratum of the three teaching methods in Wong's (2008) quasi-experiment.

4.1.1 Survey

Totally, 225 (75 participants × 3 teaching methods) invited participating students completed the consent form, as shown in Appendix 5, before or in the meetings for survey completion. In the meetings, each participant had a client desktop computer to open a browser to access the on-line questionnaire, as shown in Figure 4.1, and filled it independently. The on-line questionnaire was used because it could provide efficient collecting and handling of data and save paperwork.

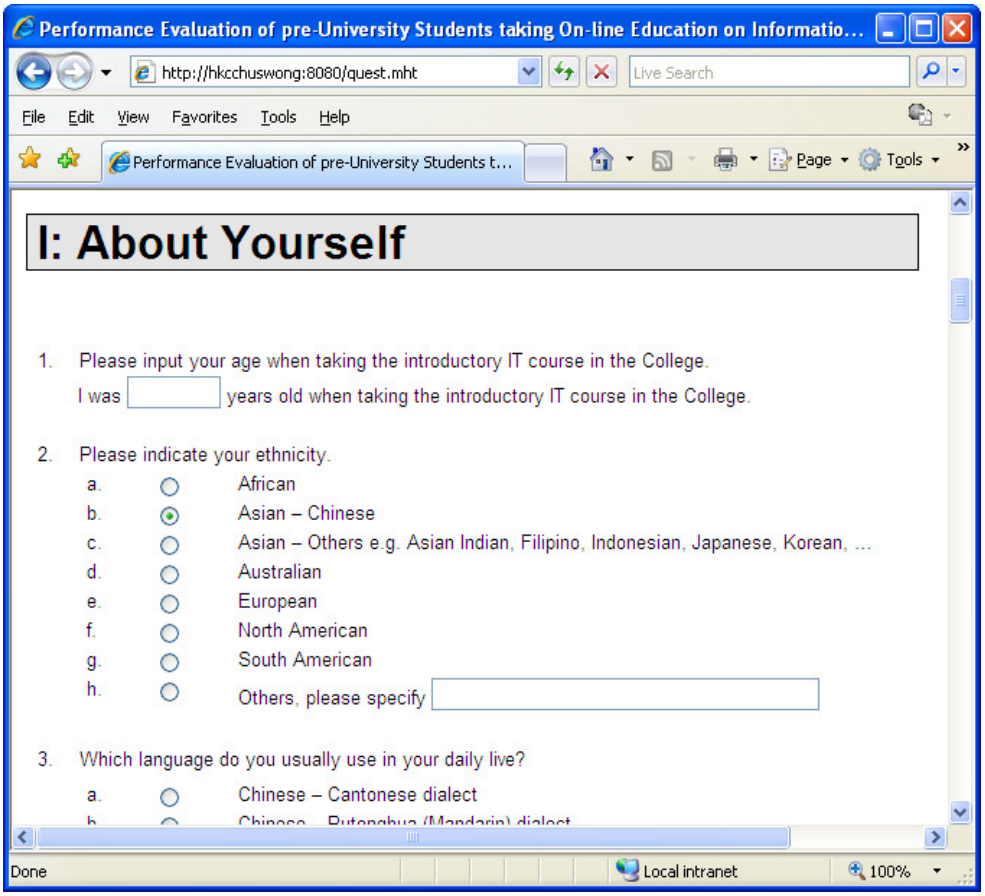


Figure 4.1: On-line Questionnaire

The data collected from the on-line questionnaire were stored in Microsoft Access 2003 (in short, Access) database in the Web server. Then, the researcher used an Access' function to export the stored data to Microsoft Excel 2003 (in short, Excel) because Excel data could be loaded in SPSS for analysis.

4.1.2 Collection of Students' Learning Language Proficiency

As shown in Tables 3.2 and 3.3, the researcher computed the mid-points for the equivalent range of overall IELTS band scores for HKALE Use of English and HKCEE English Language (Syllabus B), extended the equivalent IELTS scores for F and U grades for HKALE Use of English and HKCEE English Language (Syllabus B) to come up with SEP marks, as indicated in Table 4.1, and used these to modify the Excel data, which were then loaded into SPSS for analysis.

SEP Marks	*Equivalent IELTS Band Score#*	*Equivalent HKALE Use of English Grade**	*Equivalent HKCEE English (Syllabus B) Grade**	*Equivalent HKCEE English (Syllabus A) Grade**
9	9			
8.5	8.5			
8	8			
7.85		A		
7.5	7.5			
7.47			A	
7.16		B		
7	7			
6.71		C		
6.62			B	
6.5	6.5			
6.26		D		
6.16			C	A
6	6			
5.71		E		
5.61			D	B
5.5	5.5			
5	5	F		
4.9			E	C
4.5	4.5	U	F	D
4	4		U	E
3.5	3.5			F
3	3			U

The highest band score is 9 and the lowest band score is 0

* The highest grade is A and the lowest grade is U

Table 4.1: SEP Marks and their Equivalent Scores/Grades

4.2 Quantitative Data Analysis

The demographics of the sample of responding students indicated their ages are between 18 and 23. The majority of the respondents are Chinese (95%) and the remainder is other Asians (5%). In the respondents' daily lives, most respondents use Cantonese (94%) which is a Chinese dialect mostly used in Hong Kong, some respondents use Putonghua (or Mandarin) (4%) which is the official language of China and the rest use Hindi (2%) which is commonly used by Asian Indians living in Hong Kong. 100% of the respondents use English to learn in the college. Figure 4.2 shows the percentage distribution of the perceived learning effectiveness of teaching methods from the respondents.

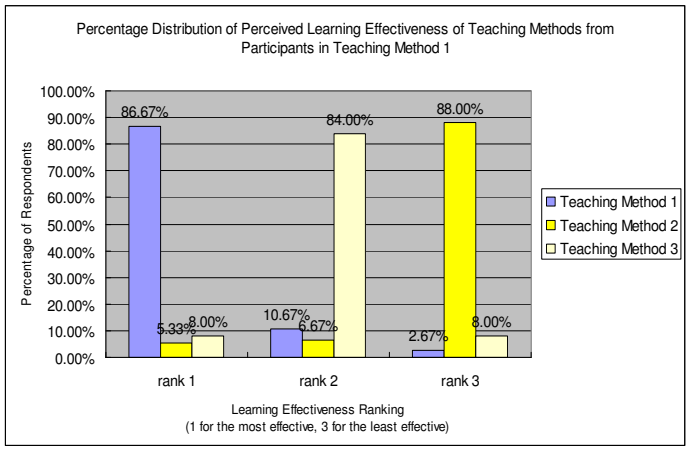


Figure 4.2 (a): Participants' Opinions on Learning Effectiveness Ranking in Teaching Method 1

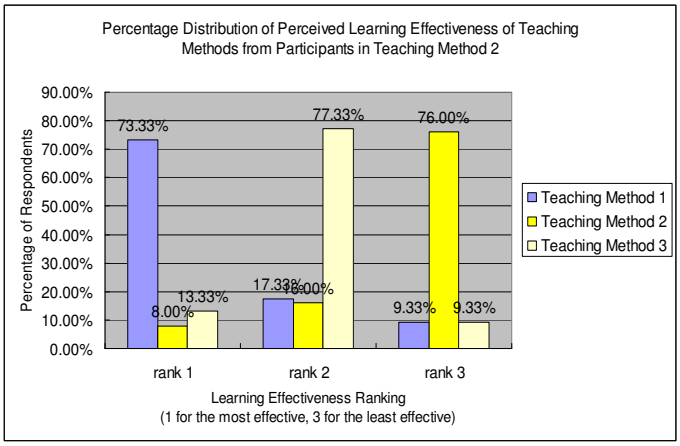


Figure 4.2 (b): Participants' Opinions on Learning Effectiveness Ranking in Teaching Method 2

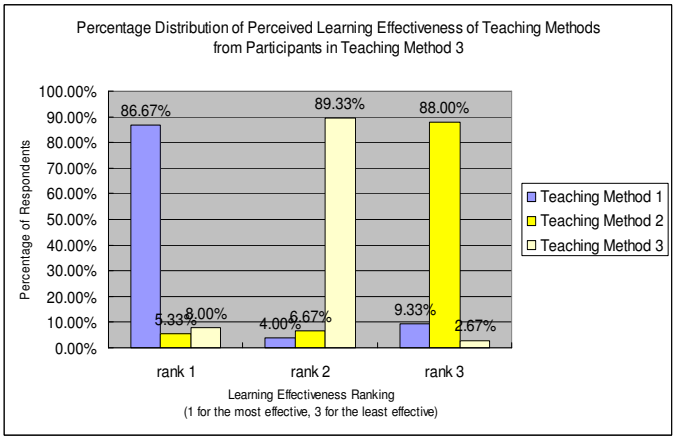


Figure 4.2 (c): Participants' Opinions on Learning Effectiveness Ranking in Teaching Method 3

From the data in response to the questionnaire question 18 in Appendix 3, the majority of the respondents (86.67%, 73.33% and 86.67% in Figures 4.2 (a), (b) and (c) respectively) ranked teaching method 1 as the most effective in learning. Most of the respondents (88%, 76% and 88% in Figures 4.2 (a), (b) and (c) respectively) regarded teaching method 2 as the least effective in learning.

The researcher obtained the score for each of the questionnaire questions 12 to 14 by computing the mean score of the seven items and excluding 0 score for "not available" item. The questionnaire question 12, 13 or 14 was used to measure the learning effectiveness of teaching method 1, 2 or 3 respectively. Table 4.2 shows SPSS-computed Cronbach's (1951) coefficient alpha α and $\alpha \geq 0.7$ means that the internal consistency reliability of the items is acceptable (DeVellis, 2003; Nunnelly, 1978). According to the participants' opinions in Table 4.2, the highest mean score (√-marked) for question 12 indicates that teaching method 1 is the most effective in learning while the lowest mean score (s-marked) for question 13 indicates that teaching method 2 is the least effective in learning. These findings are consistent with survey results of question 18 and Wong's (2008) findings.

Teaching Method the Respondents were in	***Questionnaire Question***	***Mean Score***	***Cronbach's Coefficient Alpha α***
1	12	5.84 √	0.748
	13	3.69 s	0.867
	14	4.78 x	0.875
2	12	5.23 √	0.811
	13	3.25 s	0.898
	14	4.06 x	0.866
3	12	5.42 √	0.878
	13	3.49 s	0.893
	14	4.32 x	0.837

Table 4.2: Mean Scores and α of the Questions 12, 13 and 14 of the Questionnaire

4.2.1 Correlation Analysis

The Pearson product moment correlation coefficient (or simply, linear correlation coefficient) was used to measure the correlation between each predictor variable in Figure 1.1 and the college students' test scores in Wong's (2008) quasi-experiment. The SPSS-generated correlation matrices, as shown in Appendix 6, contain the correlations among all variables under consideration in correlation and multiple regression analyses

for the samples (each sample size $N = 75$) in the three teaching methods. All correlation coefficients are significant at 1% level, as indicated by very small Sig. (1-tailed) or p value generated by SPSS. All correlation coefficients are positive (e.g. SEP marks and test scores are all positively correlated in all three teaching methods with correlation coefficients 0.609, 0.803 and 0.689 in teaching methods 1, 2 and 3 respectively in Appendix 6), meaning that the test score tends to increase as each predictor variable increases.

4.2.2 Multiple Regression Analysis

To regress the students' test scores on the three predictor variables SEP, IGD and SCD, both simultaneous and sequential multiple regressions were used. The following sub-sections present how these types of multiple regressions were conducted in this phase.

4.2.2.1 Simultaneous Multiple Regression Analysis

For simultaneous multiple regression, besides looking at the correlation coefficients between the test scores and the predictor variables in Appendix 6, the correlations among the predictor variables were taken into account to identify multicollinearity. A correlation between two predictor variables greater than |0.7| suggests that the multicollinearity exists between those predictor variables (Pallant, 2007; Sullivan, 2010:759). Multicollinearity may cause problems as two or more highly correlated predictor variables cause the same effect on the outcome variable. In such a case it is difficult to find the effect and interpret the importance of each of the predictor variables. According to Appendix 6, multicollinearity does not exist as there are no correlation coefficients between two predictor variables greater than |0.7|.

Multicollinearity can also be reflected by the tolerance and VIF (variance inflation factor) columns in the coefficients table generated by SPSS, as indicated in Appendix 7. If the tolerance value is below 0.1 or VIF, which is the inverse of the tolerance value, is above 10, then multicollinearity exists (Pallant, 2007). There are no such tolerance and VIF values (e.g. the tolerance values for SEP marks are not below 0.1 such as 0.845, 0.788 and 0.881 in teaching methods 1, 2 and 3 respectively in Appendix 7). As there is

no multicollinearity, none of the predictor variables can be excluded from the multiple regression equations for multicollinearity reason.

To obtain a multiple regression equation, the researcher performed a diagnostic check to ensure the regression model is appropriate. The regression model is appropriate when the normality, homoscedasticity, linearity and independence assumptions are met. For the following multiple regression equation in a teaching method:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$$

where y is the students' test score (the outcome variable), x_1 stands for the SEP marks, x_2 represents the number of instructors' guidance messages viewed by the students (instructors' guidance) in the on-line discussion forum (IGD), x_3 is the number of peer students' guidance messages viewed by the students in the on-line discussion forum (SCD), β_0, β_1, β_2 and β_3 are constants, the assumptions are:

(1) Normality assumption: for each set of values, x_1, x_2 and x_3, of the predictor variables, the distribution of the outcome variable y is normal.

(2) Homoscedasticity assumption: the variances of the outcome variable y are the same for all sets of values, x_1, x_2 and x_3, of the predictor variables.

(3) Linearity assumption: the regression equation, $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3$, can estimate the relationship between the predictor variables, x_1, x_2 and x_3, and the outcome variable, y, if that relationship is linear in nature.

(4) Independence assumption: the observed values of the outcome variable, y, should not be correlated. That is, the observations of the outcome variable, y, are independent of one another.

In this study, a student's test score (a value of the outcome variable) did not depend on or did not help to affect another student's test score, the independence assumption, as indicated in assumption (4), was met. According to Pallant (2007:156), the other three assumptions (1) to (3) can be assessed by analysing the standardized residuals. A standardized residual is the residual value divided by its standard deviation where a residual is the difference between an observed value of the outcome variable and the value predicted by the regression equation (Young, 2008:A57-A59). In order for

assumption (1) to be met, the standardized residuals should be normally distributed about the values of the outcome variable predicted by the regression equation; to meet assumption (2), the variances of the standardized residuals should be the same for all predicted values of the outcome variable; for assumption (3), the standardized residuals should have a straight line (linear) relationship with the predicted values of the outcome variable (Pallant, 2007:148-164).

For each teaching method, the normal probability plot (P-P) and the scatterplot of the regression standardized residuals generated by SPSS, as shown in Appendix 8, were used for the diagnostic check.

The reasonably straight diagonal lines from the bottom left to the top right in the normal P-Ps of the regression standardized residuals in Appendix 8 show the requirement in multiple regression that the regression standardized residuals are distributed normally in the three teaching methods. Therefore, the normality (assumption (1)) is met.

Homoscedasticity (assumption (2)) can also be checked with the normal P-Ps and the scatterplots of the regression standardized residuals (Pallant, 2007:149-156), as shown in Appendix 8. When the normality assumption is met and there are no outliers, the homoscedasticity assumption is met (Tabachnick and Fidell, 2007:85-86). The normality can be checked with the normal P-Ps of the residuals while the existence of the outliers can be found in the residuals scatterplots. Homoscedasticity is indicated by the situation that the standardized residuals are randomly scattered around 0 (the horizontal line) in a scatterplot. Heteroscedasticity is indicated when the standardized residuals are not evenly scattered around the horizontal line.

The linearity of relationship between predicted outcome variables and the standardized residuals (assumption (3)) should present a rectangular shape of the scatterplot. The circle points in the residuals scatterplots in Appendix 8 are scattered around the 0 point in a roughly rectangular shape though a minor outlier occurs at the standardized residual value close to 3.5 and is distributed away from the rectangular shape at the top in teaching method 2 in Appendix 8.

For a sample size $N < 1000$, outliers have a standardized residual value larger than $|3.3|$ (Tabachnick and Fidell, 2007:128). For this case, the outlier is slightly over the critical value 3.3. Next, the Mahalanobis distance for this case can be checked to identify if a multivariate outlier problem matters. Mahalanobis distance is distributed as a Chi-square (χ^2) variable with a degree of freedom (*df*) equal to the number of predictor variables. In this study, $df = 3$ as three predictor variables SEP, IGD and SCD were used. Using Tabachnick and Fidell's (2007:166-167) guide, the Mahalanobis distance should not exceed the critical value 16.266 for $df = 3$ at the alpha level $\alpha = 0.001$ in χ^2-distribution (Table Eight in Pearson and Hartley, 1966:137). As shown in the partial SPSS-generated Residuals Statistics table in Appendix 9, the maximum Mahalanobis distance for this case is 9.891 which is below the critical value 16.266. Therefore, this case does not affect the analysis.

For these reasons, the regression models shown in Table 4.3, in which the intercepts and regression coefficients are obtained from the B columns under Unstandardized Coefficients category of Coefficients table in Appendix 7, are appropriate.

Teaching Method	***Multiple Regression Equation***
1	$y = 19.481 + 6.634x_1 + 0.285x_2 + 0.289x_3$
2	$y = -11.266 + 11.067x_1 + 0.316x_2 + 0.264x_3$
3	$y = 19.633 + 6.803x_1 + 0.292x_2 + 0.172x_3$

y – Predicted test score
x_1 – SEP marks
x_2 – IGD
x_3 – SCD

Table 4.3: Multiple Regression Models

The SPSS-generated Model Summary tables in Appendix 10 show the R Square (R^2) values which are the coefficients of determination. R^2 measures how much of the variance in the outcome is explained by the influences in the multiple regression equation. R^2 is a measure of how well the multiple regression equation fits the sample data (Triola, 2011:566).

However, R^2 may not be reliable especially when there are more predictor variables involved in the multiple regression equation because the more predictor variables are included in the multiple regression equation, the larger the R^2.

> "*To compensate for the ability to artificially inflate R^2 by adding more explanatory (predictor) variables, it is recommended that the adjusted R^2 be used when working with least-squares regression models with two or more explanatory (predictor) variables.*" Sullivan (2010:764)

To explore more accurately the combined effects of all predictor variables on the outcome variable in multiple regression, adjusted R^2 is used instead. The Adjusted R Square (adjusted R^2) values in the Model Summary tables in Appendix 10 are the coefficients of determination adjusted to take into account the number of predictor variables and the sample sizes. When comparing different multiple regression equations, the adjusted R^2 should be used (Triola, 2010:562; 2011:566).

The small p values ($p = 0.000$ meaning $p < 0.0005$ in Sig. values in SPSS-generated ANOVA tables in Appendix 10) for the F-test statistic indicate that the regression equations in Table 4.3 are statistical significant and reasonable. By looking at the individual p values for the t-test statistic for the coefficients in the models (as indicated by the Sig. values in Coefficients tables in Appendix 7), it is noticed that all p values are below 0.05. Therefore, all predictor variables explain the students' test scores to a statistically significant degree. For these reasons, the regression models in Table 4.3 are appropriate.

Since the SPSS-generated regression coefficients are estimates from the samples, the researcher was interested in the true values of the regression coefficients in the population and used the 95% Confidence Interval for B columns in Appendix 7 to show the lower bounds and upper bounds for the regression coefficients. For example, in teaching method 1 in Appendix 7, there is a 95% chance that the true regression coefficient for SEP marks lies within the range 4.076 and 9.191. For a statistically significant regression coefficient, its confidence interval does not include 0 value (Thompson, 2002). 0 value is not included in any 95% confidence intervals in the Coefficients table in Appendix 7.

4.2.2.2 Sequential Multiple Regression Analysis

The statistical significance and the magnitude of effect of the predictor variables in a sequential multiple regression depends on the order of entering the predictor variables into the regression equation (Keith, 2006:80-90).

Keith (2006:82) points out that perceived importance is one of the methods for deciding the order of entering variables into the regression equation in multiple regression. Therefore, the researcher determined the entry order based on the perceived importance of the variables obtained from the questionnaire question 19.

Figure 4.3 shows the percentage distribution of perceived importance of the potential factors in the teaching methods. SEP is mostly given the highest importance rank – 58.67%, 52% and 74.67% of the respondents in the teaching methods 1, 2 and 3 in Figures 4.3 (a), (b) and (c) respectively. In contrast, SCD is mostly given the least importance rank – 64%, 56% and 85.33% of the respondents in the teaching methods 1, 2 and 3 in Figures 4.3 (a), (b) and (c) respectively.

The researcher computed the mean score of the seven items, excluding the 0 score for "not available" item, of the questionnaire questions 15 to 17. These questions were used to obtain the respondents' ranking of the importance of SEP, IGD and SCD respectively. In Table 4.4, the question 15 indicates the greatest importance of SEP (√-marked) while the question 17 indicates the least importance of SCD (s-marked) which are consistent with the survey results of the questionnaire question 19. The SPSS-generated $\alpha \geq 0.7$ in Table 4.4 means that there is internal consistency reliability of the items (DeVellis, 2003; Nunnelly, 1978).

From these results, the researcher first entered the most important predictor variable SEP, then IGD, and finally the least important predictor variable SCD into the sequential regression. In the SPSS-generated Model Summary tables in Appendix 11, model 1 refers to the first predictor variable SEP entered, model 2 includes SEP and IGD while model 3 contains all SEP, IGD and SCD.

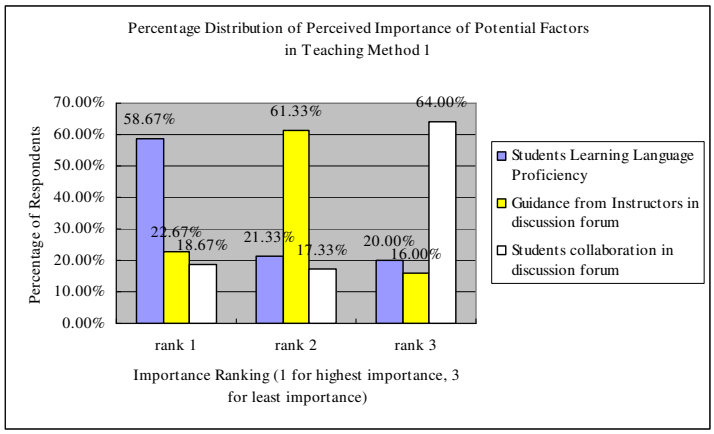


Figure 4.3 (a): Percentage Distribution of Perceived Importance of Potential Factors in Teaching Method 1

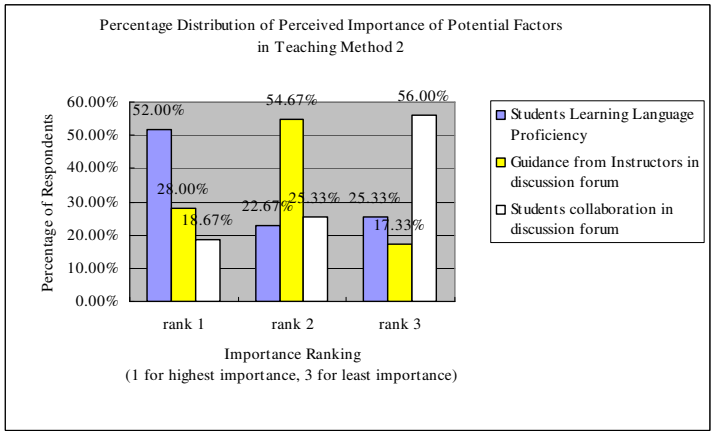


Figure 4.3 (b): Percentage Distribution of Perceived Importance of Potential Factors in Teaching Method 2

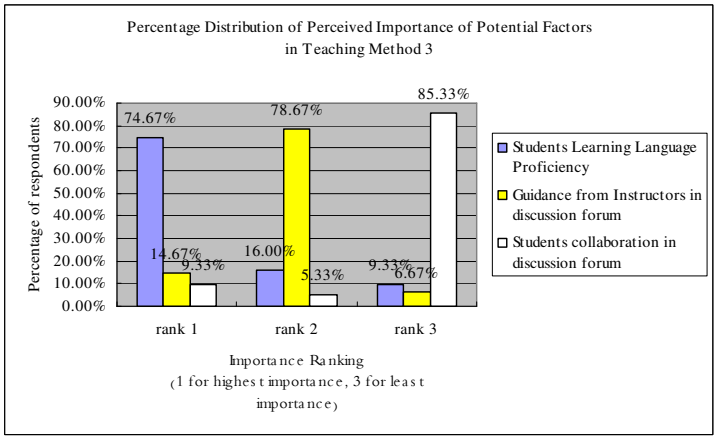


Figure 4.3 (c): Percentage Distribution of Perceived Importance of Potential Factors in Teaching Method 3

Teaching Method the Respondents were in	*Questionnaire Question*	*Mean Score*	*Cronbach's Coefficient Alpha α*
1	15	5.85 √	0.829
	16	4.21 x	0.891
	17	2.82 s	0.937
2	15	5.88 √	0.798
	16	3.90 x	0.896
	17	2.29 s	0.885
3	15	5.44 √	0.884
	16	3.96 x	0.806
	17	2.57 s	0.774

Table 4.4: Mean Scores and α of the Questions 15, 16 and 17 of the Questionnaire

All the effects contributed by the additional predictor variables are statistically significant as all Sig. F Change values in Appendix 11 are below 0.05. Also, the p (or Sig.) values in F-test statistics in SPSS-generated ANOVA tables in Appendix 11 show that all models as a whole in different teaching methods are statistically significant. The SPSS-generated Coefficients tables in Appendix 11 show how well each of the predictor variables contributes to the outcome. All predictor variables make statistically significant contributions as indicated by all p (or Sig.) values below 0.05 in Appendix 11.

4.3 Quantitative Results

4.3.1 Correlation Results

The researcher took a comparative approach to interpret correlation results as follows. Comparatively, the correlation between test scores and SEP marks is the largest in each of the teaching methods as indicated by the largest $r = 0.609$, $r = 0.839$ and $r = 0.689$ in teaching methods 1, 2 and 3 respectively in Appendix 6, where r is the linear correlation coefficient. These results suggest that SEP has a stronger correlation with the student's test score on the introductory IT course than IGD and SCD have.

Each correlation coefficient in teaching method 2 is stronger than its corresponding coefficient in the other teaching methods. For example, the correlation $r = 0.839$ between test scores and SEP marks in teaching method 2 in Appendix 6 is larger than its other corresponding coefficients $r = 0.609$ in teaching method 1 and $r = 0.689$ in teaching method 3 in Appendix 6. These findings indicate that the correlation between

each predictor variable and the students' test scores in teaching method 2 is larger than that correlation in other teaching methods. Table 4.5 indicates this comparative effect.

Teaching Method	***Correlation Coefficient between Test Scores and***			***Strength of Correlation***
	SEP Marks	***IGD***	***SCD***	
1	0.609	0.494	0.331	Weak
2	0.839	0.586	0.405	Strong
3	0.689	0.459	0.339	Medium
Strength of Correlation	Strong	Medium	Weak	

Table 4.5: Comparison of Strengths of Correlation between the Students' Test Scores and Each of SEP, IGD and SCD in Teaching Methods 1, 2 and 3

4.3.2 Multiple Regression Results

4.3.2.1 Simultaneous Multiple Regression Results

A multiple regression equation suggests how an outcome variable would change on average for a 1-unit increase in a predictor variable while the other predictor variables are held constant. From Table 4.3, the regression coefficient 6.634 for teaching method 1 suggests that in this teaching method, for each additional SEP mark, the student's test scores increase by 6.634 scores on average, controlling for IGD and SCD; for the same case of each additional SEP mark and the same control, the test scores would increase by 11.067 and 6.803 scores on average in teaching methods 2 and 3 respectively. According to Table 4.1, 1-SEP-mark jump is conceptually and approximately equivalent to 2-grade increment in HKALE and HKCEE English examinations. An example is the jump from 6.71 marks to 7.85 marks which would be the increment from HKALE C grade to HKALE A grade. In this analysis, a 2-grade increment in either HKALE or HKCEE English examination would lead to an increase by 6.634 to 11.067 scores depending on the teaching method and controlling for IGD and SCD. In either teaching method 1, 2 or 3, IGD and SCD have a comparatively smaller effect (less than 1 score) on students' test scores if SEP marks stay constant.

A more interesting investigation is to look for which predictor variable has the stronger or lesser effect on students' test scores in each teaching method. To compare the contribution of each predictor variable to the students' test scores, regression

coefficients in the B columns under the Unstandardized Coefficients category of Coefficients tables in Appendix 7 are not used because their corresponding variables have different scales. An example of these different scales is that SEP marks start from 3, next 3.5 and so on while IGD starts from 0 viewed messages, next 1 viewed message, then 2 viewed messages and so on. Instead, the investigator looked at the Beta (β) values under Standardised Coefficients in the Coefficients tables in Appendix 7. The standardized coefficients for different predictor variables have been converted to the same scale and therefore can be used for comparison (Keith, 2006:31; Pallant, 2007:159). From Appendix 7, the standardized regression coefficient $\beta = 0.480$ for teaching method 1 means that in this teaching method, for each standard deviation increase on SEP marks, the student's test scores will, on average, increase by 0.480 standard deviation, controlling for IGD and SCD. These β values represent the magnitude of effects in multiple regression. Different areas have different criteria for judging the magnitude of effects (Cohen, 1988). The investigator took Keith's (1999; 2006:62) criteria as these criteria were used in a similar research focus on school learning and learning performance. In Keith's (1999; 2006:62) criteria, $\beta < 0.05$ is considered to be a very small influence on school learning, $0.05 < \beta \leq 0.1$ is considered a small but meaningful influence, then the range $0.1 < \beta \leq 0.25$ is considered a moderate influence and $0.25 < \beta$ is regarded as a large influence.

The β values in Appendix 7 and Keith's (1999; 2006:62) criteria have led to the build-up of Table 4.6 which indicates magnitude of effect for each predictor variable in all three teaching methods. For example, it can be seen from Table 4.6, SEP has a very large effect ($\beta = 0.702$) on the students' learning while IGD and SCD have a moderate effect ($\beta = 0.214$ and $\beta = 0.173$ respectively) on the students' learning in teaching method 2. Also from Table 4.6, by comparing across different teaching methods, SEP has the largest effect (√-marked) on the students' learning in teaching method 2 while the smallest effect (s-marked) in teaching method 1; IGD has the largest effect (√-marked) on the students' learning in teaching method 1 while the smallest effect (s-marked) on the students' learning in teaching method 2; and SCD has the largest effect (√-marked) on the students' learning in teaching method 1 while the smallest effect (s-marked) on the students' learning in teaching method 2.

Predictor Variables	Beta (β) in Teaching Method			Magnitude of Effect
	1	2	3	
SEP Marks	.480 s	.702 √	.578	large
IGD	.256 √	.214 s	.242	moderate
SCD	.192 √	.173 s	.174	moderate

√ - the largest influence among the three teaching methods

s - the smallest influence among the three teaching methods

Table 4.6: Magnitude of Effects of Predictor Variables on the Students' Test Scores

Using the adjusted R^2 in Appendix 10, 46.1% of the variation in students' test scores for teaching method 1 can be explained by predictor variables; all three predictor variables can explain 77.6% of variation of students' test scores in teaching method 2 and the predictor variables explain 55% of variation of the outcome in teaching method 3.

By comparison with teaching method 1 with adjusted $R^2 = 0.461$ and teaching method 3 with adjusted $R^2 = 0.550$, the variables have the strongest combined effect on the students' test scores in teaching method 2, as indicated by the adjusted $R^2 = 0.776$. Table 4.7 compares the different magnitudes of the combined effect in these three teaching methods.

Teaching Method	Adjusted R^2	Magnitude of Combined Effect
1	0.461	Weak
2	0.776	Strong
3	0.550	Medium

Table 4.7: Magnitude of Combined Effect of Predictor Variables on the Students' Test Scores

From the multiple regression equations in Table 4.3, in each teaching method, IGD (x_2) and SCD (x_3) have a comparatively smaller effect (less than 1 score) on the students' test scores.

4.3.2.2 Sequential Multiple Regression Results

In model 1 in Appendix 11, the overall model explains 37.1%, 70.4% and 47.5% (R^2 in

Appendix 11) of the variance in the students' test scores in teaching methods 1, 2 and 3 respectively. After the second block of variables are included in model 2 in Appendix 11, the overall model explains 44.8% (with small R^2 change, ΔR^2 = 7.7% in teaching method 1), 75.8% (with small ΔR^2 = 5.4% in teaching method 2) and 54% (with small ΔR^2 = 6.5% in teaching method 3) of the variance in the students' test scores in teaching methods 1, 2 and 3 respectively. In Appendix 11, by comparison to model 2, model 3 explains an additional 3.4% (ΔR^2 in teaching method 1), 2.7% (ΔR^2 in teaching method 2) and 2.8% (ΔR^2 in teaching method 3) of the variance in the students' test scores. Based on the Beta (β) values in the Coefficients tables in Appendix 11 and Keith's (1999; 2006:62) criteria, Figure 4.4 compares the magnitude of effects among the predictor variables in the three models. The comparison findings show the SEP has the largest effect on the students' test scores in the models.

Predictor Variables	***Beta (β) in Teaching Method***			***Magnitude of Effect***
	1	***2***	***3***	
SEP Marks	.609 s	.839 √	.689	large

Model 1

Predictor Variables	***Beta (β) in Teaching Method***			***Magnitude of Effect***
	1	***2***	***3***	
SEP Marks	.491 s	.722 √	.605	large
IGD	.302 √	.260 s	.268	moderate

Model 2

Predictor Variables	***Beta (β) in Teaching Method***			***Magnitude of Effect***
	1	***2***	***3***	
SEP Marks	.480 s	.702 √	.578	large
IGD	.256 √	.214 s	.242	moderate
SCD	.192 √	.173 s	.174	moderate

Model 3

√ - the largest influence among the three teaching methods
s - the smallest influence among the three teaching methods

Figure 4.4: Magnitude of Effects of Predictor Variables on the Students' Test Scores in the Three Models in Teaching Methods 1, 2 and 3

4.4 Implications for Qualitative Phase

The main purpose of this quantitative phase was to answer the research questions 1 to 3 in section 1.5. Then, how can the statistical results obtained for these questions in this phase be explained? In other words, are there any perceived reasons for the quantitative findings in this phase? Also, based on the found reasons, how can one help to develop effective learning in on-line education?

Correlation analysis is appropriate to find how each of the three predictor variables SEP, IGD and SCD and a student's test score is correlated. Multiple regression is applicable to find the combined effect between these variables and the students' test scores. However, these quantitative analyses cannot confirm the cause-effect relationship between the variables and the students' learning.

Qualitative interviews can be used as a follow-up to obtain the perceived reasons to explore this cause-effect relationship. Also, interviews can be carried out to obtain the participants' views on their experiences of using on-line education and on how to develop effective learning in on-line education. Through analysing interview data in the next phase, the quantitative findings in this phase might be explained.

Chapter 5

The Second Qualitative Phase

In the second qualitative phase, the researcher attempted to obtain the perceptions of the participating students about their on-line learning effectiveness by collecting the linguistic symbols, through which people express their meaning and learning (Berg, 2009:9), using semi-structured interviews. The researcher also managed the collected qualitative data: transcribing the interviews, storing and retrieving the interview transcripts in an efficient and systematic way with the help of software and looking for regular patterns in the transcripts. This chapter focuses on the data collection, analyses and findings in this second qualitative phase.

5.1 Qualitative Data Collection

The researcher invited 8 of the participating students from each of the three teaching methods in the survey of the first quantitative phase for the semi-structured interviews. Totally, 24 (8 participants × 3 teaching methods) interviewees were selected. As mentioned earlier in research design in section 3.4.2, the selection of the interviewees was based on a stratified purposeful sampling (Gall et al, 2003:179) which reflected the diversity of the characteristics of the participating students in the three teaching methods.

5.1.1 The Participants

Table 5.1 describes these participating interviewees in the three teaching methods. In order to protect the anonymity of the interviewees, the researcher used codes as an encryption device (Bernard and Ryan, 2010:87) to hide their names and ensured that no identifying biographical data about them were presented.

Code	Participant Description
S1T1	The participant was Associate in Health Studies student in the college. She usually uses Cantonese[1] in her daily life. She could express her ideas well and clearly in both Chinese and English. She could provide points to ponder in the interview.
S2T1	The participant was Associate of Arts student in the college. She is fluent in both Putonghua (or Mandarin[2]) and Cantonese[1]. She usually uses Cantonese[1] in the college but talks in Putonghua[2] at home with her parents as they have come from northern parts of China. She was able to talk precisely and concisely at length in the interview.
S3T1	The participant registered for Associate in Business with the specialty in Tourism and Recreation Management in the college. She was given a summer internship opportunity to work in an international hotel in southern part of China in her first year of study. She mentioned that she had great opportunities to practice her English and Putonghua[2] in the internship work. She was very fluent in English and thoughtful in this interview.
S4T1	The participant had about 2 years experience in working in human resources administration before she came to the college. She first registered for Associate in Business without any specialty in the first semester of her first year of study in the college. Since semester 2 of her first year of study, she had transferred to Associate in Business with specialty in the area of Logistics and Supply Chain Management. She usually speaks Cantonese[1] in her daily life and her spoken English was fluent in this interview. It seemed that she enjoyed this interview opportunity to let her express her ideas.
S5T1	The participant was an Associate in Information Technology student. He expressed the view that he was knowledgeable about the software tools and computer skills helped him a lot in his learning in the college. In his daily live, he just uses Cantonese[1] all the time and occasionally uses English with some of his ex-classmates because he studied in an English international school[3] in Hong Kong before.
S6T1	The participant studied for the Associate Degree in Business with no specialty in the college. He usually uses Cantonese[1] in his daily life and work. He spoke some English in his work as he worked in customer relationship field and sometime talked in English with the English-speaking customers. As he mentioned at the start of the interview, he was not so comfortable with speaking in English as his English was not good, non-verbal prompting like smiling and nodding was frequently used to encourage him to speak in English in the interview.
S7T1	The participant was Associate in Applied Social Sciences student. He was active in organising student activities for the college and had many leadership positions in the college students' organisations. He could speak English well in the interview.
S8T1	The participant had experience in working in China before she joined the college. She studied for the Associate Degree in Business with specialty in Hospitality Management. She is fluent in all English, Putonghua[2] and Cantonese[1]. She was very expressive and gave many opinions in this interview.

Note:

1. Cantonese is a Chinese dialect commonly used in Hong Kong.

2. Putonghua is a Chinese dialect widely used in northern, central and southwestern parts of China such as Beijing. The main difference between Putonghua and Cantonese lies in the pronunciations of Chinese words.

3. International schools in Hong Kong "*follow a non-local curriculum and whose students do not sit for the local examinations… they (the international schools in Hong Kong) are operated with curricula designed for the needs of a particular cultural, racial or linguistic group or for students who wish to pursue their studies overseas*" (Yamato, 2003:11).

Table 5.1 (a): Descriptions of the Participating Interviewees in Teaching Method 1

Code	*Participant Description*
S1T2	The participant was Associate of Arts student in the college. He acknowledged that his English was not good. However, the interviewer found that he was able to use English to talk precisely and concisely at length in the interview.
S2T2	The participant studied for Associate Degree in Business with no specialty in the college. He grew up in Wuhan[1], a central city in China, and came to the college for study in 2007. He always used Putonghua (or Mandarin[2]) in his daily life with his family. He spoke English with his classmates in Hong Kong. He could speak English well and so the interviewer did not use prompting much.
S3T2	The participant studied for Associate Degree in Beauty and Health Therapy areas. She also had some part-time jobs in those areas. Her parents always talked with her in Fujianese[3] (a Chinese dialect) because her parents had come from Fujian province of China. She came to Hong Kong from Fujian province in 1993 when she was 6 years old. She grew up in Hong Kong and is familiar with Cantonese[4]. The interviewer gave very little prompting in the interview as she could express herself in English well. She could point out the problems of the on-line education.
S4T2	The participant studied for Associate Degree in Business with specialty in Information Systems and Knowledge Management. He is familiar with using computers and a large variety of software applications as he had his business about computer systems in Shenzhen, a southern part of China. So, he always travels to Shenzhen to run his business.
S5T2	The participant was Associate in Business student and her interest of study was marketing. She did not usually use English and Putonghua[2] at home. She just used English in the college and could speak Putonghua[2] quite well as she was learning Putonghua[2]. She usually used Cantonese[4]. Little prompting and encouragement were needed to make her speak up in English in this interview.
S6T2	The participant was Associate in Business student and she had no specialty in business to study. In the interview, she could express her ideas with correct English words clearly.
S7T2	The participant was Associate in Information Technology student. It seemed that he did not have many ideas to express. So, the interviewer prompted him a bit in the interview. He mentioned that when he was young, his family wanted him to have good English, his family built up English speaking atmosphere at home. All his family members had to use English at home. Later on, his family wanted him to have good Putonghua[2], his family hired a Putonghua[2] teacher to teach him Putonghua[2].
S8T2	The participant studied for Associate in Business with specialty in Information Systems and Knowledge Management. She was quite passive and did not express much in the interview. Frequent probing and prompting were used in the interview.

Note:

1. Wuhan is located in central part of China. People in Wuhan usually use Putonghua.

2. Putonghua is a Chinese dialect widely used in northern, central and southwestern parts of China such as Beijing. The main difference between Putonghua and Cantonese lies in the pronunciations of Chinese words.

3. Fujianese is a Chinese dialect used in southeast coast of China.

4. Cantonese is a Chinese dialect commonly used in Hong Kong.

Table 5.1 (b): Descriptions of the Participating Interviewees in Teaching Method 2

Code	*Participant Description*
S1T3	The participant was Associate in Information Technology student in the college. He usually used Cantonese[1] in his daily life. He spoke English well as he joined a study tour in Summer 2007 in Australia and practiced English there. The interview with this student was very smooth.
S2T3	The participant was Associate in Engineering student in the college. Although he seldom used English even in the college, he was able to express his ideas in English in the interview. Therefore, the time spent for the interview was not as much as that in the other interviews.
S3T3	The participant registered for Associate in Business with specialty in Accounting and Finance in the college. She engaged thoughtfully in the interview. She could express her ideas in English clearly.
S4T3	The participant studied for Associate in Business with specialty in Marketing in the college. She was quite expressive and thoughtful in the interview. As she always used English in her part-time jobs, she could speak English well in this interview. She usually uses Cantonese[1] and little Putonghua (or Mandarin[2]) in her daily life.
S5T3	The participant studied for Associate in Business with specialty in Human Resources Management. In her daily life, her main language is Cantonese[1]. In the college, she used English. She mentioned that as many lecturers in this college wanted the students to present their projects in English, she was trained with and used to using English.
S6T3	The participant studied for Associate in Business with specialty in Marketing in the college. She usually uses Cantonese[1] in her daily life and just used English in the college.
S7T3	The participant was Associate in Engineering student in the college. He did not have much confidence in speaking in English, so in order to build rapport with him, the interviewer spent a lot of time on talking with him in Cantonese[1] at the beginning of the interview, and made sure he understood the interview questions.
S8T3	The participant first registered for Associate in Engineering programme, later he changed to Associate in Information Technology programme as he had more interest in information technology area. He always used Cantonese[1] in his daily life. He lacked confidence in talking in English and pronounced some English words wrongly in the interview, so the interviewer used prompts and confirmed with him about some English words he expressed in the interview.

Note:

1. Cantonese is a Chinese dialect commonly used in Hong Kong.

2. Putonghua is a Chinese dialect widely used in northern, central and southwestern parts of China such as Beijing. The main difference between Putonghua and Cantonese lies in the pronunciations of Chinese words.

Table 5.1 (c): Descriptions of the Participating Interviewees in Teaching Method 3

The "encryption" code S2T3, for example, is "the student 2 in teaching method 3" which means the second student interviewed and this student used teaching method 3 in the quasi-experiment.

The majority (23 out of the total 24) of the participating interviewees are Hong Kong Chinese. One interviewee, coded with S2T2 in Table 5.1 (b), is also Chinese but grew up in northern part of China. This interviewee came to Hong Kong for study in the college in 2007. Although this interviewee came from a culture rather different from most college students, this interviewee used English to learn in the college. All these interviewees seldom use English in their daily lives. They only use English in the college.

5.1.2 The Interviews

All interviews conducted were one-to-one face-to-face semi-structured interviews between the interviewer and a single interviewee. The interviewer had a list of questions to be covered, as stated in the interview protocol in Appendix 4. In the actual running of the interviews, the interviewer added some questions to probe views and clarify or confirm some points. Also, a number of questions were omitted or modified in certain situations. For example, if the interviewer found that the interviewees mentioned that the variables like SEP, IGD and SCD influenced their on-line learning, then the interviewer would use an echo probe, which repeats what the interviewee said before (Bernard and Ryan, 2010:31), to confirm with the interviewees; so, instead of using the interview question 8, the researcher asked "According to what you talked about before, you think students' English proficiency, instructors' guidance in on-line discussion forum and students' collaboration in on-line discussion forum are factors that influence your on-line learning, don't you?".

At the beginning of an interview, the interviewer used Chinese to introduce himself, state the purpose of the interview, describe the interview procedures and briefly talk about the interview protocol in order to make sure the interviewee had the idea about the scope of the interview topics. He also explained the ethical issues and assured the interviewees that the data collected from the interviewee would be used for this research study only and kept in strict confidence. Chinese was used at this introduction because

the interviewer wanted to ensure that all the Chinese interviewees understood these important research issues. The interviewer also used Chinese to ask each interviewee the interview question 1. Using Chinese to ask the first question was a way to build a rapport - to make the Chinese interviewee relax and feel comfortable by replying in Chinese. Then, the interviewer stated that the coming questions and answers would be in English, explained that the interview would be audio recorded for transcription and reporting in English at a later stage. The interviewer obtained the interviewees' permission for audio recording. Noticing that both the interviewer and all interviewees can speak and listen to Chinese, the interviews could have been conducted in Chinese. The main reasons why the interviews had to be conducted in English instead of Chinese are that translation time could be saved, the English interview data could be transcribed and stored in word processing software which could be later exported to software for organising, manipulating and analysing data, and this facilitated the analysis of the interview data in English.

The interviewer used active listening skills which involve "*attentive listening, that is, not just listening to the words that are being said, but also to the tone and emphasis*" (Gray, 2009:383). The interviewer tried to be a good listener and avoided talking too much so as to let the interviewees express more ideas during the interviews. Prompting was occasionally used. Prompting may lead to the situation that the interviewer leads and speaks for the interviewee. So, prompting may not help the interviewer to get the genuinely perceived responses from the interviewee. However, prompting was needed in this situation that the interviewees were not familiar with talking in English. The prompts used were just cues to remind the interviewees of the correct words and pronunciations. For example, when the interviewee S8T3 struggled to pronounce the word "colla…", the interviewer noticed that it had the pattern of the word "collaboration" as a hint and prompted the interviewee S8T3 by asking "collaboration?", the interviewee S8T3 replied "Yes". In addition to verbal prompting just mentioned, the interviewer used non-verbal prompting like nodding and smiling (Gall et al, 2003) to encourage the interviewee to speak out in English.

Also, probing questions were used during the interview to ensure all aspects of the participants' views were discussed. For example, the interviewee S3T2 mentioned that it was hard to find the correct meaning from dictionary, the interviewer asked "Like what?

Can you give me specific example?" to probe more views on this point.

At the end of each interview, the interviewer checked to ensure that all the questions in the interview protocol had been covered. The interviewer also asked if the interviewee had any more comments. In several cases, the interviewees gave valuable comments. The interviewer then expressed his gratitude for the interviewees' help in the interviews and requested their later help in checking the accuracy of the interview data when the interview transcripts were ready.

After completing the interview transcription, the researcher went through member checking by inviting each of the interviewees to check his or her interview transcript, and clarifying and confirming with them about the views in the transcript. In some cases, after getting the explanation and exact meaning of what the interviewees wanted to convey, the researcher modified the transcripts.

Figure 5.1 shows an example of a partial transcript in a codebook which is a document for coding and contains three kinds of codes: (1) structural code which describes the environment features (Richards, 2002; Richards and Richards, 1995) such as features of the interviewer and interviewees, interview topics, interview date, time and location (Bernard and Ryan, 2010:76-77), (2) thematic code which shows how the themes are identified in a text (Bernard and Ryan, 2010:76) and (3) memos which are field notes about codes and comments or accounts of the researcher's experiences and thoughts in the course of collecting and reflecting on the qualitative data (Bogdan and Biklen, 2007:118-119; Strauss and Corbin, 2008). In Figure 5.1, the memos are included inside the square brackets [ ] and the label in the right hand column of the table of coding in the transcripts was used as a mnemonic device in the coding process for the coders to tag, index or label the text for themes (Bernard and Ryan, 2010:87; Richards, 2005).

Structural Code

Interview Information

Interview No: 5
Interviewer: Simon Wong
Interviewee: Male Student
Alias: S5T1
Date of Interview: 17 June 2010
Start Time of the Interview: 11:00AM
End Time of the Interview: 12:00 noon
Venue of Interview: Common Area in Hong Kong University

Introduction
Give brief introduction about myself and the purpose of the interview. Also mention that the data collected in this interview will be used for this research study only and kept in strict confidence.

Student Background

Age	21
Ethnicity	Chinese (Hong Kong) who was born in China
English subject grade in your previous examinations **Hong Kong Certificate of Education Examination or equivalent:** **Hong Kong Advanced Level Examination or equivalent:**	 E E
Teaching method you used for the introductory IT course in the college:	1

Coding in the transcripts

STRUCTURAL CODE		THEMATIC CODE AND MEMOS	
Interview Topic	Speaker	Transcript	Label
Experiences in using on-line education	Interviewer	**I would like you to do is to describe as much as possible your experiences in using on-line education?**	
	S5T1	We used it [the college's on-line education system] to download notes or send email to ask some questions and may be we had some time to discuss some questions using the discussion forum. May be, the teacher or other students would answer me and tried to discuss or explain it in the forum or I always emailed to ask questions and of course after the lecture, they would try to explain it and give me a clear answer. I like this method the most.	
Difficulties/ benefits of using on-line education	Interviewer	**Did you have difficulties when using on-line education system?**	
	S5T1	No, it's the system is very easy to use and simple. And there is no difficulty in using it.	
	Interviewer	**Did you have difficulties in understanding English? Because the learning language we use is English, but in our daily lives, we usually use Cantonese or just Chinese, right? So, do you have problem in understanding English terms from the on-line education system?**	
	S5T1	Yes, may be I have a problem but actually that will not be a big problem because there are lots of software to help me to solve the problem like Doctor Eye and it can translate the unknown vocabulary into Chinese in less than one second. So, there will not be a big problem about the unknown words.	
	Interviewer	**You mean you can use the software like Doctor Eye that can translate the English terms into Chinese instantly?**	
	S5T1	Yes.	
	Interviewer	**So, how did Doctor Eye work? I mean the operation like if you see the word and use the mouse to point at that word, then the Chinese terms will show out.**	
	S5T1	No matter it is in IE [Internet browser called Internet Explorer] or in some Word [Microsoft Word documents], we just use the mouse to point to the unknown words [the meaning of the words is unknown to the student], then there will be a Chinese explanation near that. They will open a little box and there will be some detailed explanations. Also, we can see the examples too. Very detailed.	
	Interviewer	**Can that software translate the whole message?**	
	S5T1	No, I don't think so. There are some software can try to do that, but the explanation is very difficult to understand. I tend to translate a few words. I just tried to understand the whole sentence by myself.	

Memos in [ ]

Figure 5.1: An Example of Structural Codes, Thematic Codes, Memos and Transcript

5.2 Qualitative Data Analysis

As mentioned earlier in Figure 3.7, nine steps were conducted in this phase as follows:

Step 1: Codebook Creation

After confirming the transcripts with the interviewees, the researcher built codebooks. Figure 5.1 shows a partial codebook. The researcher stored the codebooks in the word processing software Microsoft Word 2003 (in short, Word) and these Word files were accessible and readable by all coders.

Step 2: Application of the A Priori Codes to Some Transcripts

At this step, a priori codes were derived from the research questions and the quantitative findings in the first phase. The researcher and the other two coders independently studied and applied the a priori codes to 6 transcripts which were randomly selected from all 24 transcripts. The coders segmented the interview data into analytical units and applied codes to them. The coders were allowed to have flexibility in adding codes, deleting and modifying the a priori codes wherever they deemed it appropriate and necessary. One coder and the researcher used the software NVivo 8 (in short, NVivo) for coding. Another coder used the software NUD*IST 6 (in short, NUD*IST) as this software was available in her work. The transcripts in Word files were distributed to the coders for importing into NVivo or NUD*IST for coding.

To discover themes, with the assistance of NVivo or NUD*IST, all coders systematically examined and searched for patterns in the data such as transitions from one event to another which might indicate cause-effect relationship, linguistic connectors (e.g. the word “because” indicates the following words give explanation (Casagrande and Hale, 1967)), word or code frequency, similarities and differences.

Step 3: Comparison of the Themes among the Coders

For easy comparison of the themes, all coders put the codes in the label columns of the codebooks and counted the occurrence of a theme in each transcript. All coders used the binary theme – presence of a theme is counted as 1 or absence of the theme is counted as 0 – in each interview transcript and put the counter value of each theme in agreement matrices, similar to Table 5.3.

All the counted frequencies in the agreement matrices were entered into SPSS and Hayes and Krippendorff's (2007) macro for computing Krippendorff's alpha in SPSS was executed. Krippendorff (2004a:241) recommends the Krippendorff's alpha of 0.8 or higher is an acceptable level of inter-coder reliability. The SPSS-computed Krippendorff's alpha was 0.5641 which did not reach the acceptable level.

Step 4: Modification of the Priori Codes for Consistent Coding

The coders found that the explanation for some disagreements lay in the questions as to why a particular variable is a factor and why a factor is more important. After discussion and careful examination of the coded transcripts, all coders agreed to focus on five main interview topics with regard to research questions in section 1.5. These five interview topics were coded with: (1) FACTOR meaning that a variable is a factor affecting on-line learning, (2) FACTOR_EXP meaning the explanation on why the variable is a factor influencing on-line learning, (3) IR*x* meaning the importance rank *x* of a factor where *x* is 1, 2 or 3, (4) RANK_EXP meaning the explanation for importance ranking of the factors and (5) IMPROVE meaning the suggestion for improving on-line education. The coders refined the a priori codes and organised them into a common hierarchical structure, as shown in Table 5.2. This hierarchical organisation of codes could be transferred to the tree nodes in NVivo (Gibbs, 2002:70-76) for searching and referencing the coded segments in the transcripts.

Table 5.2 is classified into 5 categories: the inductive code list shown in (1) Table 5.2 (a) was used for coding a particular variable as a factor influencing on-line learning, (2) Table 5.2 (b) was used for explanations about why a particular variable is a factor influencing on-line learning, (3) Table 5.2 (c) was used for the importance ranking of the factors, (4) Table 5.2 (d) was used to explain the importance ranking of the factors, and finally (5) Table 5.2 (e) was used for suggestions for improving on-line education.

The levels of the labels/tags could be concatenated only from left to right (from highest level to lowest level). For example, with reference to Table 5.2 (c), I_Gui_DisF.IR3 is not allowed. It should be changed to IR3.I_Gui_DisF which means importance rank 3 for IGD.

Label/Tag		*Meaning*
1st Level	*2nd Level*	
FACTOR		Factor affecting on-line learning
	S_EP	Students' English proficiency is a factor influencing on-line learning
	I_Gui_DisF	Instructors' guidance in on-line discussion forum is a factor influencing on-line learning
	S_Col_DisF	Students' collaboration in on-line discussion forum is a factor influencing on-line learning

Table 5.2 (a): Inductive Code List for Factors Influencing On-Line Learning

Label/Tag			*Meaning*
1st Level	*2nd Level*	*3rd Level*	
FACTOR_EXP			Explanation of why a particular variable is a factor influencing on-line learning
	S_EP		Explanation of why students' English proficiency is a factor influencing on-line learning
		ENG_INSTRUCT	English instruction (e.g. on-line materials are written in English, updated IT information on the reference Web sites are in English)
		PROB_TRANS	Problems in translating English into Chinese (e.g. it is difficult to translate English IT terms into Chinese IT terms)
		S_LESS_RESP	Students are less responsible
		S_LESS_EP	Students are less proficient in English
		I_LESS_RESP	Instructors are less responsible
	I_Gui_DisF		Explanation on why instructors' guidance in on-line discussion forum is a factor influencing on-line learning
		PROB_TECH	Problem in technical issues results in instructors' guidance in on-line discussion forum
		I_MONITOR	Instructors can monitor students' discussion in on-line discussion forum
		I_MORE_KNOW	Instructors are more knowledgeable in IT subjects
		I_MORE_EP	Instructors are more proficient in English
		S_LESS_RESP	Students are less responsible
		S_LESS_KNOW	Students are less knowledgeable in IT subjects
	S_Col_DisF		Explanation of why students' collaboration in on-line discussion forum is a factor affecting on-line learning
		S_FAST_REPLY	Students' fast response rate arouses students' collaboration in on-line discussion forum
		I_SLOW_REPLY	Instructors' slow response rate arouses students' collaboration in on-line discussion forum
		PROB_TECH	Problems in technical issues arouse students' collaboration in on-line discussion forum
		S_CU_DisF	Students' use of Chinese in on-line discussion forum
		S_SOCIAL	Social process like chatting, talking about lives and interesting things, and students learn through social process

Table 5.2 (b): Inductive Code List for Explanations for Factors Influencing On-Line Learning

Label/Tag		*Meaning*
1st Level	***2nd Level***	
IR*i*		Importance rank *i* where *i*=1, 2 or 3 (e.g. IR2 for importance rank 2) IR1 – The most important IR2 – The medium important IR3 – The least important
	S_EP	IR*i* for students' English proficiency
	I_Gui_DisF	IR*i* for instructors' guidance in on-line discussion forum
	S_Col_DisF	IR*i* for students' collaboration in on-line discussion forum

Table 5.2 (c): Inductive Code List for Importance Ranking of the Factors

Label/Tag			*Meaning*
1st Level	***2nd Level***	***3rd Level***	
RANK_EXP			Explanation for importance ranking of the factors
	S_EP_MORE		Explanation on why students' English proficiency is more important
		ENG_INSTRUCT	English instruction (e.g. on-line materials are written in English, updated IT information on the reference Web sites are in English)
		INT	Issues related to interaction/communication
		INCONVEN	Issues related to inconvenience
		UNDERSTAND	Issues related to students' understanding and thinking,
	S_EP_LESS		Explanation for why students' English proficiency is less important
	I_Gui_DisF_MORE		Explanation of why instructors' guidance in on-line discussion forum is more important
		I_MORE_KNOW	Instructors are more knowledgeable in IT subjects
		S_LESS_KNOW	Students are less knowledgeable in IT subjects
		I_ MORE _RESP	Instructors are more responsible
		I_FEEDBACK	Instructors can give feedback
		I_MONITOR	Instructors can monitor students' discussion in on-line discussion forum
		I_MORE_EP	Instructors are more proficient in English
	I_Gui_DisF_LESS		Explanation of why instructors' guidance in on-line discussion forum is less important
		I_INFO	Instructors just give information
	S_Col_DisF_MORE		Explanation of why students' collaboration in on-line discussion forum is more important
		S_THINK	Students' collaboration arouses students to think
	S_Col_DisF_LESS		Explanation of why students' collaboration in on-line discussion forum is less important
		S_LESS_KNOW	Students are less knowledgeable on IT subjects
		S_LESS_RESP	Students are less responsible
		S_COMPETE	Students compete with each other

Table 5.2 (d): Inductive Code List for Explanations for Importance Ranking of the Factors

Label/Tag		*Meaning*
1st Level	*2nd Level*	
IMPROVE		Suggestions for improving on-line education
	REAL-TIME	To have facilities for real-time communication
	MORE_EX	To have more exercises
	FAST_REPLY	To have fast response rate
	MONITOR	To have monitoring mechanism
	FEEDBACK	To have feedback mechanism
	HYBRID	To have hybrid teaching (e.g. classroom teaching plus on-line education)
	TRANS	To have translation tool
	ATTENTION	To have mechanism that draws students' attention
	FORMULAS	To have mechanism for typing formulas
	PRACTICE	To have mechanism that facilitates practicing (e.g. video and animation showing step-by-step instructions for practical skills)

Table 5.2 (e): Inductive Code List for Suggestions for Improving On-Line Education

Step 5: Application of the Inductive Codes to All Interview Transcripts

At this step, all coders independently studied and applied the inductive codes in Table 5.2 to all 24 transcripts. All coders were allowed to add, delete and modify codes to build new inductive codes if necessary. Again, with the assistance of NVivo or NUD*IST, the coders came up with some new themes.

Step 6: Further Comparison of the Themes among the Coders

The researcher entered the counted frequency of presence (or counter value) of each theme (both existing and new ones) by each coder in agreement matrices. For example, Table 5.3 shows the agreement matrix of the theme on suggestions for improving on-line education. The coder 1 put the counter value 3 for the theme "Students using on-line education should be proficient in English". It means that the coder 1 found 3 out of the total 24 interview transcripts indicated this theme. The coders 2 and 3 found 2 out of the total 24 transcripts indicated this theme, as shown by the counter value 2 for this theme.

Theme Category	*Themes*	*Coder*		
		1	*2*	*3*
Suggestions on improving on-line education	To have facilities for real-time communication	7	7	7
	To have more exercises	1	1	1
	To have fast response rate	3	3	3
	To have monitoring mechanism	2	2	2
	To have feedback mechanism (e.g. the mechanism that understands and motivates students)	6	6	6
	To have hybrid teaching (e.g. classroom teaching plus on-line education)	9	9	9
	To have a translation tool	3	3	3
	To have a mechanism that draws students' attention	3	3	3
	To have a mechanism for typing formulas	0	0	1
	To have a mechanism that shows step-by-step instruction for practical skills (e.g. video and animation)	4	4	4
	Not to use on-line education for practical subjects *	2	2	3
	To have a mechanism for learning through social process *	1	0	1
	To have a facilitator in the discussion forum *	2	2	2
	Students using on-line education should have self-learning ability *	3	3	3
	Students using on-line education should be proficient in English *	3	2	2
	Students using on-line education should have basic IT skills *	3	3	3
	Students using on-line education should have self-control *	2	2	2
	To have 24-hour technical support *	1	1	1
	On-line education is suitable for independent students *	1	0	0
	Technical issues e.g. fast and reliable computers and network *	1	1	1
	To have clear solutions and explanations *	1	1	1
	To have a mechanism for sorting out relevant information *	1	1	1

* Newly added theme in step 5

Table 5.3: Agreement Matrix of the Themes Related to Suggestions for Improving On-Line Education

The SPSS-computed Krippendorff's alpha was 0.8415, as shown in Figure 5.2, which was above Krippendorff's (2004a:241) recommended acceptable reliability level of 0.8.

```
Krippendorff's Alpha Reliability Estimate

                Alpha       Units      Obsrvrs       Pairs
Ratio           .8415     87.0000       3.0000    261.0000

Judges used in these computations:
 coder1    coder2    coder3
```

Figure 5.2: Inter-coder Reliability

Step 7: Further Generation of Inductive Codes if Necessary for Consistent Coding

The researcher found the inconsistency mainly lay in the coding for the new themes and the use of new labels for the new themes. After discussion, all coders agreed to the common use of the new labels as shown in Tables 5.4 (a) and (b).

Label/Tag			***Meaning***
1st Level	***2nd Level***	***3rd Level***	
FACTOR_EXP			Explanation of why a particular variable is a factor affecting on-line learning
	I_Gui_DisF		Explanation of why instructors' guidance in on-line discussion forum is a factor affecting on-line learning
		I_INIT	Instructors can initiate/facilitate discussion in on-line discussion forum
		CONVEN	It is convenient to learn through discussing with instructors in on-line discussion forum as there is no need to travel to a classroom
	S_Col_DisF		Explanation of why students' collaboration in on-line discussion forum is a factor affecting on-line learning
		S_INIT	Students initiate discussion with familiar peers.
		S_THINK	Students' posted questions arouse peers to think and learn
		S_SOL	Students are willing to share solutions/answers with peers and discuss
		CONVEN	It is convenient to learn through discussing with peers in on-line discussion forum as there is no need to travel to a classroom
RANK_EXP			Explanation for importance ranking of the factors
	S_EP_LESS		Explanation of why students' English proficiency is less important
		I_CH_INSTRUCT	Instructors can use Chinese for instruction
		I_CH_EXPLAIN	Instructors can use Chinese for explanation
		DICT	Students can check with dictionary
	I_Gui_DisF_MORE		Explanation of why instructors' guidance in on-line discussion forum is more important
		I_TEACH	Instructors have teaching skills
		S_NO_TEACH	Students have no teaching skills
		S_LESS _RESP	Students are less responsible
	S_Col_DisF_MORE		Explanation of why students' collaboration in on-line discussion forum is more important
		I_INFO	Instructors just give information only
		S_SOL	Students are willing to share solutions
		S_SOCIAL	Students learn in social process
		S_CORRECT	Students correct errors

Table 5.4 (a): Inductive Code List for New Themes in the Category of Factors Influencing On-line Learning and Explanations for Ranking of the Factors

Label/Tag		*Meaning*
1st Level	*2nd Level*	
IMPROVE		Suggestions for improving on-line education
	NO_PRACT	Not to use on-line education for practicing/practical subjects
	SOCIAL	To have mechanism for learning through social process
	FACILITATOR	To have a facilitator in the discussion forum
	S_SELF-LEARN	Students using on-line education should have self-learning ability
	S_EP	Students using on-line education should be proficient in English
	S_IT-SKILLS	Students using on-line education should have basic IT skills
	S_SELF-CONTROL	Students using on-line education should have self-control
	TECH_SUPPORT	To have technical support
	S_INDEPENT	On-line education is suitable for independent students
	TECH_ISSUES	Technical issues e.g. fast and reliable computers and network
	SOL	To have clear solutions and explanation
	RELEV	To have mechanism for sorting out relevant information

Table 5.4 (b): Inductive Code List for New Themes in the Category of Suggestions for Improving On-Line Education

Step 8: Creation of Data and Similarity Matrices

The coders applied the modified inductive codes, which consisted of the codes in Tables 5.2 and 5.4, to all transcripts. Table 5.5 shows an example of applying the inductive codes to a partial S1T1's interview transcript (Two other examples of this application are shown in Appendices 12 and 13). To see the patterns in the interview data, the researcher used a code frequency which shows how often a code was mentioned by an interviewee. As different questions were used in the semi-structured interviews, some interviewees mentioned a code more or less frequently and it was hard to compare the code frequencies among different interviewees just based on the different interview questions. The researcher turned a code frequency into 1 or 0 for each interviewee – 1 means the code was mentioned while 0 means the code was not mentioned by the interviewee.

In order to find out the convergent patterns of the interview data from the open-ended questions among different participant groups, scree plots were first used to choose the codes that were frequently mentioned by the interviewees. The open-ended questions include questions 2 to 7 of the interview protocol in Appendix 4 which were used to obtain explanations about why the specific variables are the factors influencing students' on-line learning and questions 9 to 10 in the interview protocol which were used to explore how on-line education could be improved. Based on Bernard and Ryan's (2010:168) suggestion, the researcher chose the codes that were mentioned by at least 10% (about 2 out of 24 interviewees) to study in more depth.

Coding in the transcripts

STRUCTURAL CODE		THEMATIC CODE AND MEMOS	
Interview Topic	Speaker	Transcript	Label
Experiences in using on-line education	Interviewer	**I would like you to do is to describe as much as possible your experiences in using on-line education?**	
	S1T1	In the past, I seldom used it because the teachers taught us in classroom. I only used it to download notes, assignments and find the suggested solutions from other students in discussion forum when we had to submit the assignments.	
Difficulties/ benefits of using on-line education	Interviewer	**Did you get help from the other students in the discussion forum?**	
	S1T1	Yes. They [the other students] also help me in other areas like they showed me which model of notebook to buy, they gave me suggestions about newest information technology products.	FACTOR_EXP.S_Col_DisF.PROB_TECH
	Interviewer	**What difficulties did you have when using WebCT [the on-line education system used in the college for the introductory IT course]?**	
	S1T1	No [No difficulties in using WebCT]. It [WebCT] is quite easy to use.	
	Interviewer	**Did you have difficulty in understanding the English materials posted in WebCT?**	
	S1T1	Sometime, it [the materials posted in WebCT] may be used with difficult English. I did not understand the contents [the contents of the teaching materials]. I tried to read several times to try to understand them. I also asked someone to help.	FACTOR_EXP.S_EP.ENG_INSTRUCT
	Interviewer	**How did you get help?**	
	S1T1	I just called my friends or post questions in discussion forum.	
Factors affecting on-line learning	Interviewer	**So, do you think students' English proficiency is important factor that influences their learning?**	
	S1T1	Yes, of course. This is the basic skill of the students. No one has the patience to explain everything every word to you, so you must have good English to learn.	FACTOR.S_EP FACTOR_EXP.S_EP.ENG_INSTRUCT

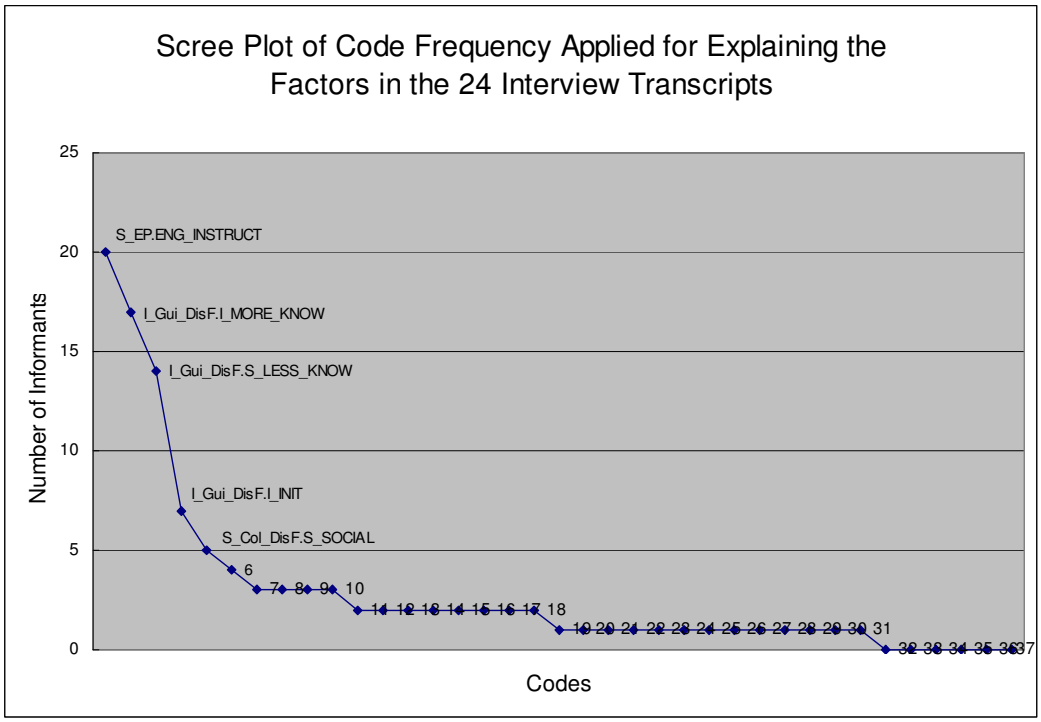
Memos in [ ]

Table 5.5: An Example of Consistent Coding in Partial S1T1's Interview Transcript

The scree plot of code frequency applied for explaining the factors in the 24 interview transcripts is shown in Figure 5.3 (a). The code numbers 19 to 31 were mentioned once while the code numbers 32 to 37 were not mentioned in all 24 transcripts. Therefore, these code numbers 19 to 37 were not used for further study. Figure 5.3 (b) shows the scree plot of code frequency applied for perceived on-line education improvements in the 24 interview transcripts. The code numbers 13 to 22 were mentioned once or not mentioned in all the transcripts and therefore were not used for further study. The researcher wanted to study only the frequent views among the different participant groups and therefore chose the codes that were mentioned at least twice in the transcripts. The ideas of the whole groups, as contrasted with an individual, were reflected by their shared content.

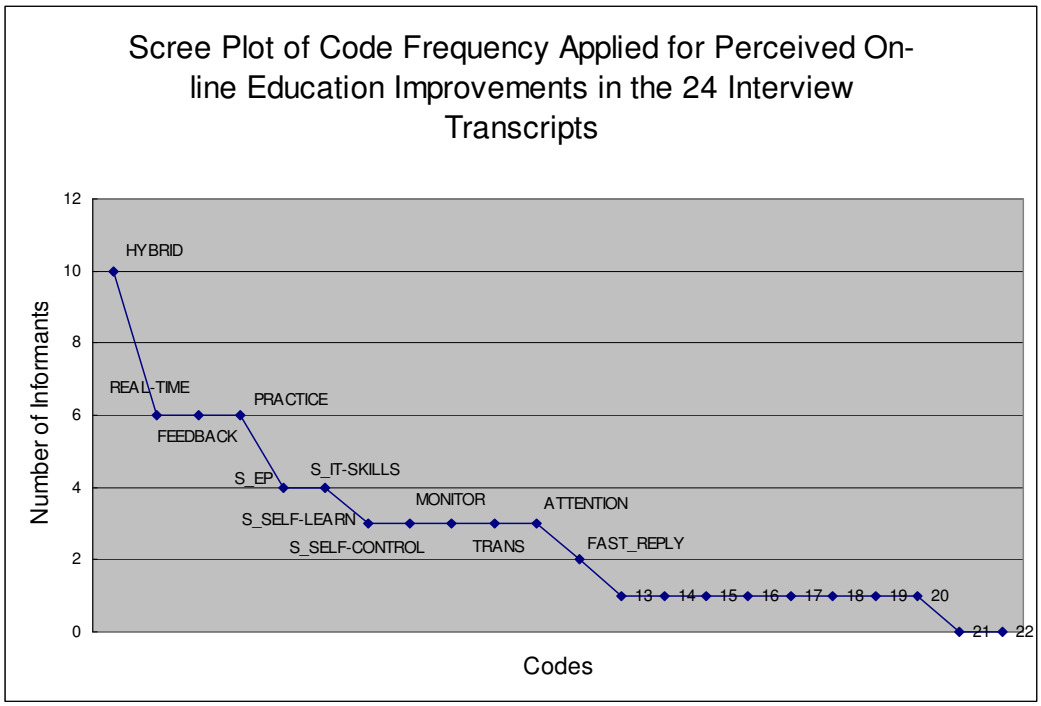
Next, the data matrices were derived from the frequently mentioned codes. The data matrix shows whether a particular code was mentioned by each interviewee and the code frequency in all transcripts. Table 5.6 (a) shows the data matrix of the "factor explanation" hierarchical codes while Table 5.6 (b) shows the data matrix of the "on-line education improvement" hierarchical codes that were mentioned by the 24 interviewees. In these tables, 1 means the code was mentioned. Code frequency is the sum of 1s across all the 24 interviewees. In this sense, the code frequency can be 0 meaning that this code was not mentioned at all and the maximum code frequency for a particular code for all interviewees is 24.

To see patterns in the data matrices, the researcher conducted a semantic network analysis. A semantic network analysis begins by producing similarity matrices (Bernard and Ryan, 2010:210). The similarity matrix shows the similarity among the pairs of codes (as shown by the covariation between all pairs of rows in a data matrix) and how similar the codes were among the interviewees (as shown by the covariation between all pairs of columns in a data matrix). Semantic network analysis then performs multidimensional scaling (MDS) and cluster analysis on data in the similarity matrices (Bernard and Ryan, 2010:116-117, 212).



Code No	Hierarchical Code	Code No	Hierarchical Code
1	S_EP.ENG_INSTRUCT	19	I_Gui_DisF.I_MORE_EP
2	I_Gui_DisF.I_MORE_KNOW	20	I_Gui_DisF_LESS.I_INFO
3	I_Gui_DisF.S_LESS_KNOW	21	I_Gui_DisF_MORE.I_FEEDBACK
4	I_Gui_DisF.I_INIT	22	I_Gui_DisF_MORE.I_MORE_RESP
5	S_Col_DisF.S_SOCIAL	23	S_Col_DisF.I_SLOW_REPLY
6	S_Col_DisF.S_SOL	24	S_Col_DisF.PROB_TECH
7	S_Col_DisF.S_CU_DisF	25	S_Col_DisF.S_FAST_REPLY
8	S_Col_DisF.S_THINK	26	S_Col_DisF_LESS.S_COMPETE
9	S_EP.PROB_TRANS	27	S_Col_DisF_MORE.S_CORRECT
10	S_EP_LESS.I_CH_EXPLAIN	28	S_EP.S_LESS_EP
11	I_Gui_DisF.I_MONITOR	29	S_EP_LESS.DICT
12	I_Gui_DisF_MORE.I_TEACH	30	S_EP_LESS.I_CH_INSTRUCT
13	I_Gui_DisF_MORE.S_NO_TEACH	31	S_EP_MORE.UNDERSTAND
14	S_Col_DisF.S_INIT	32	I_Gui_DisF.CONVEN
15	S_Col_DisF_LESS.S_LESS_RESP	33	I_Gui_DisF.PROB_TECH
16	S_Col_DisF_MORE.I_INFO	34	I_Gui_DisF.S_LESS_RESP
17	S_EP_MORE.INCONVEN	35	S_Col_DisF.CONVEN
18	S_EP_MORE.INT	36	S_EP.I_LESS_RESP
		37	S_EP.S_LESS_RESP

Figure 5.3 (a): Scree Plot of Code Frequency Applied for Explaining the Factors in the 24 Interview Transcripts



Code No	Hierarchical Code (all with level-1 label IMPROVE)	Code No	Hierarchical Code (all with level-1 label IMPROVE)
1	HYBRID	12	FAST_REPLY
2	REAL-TIME	13	NO_PRACT
3	FEEDBACK	14	SOCIAL
4	PRACTICE	15	TECH_SUPPORT
5	S_EP	16	S_INDEPENT
6	S_IT-SKILLS	17	TECH_ISSUES
7	S_SELF-LEARN	18	SOL
8	S_SELF-CONTROL	19	MORE_EX
9	MONITOR	20	FORMULAS
10	TRANS	21	FACILITATOR
11	ATTENTION	22	RELEV

Figure 5.3 (b): Scree Plot of Code Frequency Applied for Perceived On-line Education Improvements in the 24 Interview Transcripts

Hierachical Code	Interviewees																								Code Frequency
	S1T1	S2T1	S3T1	S4T1	S5T1	S6T1	S7T1	S8T1	S1T2	S2T2	S3T2	S4T2	S5T2	S6T2	S7T2	S8T2	S1T3	S2T3	S3T3	S4T3	S5T3	S6T3	S7T3	S8T3	
S_EP.ENG_INSTRUCT	1	1	1	1	1	1	1		1		1	1	1	1		1	1	1		1	1	1	1	1	20
I_Gui_DisF.I_MORE_KNOW	1		1	1	1	1	1	1	1	1	1	1			1		1		1	1	1		1		17
I_Gui_DisF.S_LESS_KNOW	1				1	1	1		1	1	1	1	1	1	1		1			1			1		14
I_Gui_DisF.I_INIT										1			1				1			1	1	1	1		7
S_Col_DisF.S_SOCIAL								1		1	1								1				1		5
S_Col_DisF.S_SOL					1					1								1		1					4
S_Col_DisF.S_CU_DisF	1			1						1															3
S_Col_DisF.S_THINK	1	1															1								3
S_EP.PROB_TRANS				1					1												1				3
S_EP_LESS.I_CH_EXPLAIN							1	1					1												3
I_Gui_DisF.I_MONITOR			1						1																2
I_Gui_DisF_MORE.I_TEACH					1										1										2
I_Gui_DisF_MORE.S_NO_TEACH					1										1										2
S_Col_DisF.S_INIT							1				1														2
S_Col_DisF_LESS.S_LESS_RESP										1	1														2
S_Col_DisF_MORE.I_INFO		1								1															2
S_EP_MORE.INCONVEN									1						1										2
S_EP_MORE.INT																	1		1						2

Table 5.6 (a): Data Matrix of the Hierarchical Codes Mentioned by the 24 Interviewees for Explanations for Factors Influencing Students' On-line Learning

Hierachical Code (all with Level-1 Label IMPROVE)	Interviewees																								Code Frequency
	S1T1	S2T1	S3T1	S4T1	S5T1	S6T1	S7T1	S8T1	S1T2	S2T2	S3T2	S4T2	S5T2	S6T2	S7T2	S8T2	S1T3	S2T3	S3T3	S4T3	S5T3	S6T3	S7T3	S8T3	
HYBRID	1			1			1		1			1					1	1		1	1		1		10
REAL-TIME		1				1	1			1								1		1					6
FEEDBACK		1	1			1	1	1									1								6
PRACTICE				1		1	1	1				1									1				6
S_EP									1				1	1								1			4
S_IT-SKILLS									1		1			1								1			4
S_SELF-LEARN								1						1								1			3
S_SELF-CONTROL								1						1								1			3
MONITOR			1				1	1																	3
TRANS					1				1											1					3
ATTENTION	1															1								1	3
FAST_REPLY					1					1															2

Table 5.6 (b): Data Matrix of the Hierarchical Codes Mentioned by the 24 Interviewees for Suggestions for Improving On-line Education

The researcher used the software UCINET to convert the code-by-interviewee data matrices in Table 5.6 into similarity matrices. Table 5.6 (a) was converted into two similarity matrices - one is 24 × 24 interviewee-by-interviewee similarity matrix (Table 5.7 (a)) and the other is 18 × 18 code-by-code similarity matrix (Table 5.8 (a)) for factor explanation. In Table 5.8 (a), the code numbers are the same as those used in Figure 5.3 (a). Table 5.6 (b) was converted into two similarity matrices - one is 24 × 24 interviewee-by-interviewee similarity matrix (Table 5.7 (b)) and the other is 12 × 12 code-by-code similarity matrix (Table 5.8 (b)) for suggestions on on-line education improvement. In Table 5.8 (b), the code numbers can be found in Figure 5.3 (b).

The interviewee-by-interviewee similarity matrix can be visualized by comparing two interviewees down the columns and counting the matches (both 1s or both blanks occur in the two columns). For example, there are 14 matches between S1T1 and S2T1 out of the total 18 codes in Table 5.6 (a), therefore 0.778 (which is approximately 14 divided by 18) is shown in the cell between S1T1 and S2T1 (intersection between S1T1 row (or column) and S2T1 column (or row)) in Table 5.7 (a). A similar approach was applied to obtain a code-by-code similarity matrix. So, the diagonals of the similarity matrices are all 1s, signifying that the interviewee is similar to himself or herself and the code co-occurs with itself. The similarity matrices are symmetric – the values above and below the diagonals mirror one another. For example, the value 0.889 at the intersection point between S1T1 row and S6T1 column is the same as the value at the intersection point between S6T1 row and S1T1 column.

The researcher used UCINET to generate MDS maps of and perform cluster analysis on the data in the similarity matrices in Tables 5.7 and 5.8 as the next step for seeing patterns in these graphs was easier than discovering the patterns in the similarity matrices.

Inter-viewees	S1T1	S2T1	S3T1	S4T1	S5T1	S6T1	S7T1	S8T1	S1T2	S2T2	S3T2	S4T2	S5T2	S6T2	S7T2	S8T2	S1T3	S2T3	S3T3	S4T3	S5T3	S6T3	S7T3	S8T3
S1T1	1.000	0.778	0.778	0.833	0.722	0.889	0.778	0.667	0.722	0.611	0.722	0.889	0.722	0.833	0.667	0.778	0.833	0.722	0.667	0.778	0.722	0.722	0.778	0.778
S2T1	0.778	1.000	0.778	0.722	0.611	0.778	0.667	0.667	0.611	0.500	0.611	0.778	0.722	0.833	0.556	0.889	0.722	0.833	0.667	0.667	0.722	0.833	0.667	0.889
S3T1	0.778	0.778	1.000	0.833	0.722	0.889	0.778	0.778	0.833	0.500	0.722	0.889	0.722	0.833	0.667	0.889	0.722	0.833	0.778	0.778	0.833	0.833	0.778	0.889
S4T1	0.833	0.722	0.833	1.000	0.667	0.833	0.722	0.722	0.778	0.556	0.667	0.833	0.667	0.778	0.611	0.833	0.667	0.778	0.722	0.722	0.889	0.778	0.722	0.833
S5T1	0.722	0.611	0.722	0.667	1.000	0.833	0.722	0.611	0.667	0.556	0.667	0.833	0.667	0.778	0.833	0.722	0.667	0.778	0.611	0.833	0.667	0.667	0.722	0.722
S6T1	0.889	0.778	0.889	0.833	0.833	1.000	0.889	0.778	0.833	0.611	0.833	1.000	0.833	0.944	0.778	0.889	0.833	0.833	0.778	0.889	0.833	0.833	0.889	0.889
S7T1	0.778	0.667	0.778	0.722	0.722	0.889	1.000	0.778	0.722	0.500	0.833	0.889	0.833	0.833	0.667	0.778	0.722	0.722	0.667	0.778	0.722	0.722	0.778	0.778
S8T1	0.667	0.667	0.778	0.722	0.611	0.778	0.778	1.000	0.611	0.611	0.722	0.778	0.722	0.722	0.667	0.778	0.611	0.722	0.889	0.667	0.722	0.722	0.778	0.778
S1T2	0.722	0.611	0.833	0.778	0.667	0.833	0.722	0.611	1.000	0.444	0.667	0.833	0.667	0.778	0.722	0.722	0.667	0.667	0.611	0.722	0.778	0.667	0.722	0.722
S2T2	0.611	0.500	0.500	0.556	0.556	0.611	0.500	0.611	0.444	1.000	0.667	0.611	0.556	0.556	0.500	0.500	0.556	0.556	0.611	0.722	0.556	0.556	0.722	0.500
S3T2	0.722	0.611	0.722	0.667	0.667	0.833	0.833	0.722	0.667	0.667	1.000	0.833	0.667	0.778	0.611	0.722	0.667	0.667	0.722	0.722	0.667	0.667	0.833	0.722
S4T2	0.889	0.778	0.889	0.833	0.833	1.000	0.889	0.778	0.833	0.611	0.833	1.000	0.833	0.944	0.778	0.889	0.833	0.833	0.778	0.889	0.833	0.833	0.889	0.889
S5T2	0.722	0.722	0.722	0.667	0.667	0.833	0.833	0.722	0.667	0.556	0.667	0.833	1.000	0.889	0.611	0.833	0.778	0.778	0.611	0.833	0.778	0.889	0.833	0.833
S6T2	0.833	0.833	0.833	0.778	0.778	0.944	0.833	0.722	0.778	0.556	0.778	0.944	0.889	1.000	0.722	0.944	0.778	0.889	0.722	0.833	0.778	0.889	0.833	0.944
S7T2	0.667	0.556	0.667	0.611	0.833	0.778	0.667	0.667	0.722	0.500	0.611	0.778	0.611	0.722	1.000	0.667	0.611	0.611	0.667	0.667	0.611	0.611	0.667	0.667
S8T2	0.778	0.889	0.889	0.833	0.722	0.889	0.778	0.778	0.722	0.500	0.722	0.889	0.833	0.944	0.667	1.000	0.722	0.944	0.778	0.778	0.833	0.944	0.778	1.000
S1T3	0.833	0.722	0.722	0.667	0.667	0.833	0.722	0.611	0.667	0.556	0.667	0.833	0.778	0.778	0.611	0.722	1.000	0.667	0.722	0.833	0.778	0.778	0.833	0.722
S2T3	0.722	0.833	0.833	0.778	0.778	0.833	0.722	0.722	0.667	0.556	0.667	0.833	0.778	0.889	0.611	0.944	0.667	1.000	0.722	0.833	0.778	0.889	0.722	0.944
S3T3	0.667	0.667	0.778	0.722	0.611	0.778	0.667	0.889	0.611	0.611	0.722	0.778	0.611	0.722	0.667	0.778	0.722	0.722	1.000	0.667	0.722	0.722	0.778	0.778
S4T3	0.778	0.667	0.778	0.722	0.833	0.889	0.778	0.667	0.722	0.722	0.722	0.889	0.833	0.833	0.667	0.778	0.833	0.833	0.667	1.000	0.833	0.833	0.889	0.778
S5T3	0.722	0.722	0.833	0.889	0.667	0.833	0.722	0.722	0.778	0.556	0.667	0.833	0.778	0.778	0.611	0.833	0.778	0.778	0.722	0.833	1.000	0.889	0.833	0.833
S6T3	0.722	0.833	0.833	0.778	0.667	0.833	0.722	0.722	0.667	0.556	0.667	0.833	0.889	0.889	0.611	0.944	0.778	0.889	0.722	0.833	0.889	1.000	0.833	0.944
S7T3	0.778	0.667	0.778	0.722	0.722	0.889	0.778	0.778	0.722	0.722	0.833	0.889	0.833	0.833	0.667	0.778	0.833	0.722	0.778	0.889	0.833	0.833	1.000	0.778
S8T3	0.778	0.889	0.889	0.833	0.722	0.889	0.778	0.778	0.722	0.500	0.722	0.889	0.833	0.944	0.667	1.000	0.722	0.944	0.778	0.778	0.833	0.944	0.778	1.000

Table 5.7 (a): Interviewee-by-interviewee Similarity Matrix for Factor Explanation

Inter-viewees	S1T1	S2T1	S3T1	S4T1	S5T1	S6T1	S7T1	S8T1	S1T2	S2T2	S3T2	S4T2	S5T2	S6T2	S7T2	S8T2	S1T3	S2T3	S3T3	S4T3	S5T3	S6T3	S7T3	S8T3
S1T1	1.000	0.667	0.667	0.833	0.667	0.583	0.583	0.417	0.667	0.667	0.750	0.833	0.750	0.500	0.833	0.917	0.833	0.833	0.833	0.750	0.833	0.500	0.917	0.917
S2T1	0.667	1.000	0.833	0.667	0.667	0.917	0.750	0.583	0.500	0.833	0.750	0.667	0.750	0.500	0.833	0.750	0.833	0.833	0.833	0.750	0.667	0.500	0.750	0.750
S3T1	0.667	0.833	1.000	0.667	0.667	0.750	0.750	0.750	0.500	0.667	0.750	0.667	0.750	0.500	0.833	0.750	0.833	0.667	0.833	0.583	0.667	0.500	0.750	0.750
S4T1	0.833	0.667	0.667	1.000	0.667	0.750	0.750	0.583	0.667	0.667	0.750	1.000	0.750	0.500	0.833	0.750	0.833	0.833	0.833	0.750	1.000	0.500	0.917	0.750
S5T1	0.667	0.667	0.667	0.667	1.000	0.583	0.417	0.417	0.667	0.833	0.750	0.667	0.750	0.500	0.833	0.750	0.667	0.667	0.833	0.750	0.667	0.500	0.750	0.750
S6T1	0.583	0.917	0.750	0.750	0.583	1.000	0.833	0.667	0.417	0.750	0.667	0.750	0.667	0.417	0.750	0.667	0.750	0.750	0.750	0.667	0.750	0.417	0.667	0.667
S7T1	0.583	0.750	0.750	0.750	0.417	0.833	1.000	0.667	0.417	0.583	0.500	0.750	0.500	0.250	0.583	0.500	0.750	0.750	0.583	0.667	0.750	0.250	0.667	0.500
S8T1	0.417	0.583	0.750	0.583	0.417	0.667	0.667	1.000	0.250	0.417	0.500	0.583	0.500	0.583	0.583	0.500	0.583	0.417	0.583	0.333	0.583	0.583	0.500	0.500
S1T2	0.667	0.500	0.500	0.667	0.667	0.417	0.417	0.250	1.000	0.500	0.750	0.667	0.750	0.667	0.667	0.583	0.667	0.667	0.667	0.750	0.667	0.667	0.750	0.583
S2T2	0.667	0.833	0.667	0.667	0.833	0.750	0.583	0.417	0.500	1.000	0.750	0.667	0.750	0.500	0.833	0.750	0.667	0.833	0.833	0.750	0.667	0.500	0.750	0.750
S3T2	0.750	0.750	0.750	0.750	0.750	0.667	0.500	0.500	0.750	0.750	1.000	0.750	0.833	0.750	0.917	0.833	0.750	0.750	0.917	0.667	0.750	0.750	0.833	0.833
S4T2	0.833	0.667	0.667	1.000	0.667	0.750	0.750	0.583	0.667	0.667	0.750	1.000	0.750	0.500	0.833	0.750	0.833	0.833	0.833	0.750	1.000	0.500	0.917	0.750
S5T2	0.750	0.750	0.750	0.750	0.750	0.667	0.500	0.500	0.750	0.750	0.833	0.750	1.000	0.750	0.917	0.833	0.750	0.750	0.917	0.667	0.750	0.750	0.833	0.833
S6T2	0.500	0.500	0.500	0.500	0.500	0.417	0.250	0.583	0.667	0.500	0.750	0.500	0.750	1.000	0.667	0.583	0.500	0.500	0.667	0.417	0.500	1.000	0.583	0.583
S7T2	0.833	0.833	0.833	0.833	0.833	0.750	0.583	0.583	0.667	0.833	0.917	0.833	0.917	0.667	1.000	0.917	0.833	0.833	1.000	0.750	0.833	0.667	0.917	0.917
S8T2	0.917	0.750	0.750	0.750	0.750	0.667	0.500	0.500	0.583	0.750	0.833	0.750	0.833	0.583	0.917	1.000	0.750	0.750	0.917	0.667	0.750	0.583	0.833	1.000
S1T3	0.833	0.833	0.833	0.833	0.667	0.750	0.750	0.583	0.667	0.667	0.750	0.833	0.750	0.500	0.833	0.750	1.000	0.833	0.833	0.750	0.833	0.500	0.917	0.750
S2T3	0.833	0.833	0.667	0.833	0.667	0.750	0.750	0.417	0.667	0.833	0.750	0.833	0.750	0.500	0.833	0.750	0.833	1.000	0.833	0.917	0.833	0.500	0.917	0.750
S3T3	0.833	0.833	0.833	0.833	0.833	0.750	0.583	0.583	0.667	0.833	0.917	0.833	0.917	0.667	1.000	0.917	0.833	0.833	1.000	0.750	0.833	0.667	0.917	0.917
S4T3	0.750	0.750	0.583	0.750	0.750	0.667	0.667	0.333	0.750	0.750	0.667	0.750	0.667	0.417	0.750	0.667	0.750	0.917	0.750	1.000	0.750	0.417	0.833	0.667
S5T3	0.833	0.667	0.667	1.000	0.667	0.750	0.750	0.583	0.667	0.667	0.750	1.000	0.750	0.500	0.833	0.750	0.833	0.833	0.833	0.750	1.000	0.500	0.917	0.750
S6T3	0.500	0.500	0.500	0.500	0.500	0.417	0.250	0.583	0.667	0.500	0.750	0.500	0.750	1.000	0.667	0.583	0.500	0.500	0.667	0.417	0.500	1.000	0.583	0.583
S7T3	0.917	0.750	0.750	0.917	0.750	0.667	0.667	0.500	0.750	0.750	0.833	0.917	0.833	0.583	0.917	0.833	0.917	0.917	0.917	0.833	0.917	0.583	1.000	0.833
S8T3	0.917	0.750	0.750	0.750	0.750	0.667	0.500	0.500	0.583	0.750	0.833	0.750	0.833	0.583	0.917	1.000	0.750	0.750	0.917	0.667	0.750	0.583	0.833	1.000

Table 5.7 (b): Interviewee-by-interviewee Similarity Matrix for Suggested Improvements on On-line Education

Code No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1.000	0.542	0.583	0.375	0.125	0.250	0.208	0.292	0.292	0.208	0.250	0.167	0.167	0.250	0.167	0.167	0.167	0.167
2	0.542	1.000	0.708	0.417	0.500	0.375	0.417	0.333	0.417	0.333	0.375	0.375	0.375	0.375	0.375	0.292	0.375	0.375
3	0.583	0.708	1.000	0.542	0.458	0.500	0.458	0.458	0.375	0.458	0.417	0.500	0.500	0.500	0.500	0.417	0.500	0.417
4	0.375	0.417	0.542	1.000	0.667	0.708	0.667	0.667	0.667	0.667	0.625	0.625	0.625	0.625	0.708	0.708	0.625	0.708
5	0.125	0.500	0.458	0.667	1.000	0.708	0.750	0.667	0.667	0.750	0.708	0.708	0.708	0.792	0.875	0.792	0.708	0.792
6	0.250	0.375	0.500	0.708	0.708	1.000	0.792	0.708	0.708	0.708	0.750	0.833	0.833	0.750	0.833	0.833	0.750	0.750
7	0.208	0.417	0.458	0.667	0.750	0.792	1.000	0.833	0.833	0.750	0.792	0.792	0.792	0.792	0.875	0.875	0.792	0.792
8	0.292	0.333	0.458	0.667	0.667	0.708	0.833	1.000	0.750	0.750	0.792	0.792	0.792	0.792	0.792	0.875	0.792	0.875
9	0.292	0.417	0.375	0.667	0.667	0.708	0.833	0.750	1.000	0.750	0.875	0.792	0.792	0.792	0.792	0.792	0.875	0.792
10	0.208	0.333	0.458	0.667	0.750	0.708	0.750	0.750	0.750	1.000	0.792	0.792	0.792	0.875	0.792	0.792	0.792	0.792
11	0.250	0.375	0.417	0.625	0.708	0.750	0.792	0.792	0.875	0.792	1.000	0.833	0.833	0.833	0.833	0.833	0.917	0.833
12	0.167	0.375	0.500	0.625	0.708	0.833	0.792	0.792	0.792	0.792	0.833	1.000	1.000	0.833	0.833	0.833	0.917	0.833
13	0.167	0.375	0.500	0.625	0.708	0.833	0.792	0.792	0.792	0.792	0.833	1.000	1.000	0.833	0.833	0.833	0.917	0.833
14	0.250	0.375	0.500	0.625	0.792	0.750	0.792	0.792	0.792	0.875	0.833	0.833	0.833	1.000	0.917	0.833	0.833	0.833
15	0.167	0.375	0.500	0.708	0.875	0.833	0.875	0.792	0.792	0.792	0.833	0.833	0.833	0.917	1.000	0.917	0.833	0.833
16	0.167	0.292	0.417	0.708	0.792	0.833	0.875	0.875	0.792	0.792	0.833	0.833	0.833	0.833	0.917	1.000	0.833	0.833
17	0.167	0.375	0.500	0.625	0.708	0.750	0.792	0.792	0.875	0.792	0.917	0.917	0.917	0.833	0.833	0.833	1.000	0.833
18	0.167	0.375	0.417	0.708	0.792	0.750	0.792	0.875	0.792	0.792	0.833	0.833	0.833	0.833	0.833	0.833	0.833	1.000

Table 5.8 (a): Code-by-code Similarity Matrix for Factor Explanation

Code No	1	2	3	4	5	6	7	8	9	10	11	12
1	1.000	0.583	0.500	0.667	0.500	0.500	0.458	0.458	0.542	0.625	0.542	0.500
2	0.583	1.000	0.750	0.667	0.583	0.583	0.625	0.625	0.708	0.708	0.625	0.750
3	0.500	0.750	1.000	0.750	0.583	0.583	0.708	0.708	0.875	0.625	0.625	0.667
4	0.667	0.667	0.750	1.000	0.583	0.583	0.708	0.708	0.792	0.625	0.625	0.667
5	0.500	0.583	0.583	0.583	1.000	0.917	0.875	0.875	0.708	0.792	0.708	0.750
6	0.500	0.583	0.583	0.583	0.917	1.000	0.875	0.875	0.708	0.792	0.708	0.750
7	0.458	0.625	0.708	0.708	0.875	0.875	1.000	1.000	0.833	0.750	0.750	0.792
8	0.458	0.625	0.708	0.708	0.875	0.875	1.000	1.000	0.833	0.750	0.750	0.792
9	0.542	0.708	0.875	0.792	0.708	0.708	0.833	0.833	1.000	0.750	0.750	0.792
10	0.625	0.708	0.625	0.625	0.792	0.792	0.750	0.750	0.750	1.000	0.750	0.875
11	0.542	0.625	0.625	0.625	0.708	0.708	0.750	0.750	0.750	0.750	1.000	0.792
12	0.500	0.750	0.667	0.667	0.750	0.750	0.792	0.792	0.792	0.875	0.792	1.000

Table 5.8 (b): Code-by-code Similarity Matrix for Suggested Improvements on On-line Education

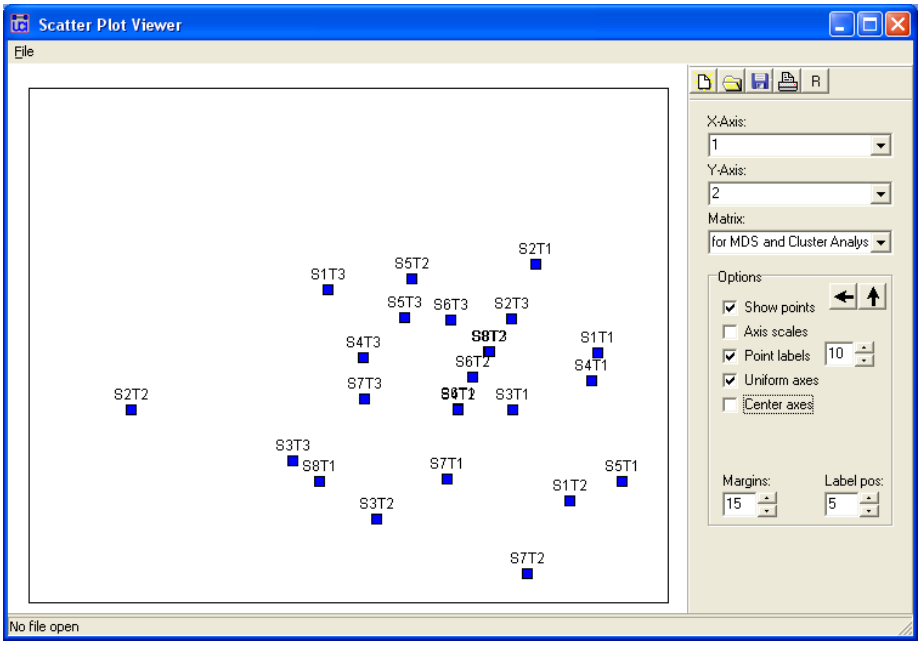
Step 9: Analysis on the Matrices

The researcher used UCINET which performed classical MDS (CMDS) (Torgerson, 1952) on the data in the similarity matrices as CMDS works on only one similarity matrix at a time. In CMDS, two similar interviewees or codes are represented by the two points that are close together (clustered) in a MDS map. However, the similarity judgment by looking at the points that are close together is not objective. Cluster analysis could be used to objectively judge the similarity among the interviewees or codes in the similarity matrices. To perform cluster analysis, the researcher used UCINET which applied Johnson's (1967) hierarchical clustering to the data in the similarity matrices in Tables 5.7 and 5.8 and showed the hierarchical clustering results in proximity dendrograms. Figures 5.4 (a) and (b) show the UCINET-generated MDS maps and dendrograms of the data in the interviewee-by-interviewee similarity matrix (Table 5.7 (a)) and the data in the code-by-code similarity matrix (Table 5.8 (a)) for factor explanation respectively. Figures 5.4 (c) and (d) show the UCINET-generated MDS maps and dendrograms of the data in the interviewee-by-interviewee similarity matrix (Table 5.7 (b)) and the data in the code-by-code similarity matrix (Table 5.8 (b)) for the interviewees' suggested improvements on on-line education respectively.

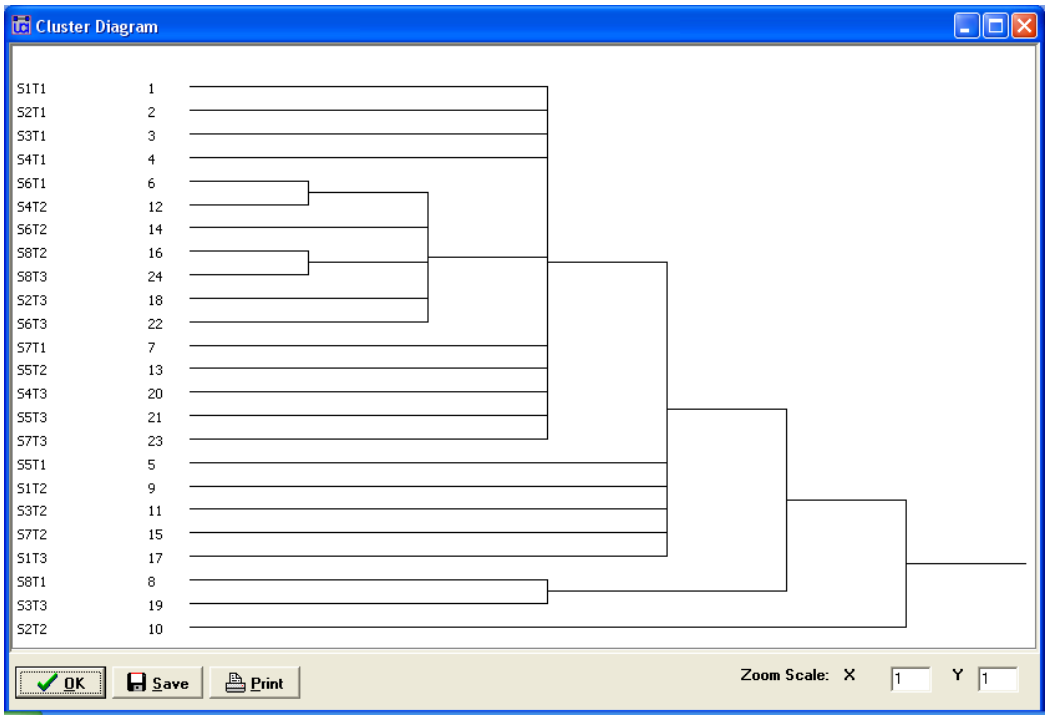
5.3 Qualitative Results

Some interview data obviously show convergent patterns like the data obtained from the question 8 of the interview protocol in Appendix 4 to explore the factors influencing students' on-line learning and the importance ranking of the factors – all 24 interviewees regarded SEP and IGD as factors that influence their on-line learning; the 24 interviewees except S3T1 regarded SCD as a factor influencing their on-line learning. Also, 83% (20 out of 24) of the interviewees ranked SEP as the most important factor, 66% (16 out of 24) of them ranked IGD as the second important factor, and 66% (16 out of 24) of them ranked SCD as the least important factor.

However, the interview data from the open-ended questions 2 to 7 of the interview protocol produce rather scattering views. So, MDS and cluster analysis were used to show the convergent patterns of these data. MDS and cluster analysis of these data show how similar or dissimilar the three groups of interviewees are and the codes mentioned by the interviewees are. The clusters on MDS maps indicate similarities.

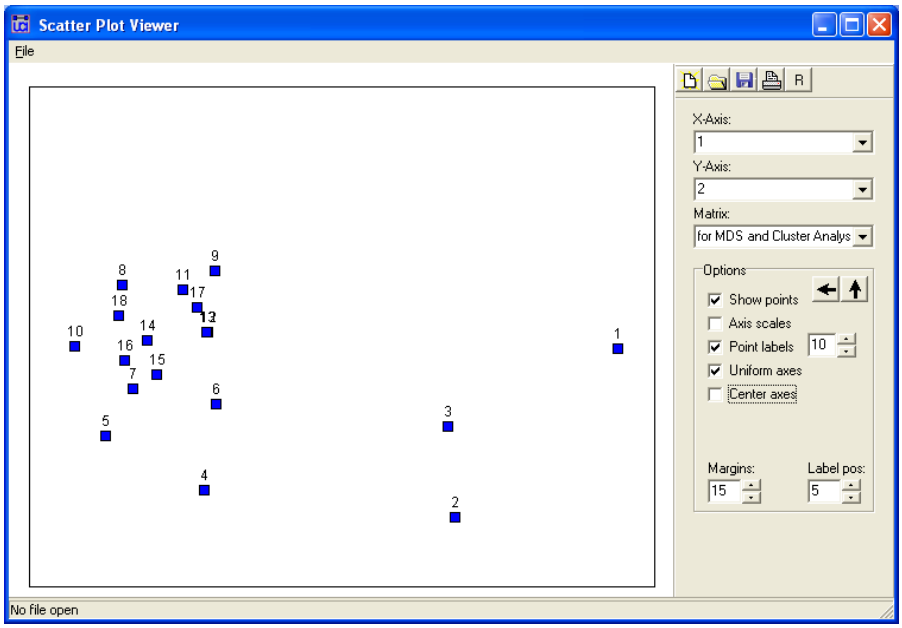


MDS Map

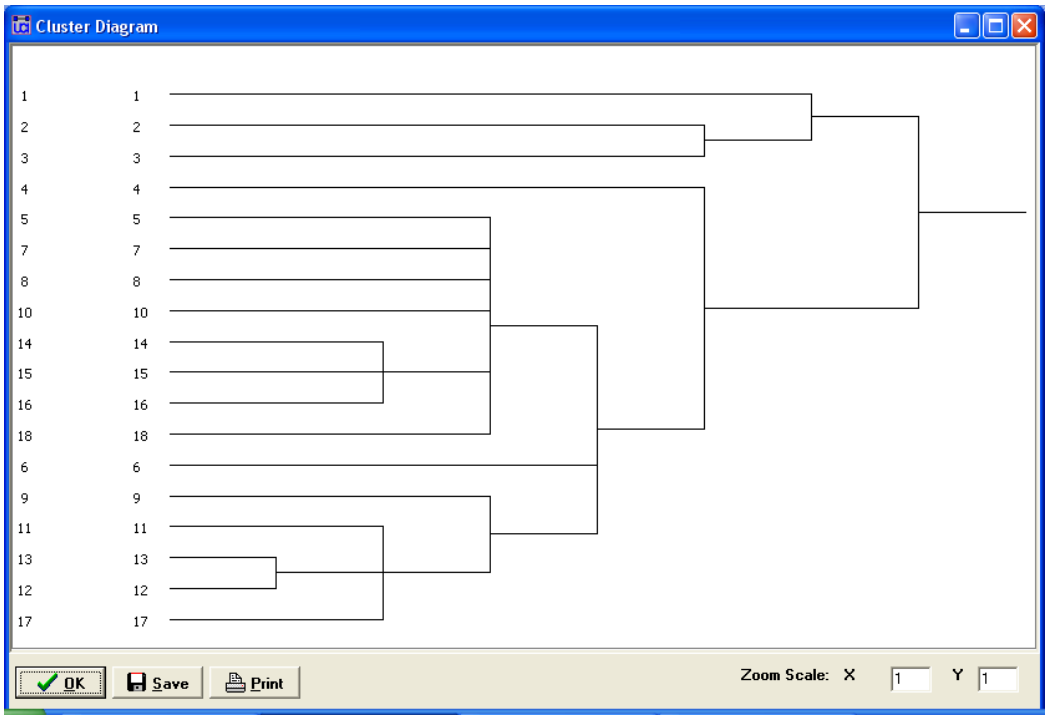


Dendrogram

Figure 5.4 (a): MDS Map and Dendrogram of the Data in the Interviewee-by-interviewee Similarity Matrix for Factor Explanation

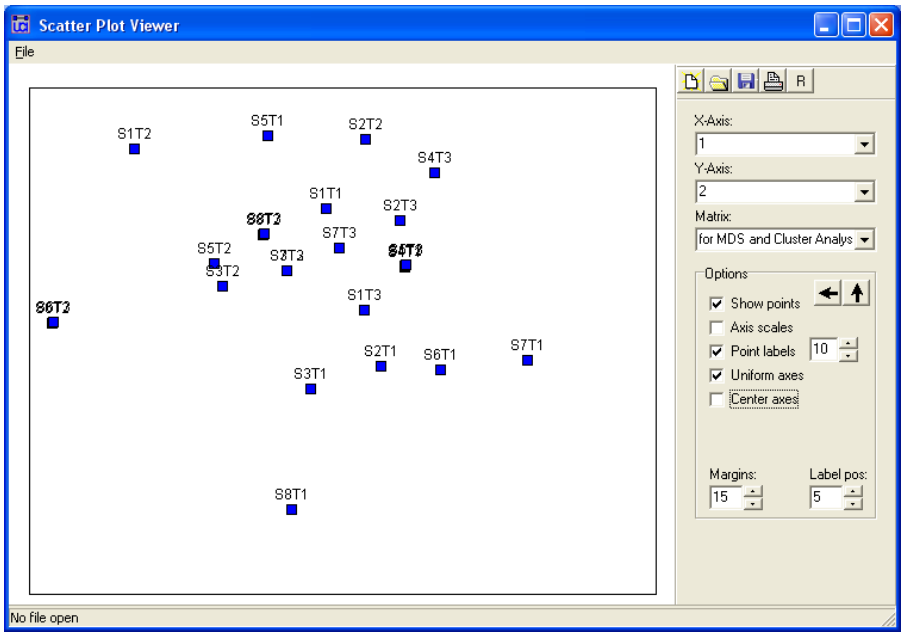


MDS Map

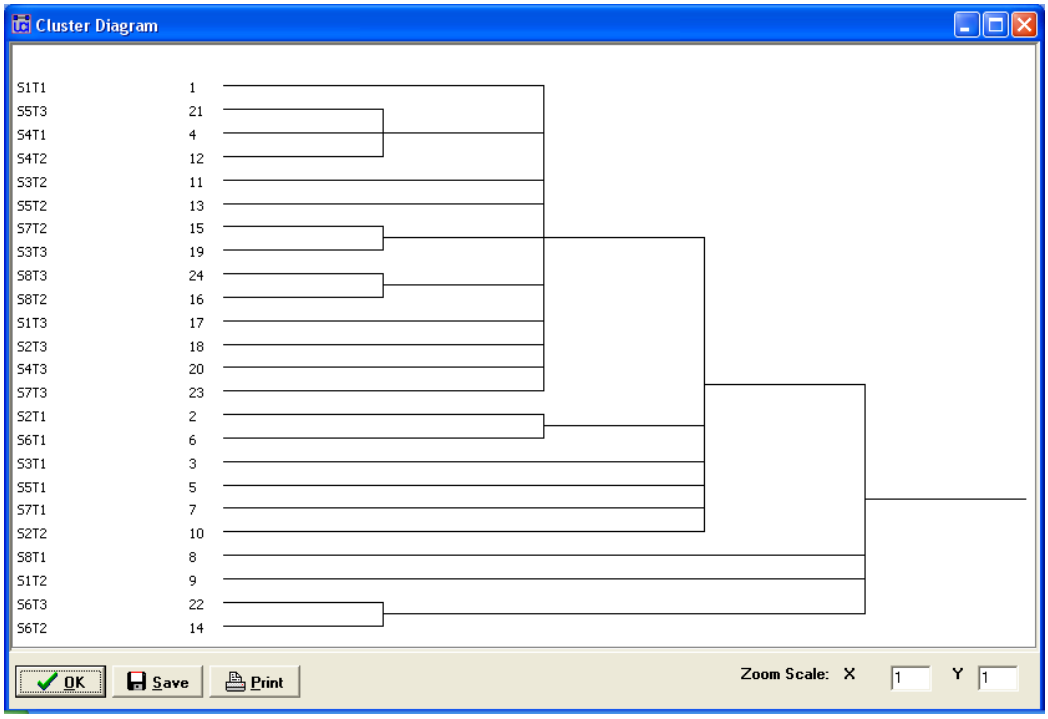


Dendrogram

Figure 5.4 (b): MDS Map and Dendrogram of the Data in the Code-by-code Similarity Matrix for Factor Explanation

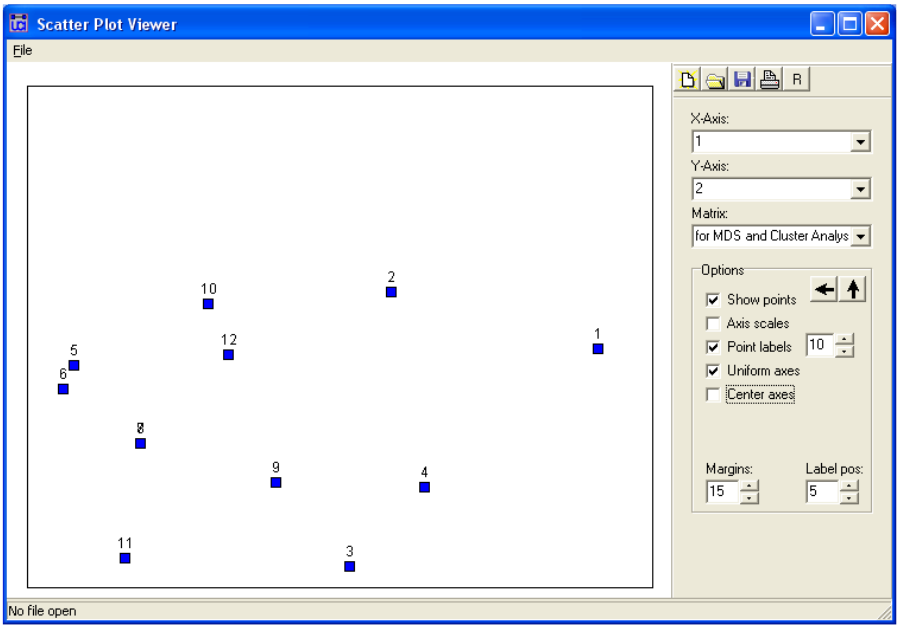


MDS Map

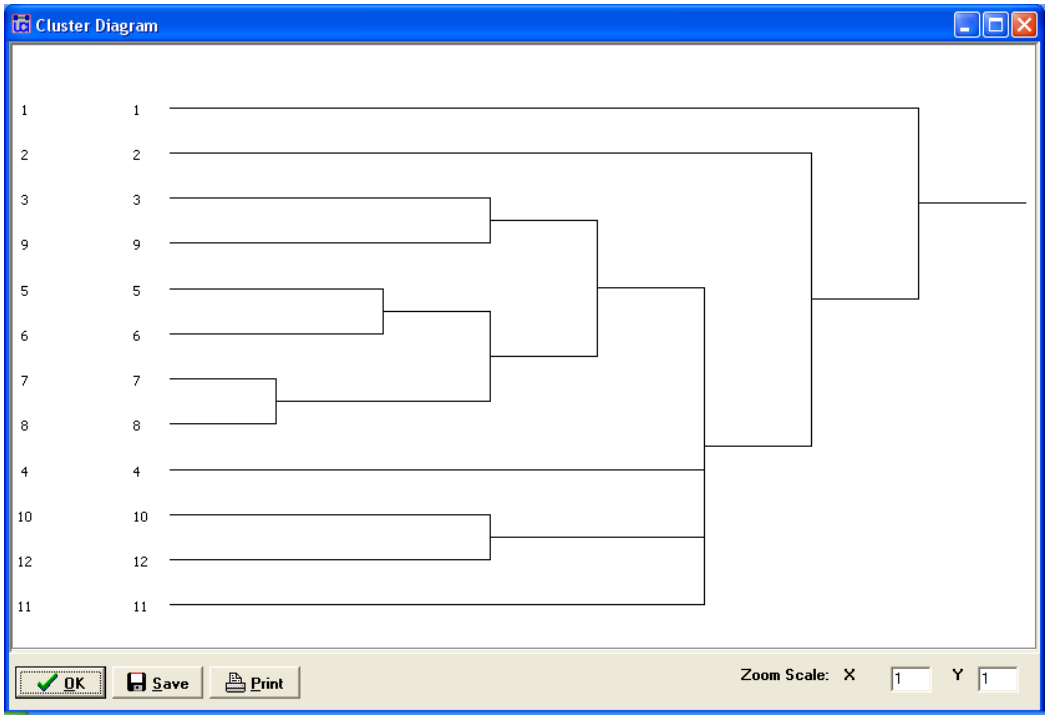


Dendrogram

Figure 5.4 (c): MDS Map and Dendrogram of the Data in the Interviewee-by-interviewee Similarity Matrix for the Interviewees' Suggestions for Improving On-line Education



MDS Map



Dendrogram

Figure 5.4 (d): MDS Map and Dendrogram of the Data in the Code-by-code Similarity Matrix for the Interviewees' Suggestions for Improving On-line Education

In the dendrogram of Figure 5.4 (a), at the first level of clustering, the different groups of the interviewees S6T1 and S4T2 form a cluster, S8T2 and S8T3 form another cluster. These two clusters together with other different groups of the interviewees S6T2, S2T3 and S6T3 form a cluster at the second level. This cluster at the second level forms a bigger cluster with 9 other interviewees from different groups like teaching method 1 (e.g. S1T1, S2T1, S3T1, S4T1 and S7T1), teaching method 2 (e.g. S5T2) and teaching method 3 (e.g. S4T3, S5T3 and S7T3) at the third level of clustering. At the first level of clustering, another cluster is found on S8T1 and S3T3. The same goes for the clusters in the dendrogram of Figure 5.4 (c). These results indicate that the interviewees within the same group of teaching method have no similar views to explain why a variable is a factor influencing the students' on-line learning and suggested improvements on on-line education.

When looking at the dissimilarities, the researcher focused on the higher levels of clustering in dendrograms. For example, in the dendrogram of Figure 5.4 (a), S5T1, S1T2, S3T2, S7T2 and S1T3 at the fourth level of clustering, S8T1 and S3T3 at the fifth level of clustering and S2T2 at the sixth level of clustering are dissimilar to the other interviewees clustered in the middle of right-half of the MDS map. After examining the Table 5.6 (a) and these interviewees' transcripts, the researcher found that two codes are distinctively mentioned by T2 (Teaching Method 2) group: the code RANK_EXP.S_EP_MORE.INCONVEN which means SEP is a more important factor because it brings convenience to the students' on-line learning and the code RANK_EXP.S_Col_DisF_LESS.S_LESS_RESP which means SCD is a less important factor because the students are less responsible. The researcher also found that one code is only mentioned by T3 group: RANK_EXP.S_EP_MORE.INT which means SEP is a more important factor because it facilitates communication and interaction between the instructors and the students when discussing and learning. In the dendrogram of Figure 5.4 (c), S8T1, S1T2, S6T3 and S6T2 at the fourth level of clustering are dissimilar to the other interviewees clustered in the middle of the top-half of the MDS map. After examining the Table 5.6 (b) and these interviewees' transcripts, the researcher found that three codes are more associated with the T1 group: IMPROVE.FEEDBACK, IMPROVE.PRACTICE and IMPROVE.MONITOR which means suggestions to provide feedback, practicing and monitoring mechanisms in on-line education.

From the MDS map in Figure 5.4 (b), there are two clusters – one contains the three code numbers 1, 2 and 3 while the other cluster contains the code numbers 4 to 18. So, in the dendrogram of Figure 5.4 (b), the "tree" branches out in two "subtrees" – one contains the code numbers 1 to 3 while the other "subtree" contains the other code numbers. The researcher focused on the first level of clustering as this shows the most similar codes in a cluster at this level. At the first level of clustering, the clusters occur at code numbers 2 and 3 as a group, 14 to 16 as another group, and 12 and 13 as the last group. These results indicate the codes in each cluster are similar in the interviewees' views. Referring to Figure 5.3 (a), Tables 5.2 and 5.4 for the meaning of the code numbers, some codes can be combined because of their similarity in meaning. For example, the cluster of the code numbers 2 and 3 suggests that these two codes can be combined and means the reason why IGD influences the students' on-line learning is "the instructors are more knowledgeable on IT subjects than the students". For another example, the cluster of the code numbers 12 and 13 suggests combination of these two codes which means the reason why SCD is a more important factor that influences the students' on-line learning is "the instructors have teaching skills which are lacked by the students". However, the cluster of the code numbers 14, 15 and 16 does not suggest a combination of these codes because there are no similarities on their meaning. This just indicates the co-occurrence of the codes - the interviewees mentioned the code number 14 also mentioned the code numbers 15 and 16.

By analysing the codes and data in Figures 5.3 (a), 5.4 (a) and (b), Tables 5.2 (a) to (d) and 5.4 (a), the researcher found the explanations for why SEP, IGD and SCD are factors contributing to the students' on-line learning as follows:

SEP contributes to the students' on-line learning because the on-line materials and medium of instruction are all in English and students found difficulty in translating English materials into their familiar language, Chinese. The interviewee S1T1 commented:

> "*Sometime, it [the materials posted in WebCT] may be used with difficult English. I did not understand the contents [of the teaching materials]. I tried to read several times to try to understand them. I also asked someone to help… This [English proficiency] is the basic skill of the students. No one has the patience to*

explain everything every word to you, so you must have good English to learn."

Other students mentioned the difficulty in translating English IT terms into Chinese IT terms:

"*…it is hard to use Chinese translations for English IT terms. For example, there are difficult … sorry … different translations for the input device mouse. We had better use mouse instead of using Chinese term for the mouse. It is easier and simpler.*" (S4T1)

"*I think we are used to English IT terms. We won't say Chinese for monitor. We use English monitor. We won't use Chinese for DVD. We just say DVD. Many examples, CD-ROM, Blu-ray, Internet, iPhone, … youtube. It is odd to say these in Chinese. I don't think many people know the correct Chinese IT terms.*" (S5T3)

IGD contributes to the students' on-line learning because the instructors are more knowledgeable in the subject, have ability to facilitate and monitor the students' discussion in on-line discussion forum. As commented by S7T1, "*I sometime ask my teacher for further clarification and explanation when I see something in doubt in the discussion forums*". S1T3 stated "*they (instructors) asked us to comment, otherwise no one posted answers and questions and no one discussed there*". S3T1 commented:

"*…instructors can sort out something relevant and control our posted messages… Students just posted the irrelevant messages like where to buy cheap computers, watches, comments on the TV programmes, how they played a Internet games, and so on. The instructors will stop this.*"

SCD contributes to the students' on-line learning because SCD is a social process among the students in which the students usually use their familiar language, Chinese, to discuss, learn and share ideas. S4T1 commented "*if we posted in Chinese, most of our students could easily understand it because there are mostly Chinese*". Other comments are:

"*…we have problem in using English to ask the instructors questions. For students,*

we could use Chinese to ask questions and give answers…students may have difficulty in using English in classes, they can write out the questions because they can think carefully and slowly by writing out the questions and post them in forum or send email. In classrooms, students have to think quickly and response quickly. Because we have English problem, it is hard for the students who have English to think and response quickly in classroom." (S1T1)

"*The students can arose [arouse] us to think of more questions in discussion forum. If a student posted question, that question may lead to another question we can think of, so … so the students can help us to think of new questions. We learnt by asking questions and obtaining answers from accurate sources like reliable students with good academic standing and instructors.*" (S1T3)

The researcher also found the explanations for the importance ranking of SEP, IGD and SCD as follows:

SEP is a more important factor because SEP brings convenience in learning and facilitates communication or discussion among the students and the instructors. As commented by S1T3, "*if the English is not proficient, and the students may not be able to communicate and read the English messages and materials in on-line education*". Another comment is:

"*If you don't understand English, there is no way to learn by yourself. All materials in the WebCT are written in English. It is very inconvenient to check every word in English if you don't want have good English. In my case, I have difficulty to learn in English. This is pre… [pre-requisite] for learning my myself.*" (S1T2)

IGD is an important factor because the instructors have the skills to teach and SCD is a less important factor because the students are not responsible for teaching the other students, as commented by S2T2:

"*…when I posted question on discussion forum, no one was obligated to answer my questions quickly. I waited for a long time for the answers. However, if I sent*

email to a specific classmate or instructor and asked them questions, they replied quickly. I think in discussion forum, people might not want to show off their answers unless the instructors asked them to show. Even some people knew the answers, they may … might not want the other students know the answers. They don't think they have responsibility to answer the questions. However, instructors are more responsible in this sense."

The clusters on the codes 3 and 9, 5 and 6, and 7 and 8 at the first level of clustering in the dendrogram of Figure 5.4 (d) indicate the co-occurrence of these three pairs of codes. By examining Figure 5.3 (b), Tables 5.2 and 5.4 for the meaning of the code numbers, the researcher found that these codes cannot be combined because of their dissimilarities in meaning but there is a close relationship in meaning in these pairs of codes. For example, the codes 3 and 9 suggest the on-line education should have feedback (code 3) and monitoring (code 9) mechanisms – these two mechanisms are both related to interacting with the students; codes 5 to 8 are related to improvements of students' abilities – the students should have good English (code 5), good IT skills (code 6), self-learning ability (code 7) and self-control (code 8). By analysing the codes and data in Figures 5.3 (b), 5.4 (c) and (d), Tables 5.2 (e) and 5.4 (b), the researcher found that the improvements on on-line education suggested by the interviewees include implementation of hybrid teaching (on-line education with instructors' guidance), real-time communication channel, mechanisms that interact with the students e.g. mechanisms that provide feedback to and monitor the students, mechanisms that facilitate students' practicing, provide fast reply and draws students' attention and translation mechanisms.

Chapter 6

Discussion

Interpreting results or findings is a process of "*developing ideas about your findings and relating them to the literature and to broader concerns and concepts*" (Bogdan and Biklen, 2007:159). This chapter discusses the interpretation of the research results as the ideas generated from both quantitative and qualitative findings of the study are explained. How these ideas are related to the research questions and literature is also considered. The first section of this chapter explains the results from the different phases and triangulates them. The second section of this chapter shows the integrated findings from the different phases based on this explanation. The third section discusses the findings' relationships with research questions and hypotheses. The last section of this chapter is the discussion about the findings in relation to the literature.

6.1 Explanation and Triangulation

The interview data in the qualitative phase reveals results in 5 areas: (1) the predictor variables SEP, IGD and SCD are factors influencing the students' on-line learning, (2) the reasons why each of these predictor variables is a factor influencing the students' on-line learning, (3) the importance ranking of these predictor variables as factors, (4) the explanations for the importance ranking of these predictor variables as factors and (5) suggested improvements on on-line education.

For the first area, the positive correlation coefficients in Table 4.5 and multiple regression results in Table 4.6 and Figure 4.4 imply a cause-effect relationship between each of the predictor variables (i.e. SEP, IGD and SCD) and the students' on-line learning. This cause-effect relationship is confirmed by the interviewees in the second qualitative phase - the majority of the student interviewees, 23 out of 24, agreed that SEP, IGD and SCD contribute to their on-line learning.

Figure 6.1, which is derived from Figure 1.1, shows these findings. In Figure 6.1, the question marks on the arrows in Figure 1.1 have been taken out to indicate the confirmation that variables in the rectangular boxes are the factors influencing the

students' on-line learning.

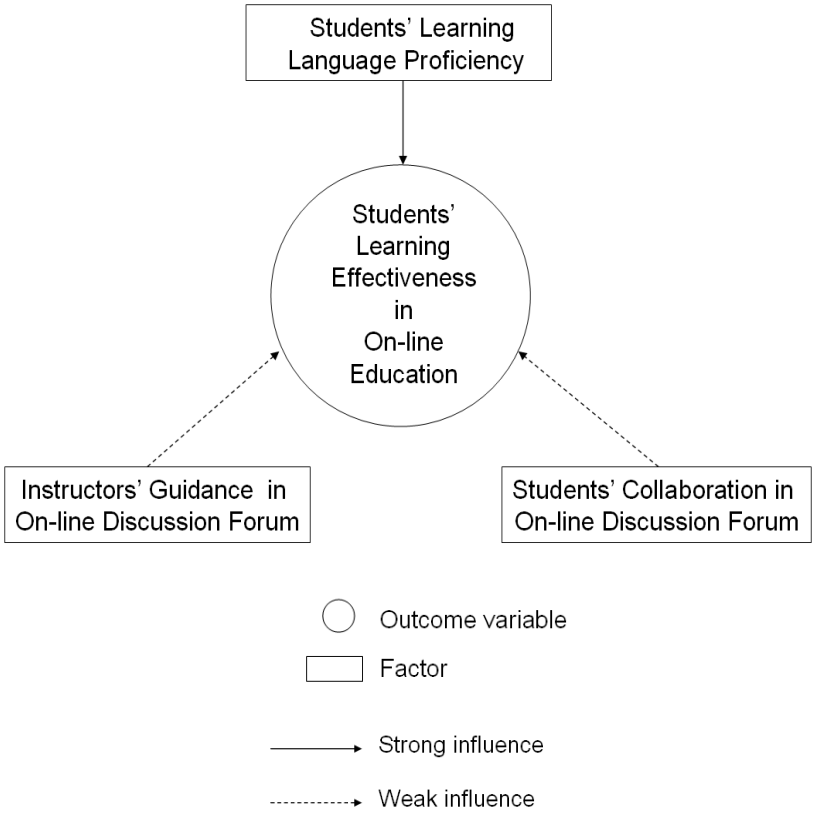


Figure 6.1: Factors that have an Impact on Learning Effectiveness of On-line Education

For the second area, the qualitative results in the second phase add explanations to the quantitative findings by correlation and multiple regression in the first phase.

For the third area, the correlation results in the first quantitative phase indicate the largest correlations between SEP marks and the students' test scores (r = 0.609 in teaching method 1, r = 0.839 in teaching method 2 and r = 0.689 in teaching method 3 in Appendix 6). Comparatively, there are medium correlations between IGD and the students' test scores (r = 0.494 in teaching method 1, r = 0.586 in teaching method 2 and r = 0.459 in teaching method 3 in Appendix 6) while there are weak correlations between SCD and the students' test scores (r = 0.331 in teaching method 1, r = 0.405 in teaching method 2 and r = 0.339 in teaching method 3 in Appendix 6). The multiple regression results indicate SEP has the largest magnitude of effect while both IGD and SCD have a moderate level of effect on the students' on-line learning in all three

teaching methods, as indicated in Figure 4.4 and Table 4.6. Comparatively, SCD has the smallest effect.

These quantitative results match the importance levels of the factors found in both quantitative and qualitative phases. SEP which has the strongest effect is ranked the most important, IGD which has the medium effect is second in importance, while SCD which has the least effect is ranked the least important. In line with the statistical findings in Figure 4.3 and Table 4.4 in the first quantitative phase, most interviewees (20 out of 24 interviewees) in the second qualitative phase ranked SEP as the most important factor, 16 out of 24 interviewees ranked IGD as the second important factor, and 17 out of 24 interviewees ranked SCD as the least important factor in the qualitative phase.

In Figure 6.1, the dotted arrows from IGD and SCD to the students' learning effectiveness in on-line education indicate the weak influence by IGD and SCD while the solid arrow from SEP to the students' learning effectiveness in on-line education represent the strong influence of SEP.

The fourth area is to provide explanations for the third area while the fifth area is to explore the improvements on on-line education suggested by the interviewees. For the fifth area, the interview question 9 in Appendix 4, which was about the comparison between classroom teaching (teaching method 1) and on-line education (either teaching method 1 or 3), and the interview question 10 explore possible improvements on on-line education. By examining the answers for the interview question 9 in the transcripts, the researcher found that most interviewees (14 out of 24) prefer classroom teaching (teaching method 1) while some interviewees (10 out of 24) suggested the combination of classroom teaching and pure on-line education (teaching method 3). These qualitative findings suggest that teaching method 2 (pure on-line education) is not preferred, as implied by the least learning effectiveness of the teaching method 2 in Wong's (2008) study and the quantitative findings in Tables 4.5 to 4.7.

6.2 Integration of Quantitative and Qualitative Findings

The researcher integrated the quantitative and qualitative results with the purpose of

gaining a better understanding of the effects of SEP, IGD and SCD and issues of on-line education improvements. This integration drew out six major findings as follows:

(1) SEP is a contributing factor to the students' on-line learning because the college students use the less familiar English to learn as English materials and English as the medium of instruction are used in the college's on-line education. There are also problems in translating English materials into their mother tongue Chinese.
(2) IGD is a contributing factor to the students' on-line learning because the college instructors are more knowledgeable and more capable of facilitating and monitoring the students' discussion in on-line discussion forum.
(3) SCD is a contributing factor to the students' on-line learning because the college students are more willing to get involved in the social process with their familiar peer students, use their familiar mother tongue Chinese to communicate and think and learn by sharing questions and answers with their peer students in the on-line discussion forum.
(4) SEP is more important than IGD and SCD because SEP brings convenience in learning and facilitates communication and discussion among the peer students and the college instructors.
(5) IGD is more important than SCD because the college instructors know how to guide on-line discussion and the college students have less responsibility to guide and share ideas in on-line discussion forum.
(6) The perceived on-line education improvements pertaining to the effect of SEP, IGD and SCD include upgrading the college students' SEP, self-learning and self-control abilities, having a real-time communication channel, mechanisms that draw the college students' attention, provide instant feedback to the students, monitor them and facilitate their practicing. One perceived on-line education improvement not related to SEP, IGD and SCD is upgrading the college students' IT skills.

The first five research findings (1) to (5) were revealed by the integrated results of the quantitative and qualitative analyses and the last research finding (6) was based on the opinions and ideas gathered in the qualitative analysis. The first three findings (1) to (3) of the integrated results of the quantitative and qualitative analyses explain why SEP, IGD and SCD are contributing factors to students' on-line learning. The other two

findings (4) to (5) of the integrated results of the quantitative and qualitative analyses explain the importance ranking of SEP, IGD and SCD.

6.3 Discussion on Research Questions and Hypotheses

This research study mainly using Creswell and Plano Clark's (2007) sequential explanatory design of mixed methods sought to answer the 6 research questions listed in section 1.5. The first 3 questions were answered by the findings of the first quantitative phase and the last 3 questions were answered by the findings of the second qualitative phase. The research question 1 was formulated by the hypotheses, as mentioned earlier in section 1.3, that the students' learning depends on SEP, IGD and SCD.

Research Question 1: How is each of the variables SEP, IGD and SCD correlated with the students' learning (Figure 1.1) as reflected by their test scores through teaching methods 1, 2 and 3?

This question concerned the correlation between each of the predictor variables SEP, IGD and SCD and the students' learning effectiveness as reflected by their test scores. The correlation findings in Table 4.5 indicate the students' test scores are positively correlated with SEP, IGD and SCD in all three teaching methods. These positive correlations indicate the criterion for all three predictor variables (i.e. SEP, IGD and SCD) to be factors contributing to the students' learning. Also, when comparing horizontally in Table 4.5 across the three variables, SEP as reflected by their English proficiency marks and the students' test scores have the strongest correlations while SCD and the students' test scores have the weakest correlations in all three teaching methods. In other words, the correlation between the students' test scores and SEP is stronger than those correlations with IGD and SCD while the correlation between the students' test scores and SCD is weaker than those correlations with SEP and IGD in all teaching methods. In addition, when comparing vertically in Table 4.5 the three teaching methods, correlations between each of these three variables and the students' test scores are the strongest for teaching method 2 while the weakest for teaching method 1. Research question 4 attempted to explore the explanations for these quantitative results.

Research Question 2: How well do the variables SEP, IGD and SCD predict the

students' learning as reflected by their test scores through teaching methods 1, 2 and 3? How much variance in the students' learning can be explained by these variables SEP, IGD and SCD through teaching methods 1, 2 and 3?

The answers for this research question 2, which was about trajectory of the combined effect of the potential factors SEP, IGD and SCD on the students' learning, provide statistical confirmation of some effects obtained for research question 1. Table 4.6 shows the magnitude of effects of the predictor variables on the outcome (the students' test scores) in simultaneous multiple regression while the Model 3 of Figure 4.4 shows the magnitude of effects of the predictor variables on the outcome in sequential multiple regression. In Table 4.6 and Model 3 of Figure 4.4, when compared vertically down the predictor variables, the comparison results for each of the predictor variables in simultaneous multiple regression and sequential multiple regression show that SEP has the largest effect on the students' test scores in all three teaching methods because each of the separate regressions showed this. These results are consistent with the largest positive correlations between SEP and the test scores in all three teaching methods in Table 4.5 for research question 1.

However, some other results for this research question 2 are inconsistent with the results for reseach question 1. For research question 1, the largest correlations are between each of the variables (i.e. SEP, IGD and SCD) and the test scores in teaching method 2 as shown in Table 4.5. For this research question 2, in Table 4.6 and Model 3 of Figure 4.4, when looking at the √ and s marks horizontally across the teaching methods, SEP has the largest influence on the students' test scores in teaching method 2 (√-marked) while the smallest influence on the students' test scores in teaching method 1 (s-marked); IGD has the largest influence on the students' test scores in teaching method 1 (√-marked) while the smallest influence on the students' test scores in teaching method 2 (s-marked); SCD has the largest influence on the students' test scores in teaching method 1 (√-marked) while the smallest influence on the students' test scores in teaching method 2 (s-marked) though the influence of SCD is very close to that in teaching method 3. The correlations in Table 4.5 for reseach question 1 did not take into account controlling for the other variables (e.g. SEP and IGD) when looking at the effect of each variable (e.g. SCD) on the test scores. Therefore, multiple regression results in Table 4.6 and Model 3 of Figure 4.4 provide a more accurate effect of each variable because of

controlling for the other variables when analysing the effect of that variable. It is understandable that the students who have less face-to-face contact with, guidance from and discussion with teachers and other peer students in teaching method 2 have to learn by themselves, therefore their SEP has the largest effect on their learning, as indicated in Table 4.6 and Model 3 of Figure 4.4. Also indicated in Table 4.6 and Model 3 of Figure 4.4, IGD and SCD have the largest effect in teaching method 1 is due to the situation that IGD and SCD add to and supplement the students' learning in the classroom (teaching method 1).

When comparing the combined effects of all the three predictor variables across different teaching methods in Table 4.7, the three predictor variables have the strongest combined effect on the students' test scores in teaching method 2 while they have the weakest combined effect on the students' test scores in teaching method 1. These results imply that teaching method 1 is the most effective in learning as it is least affected by the combined effect of the variables while teaching method 2 is the least effective in learning as it is most affected by that combined effect.

Research Question 3: What is the distribution of the students' views on comparing the learning effectiveness of the three teaching methods and comparing the importance of the variables SEP, IGD and SCD?

This question sought statistics about the students' views on learning effectiveness of the teaching methods and importance ranking of the three predictor variables. Through the analysis of the collected quantitative data, the findings of these students' views are important for the sequential multiple regression analysis and triangulation with the findings in Wong's (2008) study and qualitative phase of this study.

The implications of the quantitative findings in Table 4.7 for the research question 2 that teaching method 1 is the most effective in learning while teaching method 2 is the least effective in learning were confirmed by the findings of the students' perceptions for this research question 3. Figure 4.2 reveals the large-scale students' perceptions on the learning effectiveness of the different teaching methods – most respondents regarded teaching method 1 as the most effective in learning while teaching method 2 as the least effective in learning. Also, for this research question 3, Figure 4.3 shows the statistical

findings that SEP is ranked as the most important factor while SCD is ranked as the least important factor by most respondents. These results imply that SEP influences the students' learning most while SCD influences the students' learning least and are in line with the quantitative results for the research questions 2 and 3. These results were also important for determining the order of entering the predictor variables in sequential multiple regression.

Research question 4: How can the results of the correlation analysis obtained for research question 1 be explained? Is there any perceived cause-effect relationship between any of the variables SEP, IGD and SCD and the students' test scores through the three teaching methods?

The correlation findings in the first phase imply a cause-effect relationship between each of the predictor variables and the students' learning. The qualitative findings in the second phase confirm this cause-effect relationship. The qualitative findings also contribute to the understanding of the reasons why each of the predictor variables (factors) influences the students' learning. The research findings (1) to (3) in section 6.2 contain these reasons.

Research question 5: How can the statistical results obtained for research question 2 be explained? Are there any perceived reasons why the variables SEP, IGD and SCD predict or do not predict the students' test scores through the three teaching methods? What is the relative significant effect of each of these variables on the other variables or the students' learning via the three teaching methods?

The qualitative findings in this study highlight the idea that SEP is the most influential in facilitating students' learning while SCD is the least influential. These findings are consistent with the quantitative findings shown in Figure 4.3 for the research question 2. It is important to note that the qualitative findings also present answers to this research question 5 which inquired about the explanation on the effect of different combinations of the factors. The research findings (4) to (6) in section 6.2 contain the explanations.

Research question 6: How can the distribution obtained for research question 3 be explained? Are there any perceived reasons for the challenges and benefits related to the

use of SEP, IGD and SCD the students have when experiencing on-line education? Based on the factors found from research questions 4 and 5 together with these perceived challenges and benefits of using on-line education, how can teachers and students help develop effective learning in on-line education?

The qualitative findings in the second phase do not only provide explanations for the ranking of the learning effectiveness of different teaching methods, but also for the importance ranking of each of the factors influencing the students' learning. These findings, as also indicated by the research findings (4) to (5) in section 6.2, contribute to a better understanding of the explanations for the research questions 4 and 5. In addition, based on these findings, the importance of improving the college's on-line education is addressed. The research finding (6) in section 6.2 provides the detailed improvements.

6.4 Discussion on Literature

As stated earlier in literature review chapter (Chapter 2), the current study was inspired by the different research findings of Wong's (2008) and many other comparative studies (e.g. Aberson et al, 2000; Alghazo, 2005; Banks, 2004; Bartini, 2008; Grimstad and Grabe, 2004; Jackson, 2000; Johnson, 2000; Lim et al, 2008; Schulman and Sims, 1999; Schuttle in McCollum, 1997; Wang and Newlin, 2000; Warren and Holloman, 2005). This current study attempted to explore the explanations for these divergent and contradictory research results.

Wong (2008) reported that teaching methods 1 and 3 have equal learning effectiveness in terms of the college students' test scores of the introductory IT course while these two teaching methods are more effective in learning than teaching method 2. When examining the means of the college students' test scores in the different teaching methods in Wong's (2008) quasi-experiment, the researcher noticed that the mean of the college students' test scores in teaching method 1 is the highest while the mean of the college students' test scores in teaching method 2 is the lowest. As the learning effectiveness of a teaching method is reflected by the students' test performance, the researcher regarded that teaching method 1 leads to the highest learning effectiveness while teaching method 2 turns into the lowest learning effectiveness.

By realising that the college students' use of less familiar English to learn is an imperative characteristic in the Hong Kong higher education context and the finding of Chin et al (2000) that Asian students are more willing to take part in on-line discussion, the researcher grasped the insight into the effect of SEP, IGD and SCD on the college students' on-line learning. The research findings (1) to (3) of this current study in section 6.2 reveal this effect. By understanding this effect, the results of Wong's (2008) comparative study can be explained by that the college students have limited instructors' guidance and discussion with other peer students in classrooms and have to use their less familiar language, English, to learn mainly by themselves in asynchronous on-line education (teaching method 2). SEP has the largest effect on the college students' learning in teaching method 2 while the lowest effect on their learning in teaching method 1, as also indicated in Table 4.6 and Model 3 of Figure 4.4. The college students using the asynchronous on-line education (teaching method 2) also learn by discussing in the on-line discussion forum, and therefore the researcher expected that their learning depends highly on IGD and SCD. A rather unexpected result of this current study is that IGD and SCD have the smallest effect on their learning in teaching method 2 but the largest effect on their learning in classroom teaching (teaching method 1), as indicated in Table 4.6 and Model 3 of Figure 4.4. When investigating the combined effect of these SEP, IGD and SCD in Table 4.6 and Model 3 of Figure 4.4, the researcher noticed the college students' learning in all teaching methods 1, 2 and 3 is dominantly influenced by SEP. The research finding (4) in section 6.2 explains the importance of SEP. SEP is not a factor influencing the students' learning in other comparative studies (e.g. Aberson et al, 2000; Alghazo, 2005; Banks, 2004; Bartini, 2008; Grimstad and Grabe, 2004; Jackson, 2000; Johnson, 2000; Lim et al, 2008; Schulman and Sims, 1999; Schuttle in McCollum, 1997; Wang and Newlin, 2000; Warren and Holloman, 2005) as the students use their familiar mother tongue to learn in these comparative studies. The factor SEP gives rise to the difference between the findings of these comparative studies and Wong's (2008) study.

Also mentioned earlier in Chapter 2, the researcher was involved in the Clark-Kozma debate and attempted to carry out the current study to resolve this debate by shifting the research focus from "learning influenced by media" to "learning with the support of media". The research findings of the current study provide empirical support of how SEP, IGD and SCD support the students' learning in on-line education media. These

research findings also empirically support the CoI framework proposed by Garrison et al (2000) in Khan's (2001) pedagogical dimension. The CoI framework is a theoretical community model that supports Vygotsky's (1978) social constructivist learning and is grounded in Dewey's (1933; 1938; 1959) work on community and inquiry. In alignment with some previous studies related to the CoI framework in the literature (e.g. Arbaugh, 2008; Swan, 2001), this current research study examined the effect of each of the three elements (cognitive, teaching and social presences) of the CoI framework on the students' on-line learning. Unlike these previous studies that focused on the effect on students' perceived learning and satisfaction, the current study focused on the effect on students' learning as reflected by their test scores by examining the relationship between each element in the CoI framework (cognitive presence in terms of SEP, teaching presence in terms of IGD or social presence in terms of SCD) and the students' test scores. In addition, this current research study looked into the combined effect of the three elements in the CoI framework on students' on-line learning as reflected by their test scores. The research findings (1) to (6) of this current study in section 6.2 converge with the CoI framework in such a way that the three elements in the CoI framework behind the college's on-line discussion forum play a central vital role in the college students' academic success. These findings agree with many previous findings (e.g. Hwang and Arbaugh, 2006; Picciano, 2002; Swan, 2001) that reported the relationship between one, some or all of the elements in the CoI framework and students' learning.

When reviewing the related previous findings in the literature, the researcher noticed that the contribution of the current study is fourfold. First, the findings of this research are important as they enrich the understanding of how the factor related to the college students' own English proficiency influence their learning in the on-line introductory IT course. This research study can be extended or applied to other case courses in the bilingual Hong Kong higher education context. Similar findings showed the students' English proficiency affects their learning in Hong Kong classroom environments (e.g. Graham, 1987; Ho and Spinks, 1985). Little previous research was conducted to investigate this factor in Hong Kong on-line education context.

Second, the findings of this research are consistent with the previous findings (e.g. Gerber et al, 2007; Hwang and Arbaugh, 2009; Picciano, 2002) on how student-student and student-instructor interactions in on-line discussion forum affect students' on-line

learning. All these previous studies used an objective way to measure students' on-line learning. For instances, Gerber et al (2007) used the students' examination results, Hwang and Arbaugh (2009) used the students' multiple-choice test results and Picciano (2002) operationalised the students' learning by their examination scores and written assignment scores. The researcher operationalised the students' learning by their test scores in this study. To operationalise interactions in on-line discussion, Gerber et al (2007) counted the content-related, interpersonal and organizational messages posted by the learners, Hwang and Arbaugh (2009) used the students' feedback-seeking behaviours in discussion forums while Picciano (2002) used the number of the student postings to the discussion board. Similar to the approach by Gerber et al (2007), in the current study, the researcher operationalised student-student and student-instructor interactions in the college's on-line discussion forum by counting the relevant viewed on-line discussion messages in the quantitative phase. Moreover, the researcher collected the students' views on these interactions in the interviews in the qualitative phase of this study. The integrated findings of both quantitative and qualitative phases in the current study support these previous findings in which interactions between instructors and students are positively related to students' on-line learning. Additionally, the findings of the current study provide indication that the student-instructor and student-student interactions involving language-related messaging in on-line discussion forum influences the students' on-line learning.

Third, the findings of the present research add to the understanding of how the factors related to student-student and student-instructor interactions in on-line discussion forum influence their on-line learning in higher education in Hong Kong. For the introductory IT course in the college, the research findings reported in this study provide empirical indication of the importance of the students' learning with their English proficiency and their use of language-related messaging in on-line discussion forum. The students' proficieny in English and their use of language-related messaging in on-line discussion forum are not the concerns in the previous studies (e.g. Arbaugh, 2008; Hwang and Arbaugh, 2006; Gerber et al, 2007; Rovai and Barnum, 2003; Swan, 2001) because the learning environment in these studies is not like that in the Hong Kong higher education context in which students use less familiar English to learn. Although the researchers such as Gerber et al (2007) took into account the relevant types of messages posted in on-line communication when operationalising the student-student and student-instructor

interactions in that communication, they did not need to consider language-related messages as the students in their study did not use less familiar language to learn. This raised the question on whether the previous research findings are appropriate for the Hong Kong higher education context with the characteristic of the use of less familiar language. The explanations presented in the findings in section 6.2 help the educational stakeholders such as instructors, students, educational management and administrators to understand why SEP, IGD and SCD affect the students' on-line learning and take necessary actions to make on-line education effective in learning in the college. The research findings (1) to (6) of this study as presented in section 6.2 help the educational stakeholders to understand how SEP, IGD and SCD influence students' on-line learning in the bilingual Hong Kong higher education context or other similar multi-lingual learning environments.

Fourth, as well as understanding the factors SEP, IGD and SCD that influence the students' on-line learning, the suggested improvements on on-line education, as presented in the research finding (6) in section 6.2, have implications for the practice and enhancement of on-line education for educational policy makers, management and administrators. These educational stakeholders who are involved in organising and providing on-line education can be aware of the suggested improvements of on-line education related to students' English proficiency, student-instructor and student-student involvement in on-line discussion forum found in the present study.

Chapter 7

Conclusion

In this chapter the significant features of this research study and the integrated findings of both quantitative phase and qualitative phase of this research study are summarized as concluding remarks in the first section of this chapter. These research findings have implications for the practice of on-line education which are discussed in the second section of this chapter. Since there are limitations of this study, they are discussed in the third section of this chapter, and modifications for future research are recommended in the fourth section of this chapter.

7.1 Concluding Remarks

In conclusion, this research reveals the presence of the factors SEP, IGD and SCD that foster students' learning effectiveness in on-line education for the case of the students taking an introductory IT course in the college. In doing so, the two-phase sequential explanatory model of mixed methods, in which a quantitative approach is followed by a qualitative approach, was adopted. Quantitatively, quasi-experimental research and survey research were chosen. Qualitatively, case study was used. The quantitative analysis in the first quantitative phase was performed using correlation complemented by multiple regression while the qualitative analysis in the second qualitative phase was based on content analysis of the interviewees' transcripts.

This research significantly found in the first quantitative phase that SEP, IGD and SCD have larger effect on the students' on-line learning in asynchronous on-line education (teaching method 2) than that in classroom teaching (teaching method 1) and synchronous on-line education (teaching method 3) while SEP is the most influential and IGD is more influential than SCD.

The research findings in the second qualitative phase help explain these quantitative findings from the first phase. First, the second qualitative findings identified that SEP, IGD and SCD are factors that influence the students' on-line learning and explained why these factors were identified.

Second, in line with the quantitative findings that SEP, IGD and SCD have larger effect on the students' on-line learning in asynchronous on-line education (teaching method 2) than in other teaching methods, the second qualitative phase found that teaching method 2 is the least effective in learning. These integrated findings from both quantitative and qualitative phases as well as the suggested improvements on on-line education system provide implications for enhancing the learning effectiveness in on-line education – upgrading SEP and promoting IGD and SCD.

The findings of this research contribute to the understanding of how SEP influences the college students' learning in the on-line introductory IT course. This area has not been explored in the literature. In addition to the consistency with the previous findings (e.g. Gerber et al (2007), Hwang and Arbaugh (2009) and Picciano (2002)) on how IGD and SCD affect students' on-line learning, the findings of this study provide indication that the IGD and SCD involving language-related messaging in on-line discussion forum influences students' on-line learning and add to the understanding of how IGD and SCD influence students' on-line learning in Hong Kong higher education context. Moreover, the research findings with reference to the suggested improvements on on-line education have implications for the practice and enhancement of on-line education for educational policy makers, management and administrators.

7.2 Implications for Practice

As the case used in this research study is an on-line introductory IT course offered by the college in Hong Kong, the research findings in this study are applicable to on-line education provided in the Hong Kong higher education context. In order for on-line education to be effective in learning in Hong Kong higher education, the on-line education stakeholders such as on-line education providers, administrators, management, instructors (or facilitators) and students should be aware of the factors contributing to the students' on-line learning, the importance ranking of the factors, explanations and suggested improvements on on-line education found in this research study. Figure 6.1 presents these contributing factors for the on-line education stakeholders. For example, they need to understand the explanation that the college students have to use the less familiar English to learn with English materials in Hong Kong higher education. They also have difficulty in translating English IT terms into their familiar Chinese. So while

SEP brings convenience in learning and facilitates on-line discussions among peers and instructors, the on-line education management should note that SEP is the most important factor and has the strongest influence on the students' on-line learning, as indicated by the solid arrow in Figure 6.1. It is important for the on-line education management to plan or offer an English course as a pre-requisite or co-requisite for the college students taking on-line education. Specifically, this study reveals that the students having higher SEP marks, as reflected by their highest grades or scores of English public examination results from HKALE, HKCEE and IELTS, had higher test scores of the introductory IT course. A higher education institution offering on-line education should consider offering an English course as a pre-requisite or co-requisite for the students with lower SEP marks. As another example, the on-line education instructors should note that IGD is an important factor and has an influence on the students' on-line learning, as indicated by the dotted arrow in Figure 6.1. They need to understand that they are more knowledgeable of the course, have teaching skills, ability and authority to guide, facilitate and monitor students' discussion in on-line discussion forum. Moreover, the on-line education students should take into account the influence by SCD on their on-line learning, as indicated by the dotted arrow in Figure 6.1. Knowing the explanation for the least importance of SCD is that students may not have sufficient responsibility to guide and discuss in on-line discussion forum, the on-line education instructors should facilitate, encourage and promote this social process and idea sharing in the students' familiar language, Chinese, in student-student on-line discussion forum.

In addition to upgrading SEP and promoting IGD and SCD, the on-line education management and designers should note the suggested improvements on on-line education obtained in this research study such as upgrading students' IT skills, self-learning and self-control abilities. There are also other suggested improvements pertaining to student-student and student-instructor interaction such as designing an on-line education system that provides real-time communication (i.e. real-time chatting or instant messaging system), provides feedback to students (i.e. giving instant feedback, answers and references to students when they answer wrongly in on-line exercises), monitoring students (i.e. learning progress reports on the on-line education system and instructors helping to monitor students' discussion in on-line discussion forum) and facilitating students' practicing (i.e. designing simulation and interface that allows

students to practise IT skills by using software applications).

7.3 Limitations of the Study

When performing data collection and analyses, the researcher recognized certain limitations of the present study. The first limitation is found in the first quantitative phase of this study. Wong's (2008) quasi-experiment was conducted in the years 2006 to 2008. Meanwhile, the researcher wanted to maintain covert research because it avoided Hawthorne effect (Berg, 2009:82) and did not ask for the participants's permission in the quasi-experiment to allow the researcher to view and collect the number of their viewed guidance messages in the college's on-line discussion forum. In the survey of the quantitative phase of this study in 2010, as the researcher had no rights to access the participating students' accounts in the college's on-line education system, the researcher had to call the participating students for meetings to complete the questionnaires, ask them to log into their accounts and check the number of their viewed content-related and language-related guidance messages in their accounts. The researcher had to rely on their perceptions of the number of their viewed guidance messages posted by peer students in the discussion forum and the number of their viewed content-related guidance messages posted by the instructors. Because the researcher had no access rights to the students' accounts in the college's on-line education system and it was infeasible to check every student's viewed messages in such considerable samples (totally, 225 (75 participants × 3 teaching methods) students) in this quantitative survey, the accuracy of these data collected relies heavily on the participating students' perceptions. Also, the questions on the questionnaire were written in the participating students' less familiar English which might be plausible threat to their understanding. To lessen this plausible threat, the researcher called for the participating students to complete the questionnaires in the meetings and explained to them in their familiar Chinese if needed in the meetings.

The second limitation of this study is due to the nature of the quantitative data of IGD and SCD collected. IGD and SCD were operationalised by counting the number of viewed guidance messages for the question 11 of the questionnaire (Appendix 3). As mentioned earlier in section 3.5, there was face validity for this question as students having more guidance were more likely than the students having less guidance to view

the guidance messages in the on-line discussion forum. However, some posted guidance messages viewed by a student are long while some of them are short. This has the potential to be a plausible threat to the comparison of IGD and SCD when just counting the number of viewed guidance messages.

The third limitation is that this study did not rule out the possibility that many variables other than SEP, IGD and SCD, like those montioned in section 2.3.2.2, also influence students' on-line learning. For example, the college students' individually determined learning efforts such as reading and practicing might lead to their improved learning effectiveness. Self-reading and self-practicing efforts can be operationalised by on-line Web page hits and is positively correlated with students' learning measured by course grade (Wang and Newline, 2000). The proposed study considered the students' learning effort operationalised by the number of viewed guidance messages in the on-line discussion forum, but did not take into account the students' individual learning efforts, reading and practicing that also possibly contribute to students' learning effectiveness.

The fourth limitation of this study is the study generalizability was limited – it is difficult to generalize the findings from one case of college students taking the on-line introductory IT course in the bilingual Hong Kong higher education context. It is not clear whether the research findings can be applied to similar bilingual or multi-lingual higher education contexts such as Singapore. Also, it is not known whether the research findings can be applied to courses other than an introductory IT course. According to Rosenberg (2001), technology-assisted learning settings like on-line education is more appropriate for courses that deliver explicit knowledge than courses embracing tacit knowledge. The empirical evidence of field experiment by Hui et al (2007) suggested that a technology-assisted learning setting improves students' acquisition of knowledge that demands abstract conceptualization and reflective observation, but it adversely affects students' acquisition of knowledge that requires concrete experience. Other variables like those in technological and interface design dimensions mentioned by Khan (2001) may have the potential to contribute to students' learning in practical skills like playing musical instruments, calligraphy and ceramics. This study did not take into consideration these other variables.

The fifth limitation is found in the second qualitative phase. At the time of collecting

interview data in 2010, the interviewees had to refer back to their experiences of using the college's on-line education system in the years 2006 to 2008. The accuracy of these data collected depends on the interviewees' memory recall. The researcher chose to be dependent on the interviewees' memory recalls of their experiences as it was impossible to directly observe and check their experiences. Besides, the interviews were conducted in the participating interviewees' less familiar English which might also be plausible threat to their understanding. To lessen this plausible threat, the researcher used member checking by confirming the interview transcripts with the interviewees in their familiar Chinese.

7.4 Recommendations for Future Research

Although the researcher collected survey data from a relatively considerable sample sizes (totally, 225 (75 participants × 3 teaching methods) students) and randomly selected 24 (8 participants × 3 teaching methods) out of them for collecting interview data in the current study, it is still dubious whether the contribution that this study has made as claimed in section 6.4 is applicable to other larger sample cases in the bilingual higher education context. It is interesting to investigate whether the contribution of this study can be applied to other large-scale cases. For instance, the sample sizes in the large-scale study by Shea et al (2003) to examine the relationships between the students' perceptions of teaching presence and their satisfaction and perceived learning from online courses were over 1,000. Future research is suggested to be a large-scale study.

SEP, IGD and SCD are found to be a contributing factor to the students' on-line learning in this research study, but there are still a number of questions unanswered or missed by this research study. These unanswered or missed questions that require further investigation include the following:

1. What helps to promote each of these variables SEP, IGD and SCD in on-line education?
2. What aspects of SEP e.g. reading skills and writing skills contribute to students' on-line learning?
3. How do these aspects of SEP contribute to students' on-line learning?

4. Are there any differences between the aspects of SEP required for students' on-line learning and classroom learning? Are the listening and speaking skills of SEP in classroom teaching more important than those aspects of SEP in on-line education? Or, are the reading and writing skills of SEP in on-line education more important than those aspects of SEP in classroom teaching?
5. What types of IGD or SCD e.g. content-related, language-related, interpersonal and organisational messages contribute to students' on-line learning?
6. How do these types of IGD or SCD contribute to students' on-line learning?
7. Are there any differences between the types of IGD or SCD in on-line education and those in classroom teaching?
8. By understanding the differences, how can the teacher adjust their pedagogical skills and the students adjust their learning skills to fit in on-line education?

For an alternative perspective, the limitations of this study mentioned in section 7.3 suggest opportunities for modifying the present study in future research. One problem with this study is the restricted access to the students' accounts of the college's on-line education system. Future research can be conducted, with the college's and students' permission, to access the students' accounts of an on-line education system in order to analyse the contents of the messages in the discussion forum of the on-line education system. This future research could contribute in certain areas. For example, investigation of the contents of the messages in the on-line discussion forum can distinguish among content-related, language-related, interpersonal and organisational messages and may accurately provide criteria for operationalising student-student and student-instructor interactions in on-line discussion forum. This future research would be attempting to answer the unanswered or missed questions 1 to 7 above. It would also be interesting in future research to investigate how these types of IGD's or SCD's messages (e.g. content-related, language-related, interpersonal and organisational messages) are interrelated. Moreover, future research could look into how the types of on-line discussion messages are interrelated between IGD and SCD. Content-related and language-related messages of SCD in on-line discussion forum are related to cognitive presence in the CoI framework while interpersonal and organisational messages in on-line discussion forum are related to social presence in the CoI framework. All four types of IGD's messages in on-line discusssion forum are linked to teaching presence in the CoI framework. The recommended future research would

further examine the relationship between the elements in the CoI framework (i.e. social, cognitive and teaching presences) and students' on-line learning as well as how these elements are interrelated. For another example of possible contributing areas in future research, there are unknown reasons why there is difficulty in translating English IT-related content to Chinese in the college's on-line discussion forums. Content analysis of the messages in such forums may help to discover explanations and solutions for this issue. Is that difficulty related to semantic problem? Is that difficulty related to pragmatic problem? Or, is that difficulty a specific problem in the Hong Kong cultural context? For example, one semantic problem is the word "bug" is usually used by IT professionals to mean "an error in a computer programme", while it has other more common meanings like 'an insect'. In the introductory IT course investigated in this research study, non-IT students with semantic difficulties in IT terms may have had problem in understanding the meaning of the sentences and paragraphs containing IT terms with such multiple meanings. For pragmatic problem, the word "fishing" or "phishing" is used by IT social context to indicate a scam in which a perpetrator tries to send an official looking email that tries to obtain the email recipient's personal and financial information. Therefore, the sentence "how to avoid being victimized by fishing" may give pragmatic problem to non-IT students. As mentioned by some interviewees in this research study, there are no standardized Chinese IT terms for the same English IT terms. For example, there are different Chinese terms for the IT term "compact disc read-only memory (CD-ROM)". People in China use one Chinese term for "CD-ROM" while people in Taiwan use another Chinese term for "CD-ROM". However, in Hong Kong cultural context, there are different Chinese terms for "CD-ROM". Therefore, it is important for future research to search for the answers for whether there are semantic or pragmatic problems or is the Hong Kong cultural context a problem in on-line education. If the answer to these questions is yes, then further research is required to discover how this problem affects students' on-line learning and how this problem can be solved in on-line education.

Another problem with this research is that this research did not rule out the effects by many variables other than the three variables SEP, IGD and SCD. For example, this research did not take into account the students' other individual learning efforts such as reading and practicing that also contribute to students' learning effectiveness. These individual efforts can be operationalised by the time spent on reading the on-line

materials and reference materials, the number of on-line exercises attempted and the time spent on practicing computer skills. Therefore, it is suggested that future research should consider the effect of the variables other than SEP, IGD and SCD. For example, the future research can measure students' other learning effort such as reading and practicing, collects this information and controls for these variables when looking into the effects of SEP, IGD and SCD on students' on-line learning.

Finally, the problem with generalizability of this research suggests expanding this research. One important area that requires expansion is to investigate whether the findings can be generalized to other cases such as other courses (e.g. language training, business management and psychology courses) in other multi-lingual educational organisations. Also, an effective on-line education does not depend on good pedagogy alone. There are still many other dimensions such as assessment, institutional, technological, interface design, management, resource support and ethical dimensions mentioned by Khan (2001), which could enhance the learning effectiveness of on-line education. Further studies are suggested to focus on considering all these factors and connecting all these dimensions in a systematic way in order to design an effective on-line education system.

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Appendices

APPENDIX 1: TEST USED FOR THE INTRODUCTORY IT COURSE IN THE ACADEMIC YEAR 2006-7 IN THE COLLEGE

For questions 1 to 30, choose the best answer.

Question 1:
Printers and screens are examples of
A. input devices
B. secondary storage
C. output devices
D. memory

Question 2:
Programmers use a programming language or program development tool to create computer programs.
A. True
B. False

Question 3:
Windows XP is one of Microsoft's utility programs.
A. True
B. False

Question 4:
A USB flash drive is an example of a storage device.
A. True
B. False

Question 5:
The type of computer which is portable, small enough to fit on your lap is
A. Desktop
B. Headtop
C. Laptop
D. Notebook

Question 6:
The hardware device needed for data communications via the telephone system is a(n)
A. optical disk
B. speaker
C. browser
D. modem

Question 7:
The electronic circuitry that temporarily stores data and instructions is called
A. memory
B. disk drive
C. CPU
D. keyboard

Question 8:
The software that is used to explore the Internet is called
A. ISP
B. a browser
C. PDA
D. a Web

Question 9:
The computer converts raw data into
A. storage
B. peripherals
C. communications
D. information

Question 10:
The birthplace of the World Wide Web is considered to be
A. Netscape
B. CERN
C. ARPA
D. the Department of Defense

Question 11:
URL stands for
A. Uniform Resource Locator
B. United Region Location
C. Usenet Resource Location
D. Uniform Resource Level

Question 12:
The first screen of a Web site is called its
A. hypertext
B. link
C. browser
D. home page

Question 13:
Appropriate behavior in network communications is referred to as
A. service provision
B. netiquette
C. http
D. browser

Question 14:
Like an IP address, the components of a domain name are separated by commas.
A. True
B. False

Question 15:
Software that can find Internet sites that match certain criteria is called a(n)
A. ISP
B. hit
C. search engine
D. home page

Question 16:
http and *ftp* are examples of
A. tags
B. Web sites
C. protocols
D. domain names

Question 17:
A user can change to a different Web site by clicking the mouse on a
A. plug-in
B. link
C. scroll bar
D. tag

Question 18:
The entity that provides a server and the software that connects it to the Internet is the ISP.
A. True
B. False

Question 19:
Marc Andreessen is credited with inventing the first browser, called
A. I2
B. Mosaic
C. W3C
D. ARPANet

Question 20:
The size of a Web site is limited to the browser display window.
A. True
B. False

Question 21:
The last part of a domain name is called
A. top-level domain
B. bottom-level domain
C. middle-level domain
D. last domain

Question 22:
Software written for a specific type of customers, such as plumbers or dentists, is called
A. mail merge
B. e-mail
C. custom software
D. shareware

Question 23:
Program that controls the operations of the computer and Serves as the interface between the user, the application software, and the computer's hardware is called
A. system software
B. application software

Question 24:
Moving files from another computer to your own computer is called
A. merging
B. browsing
C. collaborating
D. downloading

Question 25:
Software that must not be copied without permission is called
A. pubic domain software
B. copyrighted software
C. site license
D. shareware

Question 26:
Copyrighted software that is distributed free for trial period is
A. custom software
B. freeware
C. shareware
D. adware

Question 27:
Which of the following is NOT a feature of word processing software?
A. AutoCorrect
B. Mail merge
C. E-mail
D. Macros

Question 28:
Task-oriented software that helps keep records about collections of interrelated facts is called
A. word processing
B. database management
C. spreadsheets
D. desktop publishing

Question 29:
The underlying software found on all computers is
A. word processing
B. operating system
C. presentation
D. desktop publishing

Question 30:
Shareware cannot be copied.
A. True
B. False

For Questions 31 to 35, fill in the blanks.

Question 31:
The _____ is a worldwide collection of networks that connects millions of businesses, government agencies, educational institutions, and individuals.

Question 32:
In a spreadsheet, a _____ is the intersection of a column and row.

Question 33:
With a(n) _____, users interact with the software using text, graphics, and visual images such as icons.

Question 34:
The _____ is the electronic component that interprets and carries out the basic instructions that operate the computer.

Question 35:
A _____ is software that enhances the functionality of the browser.

For Questions 36 to 37, give brief answer.

Question 36:
What is a portal?

Question 37:
What is computer literacy?

APPENDEX 2: CHANGE OF TEST QUESTIONS FOR THE INTRODUCTORY IT COURSE IN THE ACADEMIC YEAR 2007-8 IN THE COLLEGE

The questions are the same as those used in the academic year 2006-7 except the following:

Question 3:
Is the following statement true or false?

Windows Vista is one of Microsoft's utility programs.

A. True
B. False

Question 5:
The type of computer which is portable, small enough to fit on your lap is _____.
A. Desktop
B. Headtop
C. Laptop
D. Supercomputer

Question 10:
_____ translates the domain name to its associated IP address so data can route to the correct computer.
A. IP translator
B. DNS server
C. URL server
D. DNS client

Question 13:
Widely used Web browsers for personal computers include all of the following *except* _____.
A. Microsoft Internet Explorer
B. Netscape
C. Microsoft Office PowerPoint 2003
D. Mozilla

Question 19:
_____ is a Web site that uses a regularly updated journal format.
A. Wiki
B. Blog
C. W3C
D. ARPANet

Question 23:
Program that controls the operations of the computer and serves as the interface between the user, the application software, and the computer's hardware is called _____.
A. system software
B. application software
C. server
D. controller

APPENDEX 3: QUESTIONNAIRE

Survey of On-line Education For the introductory Information Technology Course

Purpose of this questionnaire	To collect your views on the learning effectiveness of on-line education for the general education compulsory course related to Information Technology e.g. [redacted]. Your feedback will help the researcher, who is University of Leicester EdD student, to conduct the survey on the learning effectiveness of on-line education.
Ethical Issues	Your responses will remain anonymous and will not affect your academic performance. Please give your honest views on the learning effectiveness of on-line education.
Expected Time for competing this questionnaire	40 Minutes
Instructions for completing this questionnaire	Please choose ONE option EXCEPT question 6.

1. Please input your age when taking the introductory IT course in the College. I was _____ years old when taking the introductory IT course in the College.

2. Please indicate your ethnicity.
   a. African
   b. Asian – Chinese
   c. Asian – Others e.g. Asian Indian, Filipino, Indonesian, Japanese, Korean, …
   d. Australian
   e. European
   f. North American
   g. South American
   h. Others, please specify _____

3. Which language do you usually use in your daily live?
   a. Chinese – Cantonese dialect
   b. Chinese – Putonghua (Mandarin) dialect
   c. English
   d. Others, please specify _____

4. Which language do you usually use for learning in the College?
   a. Chinese – Cantonese dialect
   b. Chinese – Putonghua (Mandarin) dialect
   c. English
   d. Others, please specify _____

5. What was your highest education level when you entered the College?
   a. Pre-Associate Degree / Foundation Programme
   b. Hong Kong Certificate of Education Examination (HKCEE)
   c. Hong Kong Advanced Level Examination (HKALE)
   d. Others, please specify _____

6. What was your highest English academic level when you entered the College?
   a. A-Level or AS-Level Use of English (Grade: _____)
   b. IELTS (Score: _____)
   c. HKCEE English Language (Syllabus: _____) (Grade: _____)
   d. Others, please specify _____(Grade/Score if any: _____)

7. Please indicate the academic discipline/field of your study in the College.
   a. Applied Social Sciences
   b. Arts
   c. Bilingual Communication
   d. Business
   e. Design
   f. Engineering
   g. English for Business Communication
   h. Health Studies
   i. Information Technology
   j. Language and Culture
   k. Science
   l. Statistics and Computing for Business
   m. Others, please specify _____

For questions 8 to 11, please check the information from the on-line education system at either **http://[redacted]** or **http://[redacted]**.

8. Which semester were you in when taking the introductory IT course in the College?
   a. Semester 1, 2006-7
   b. Semester 2, 2006-7
   c. Semester 1, 2007-8
   d. Semester 2, 2007-8

9. Please input your test score for the introductory IT course. My test score is _____.

10. Which teaching method did you use for the quasi-experiment when taking the introductory IT course in the College?
    a. Teaching method 1 – Classroom Teaching (I attended both lectures and tutorials, and could access on-line discussion forum)
    b. Teaching method 2 – Asynchronous on-line education with no lectures and no tutorials (I did not attend lectures and tutorials. I learnt independently through on-line education system and could access on-line discussion forum)
    c. Teaching method 3 – Synchronous on-line education with tutorials but no lectures (I did not attend lectures, but I attended tutorials with instructors' guidance. I also learnt independently through on-line education system and could access on-line discussion forum)

11. In the quasi-experiment, please indicate the number of guidance messages in the discussion forum, excluding the salutation, greetings, administrative messages, messages not related to guidance (e.g. Hi, How are you?, I am not interested in this course, the deadline of assignment 1 is…). The guidance message includes the message about course content, explanation and clarification. The guidance message also includes the message guided you in the use of English such as explaining IT terms, correcting the use of English words, sentences, phrases, showing the steps of doing things, …

On-line Discussion Forum

- The number of guidance messages from INSTRUCTORS viewed by me in the discussion forum is _____.
- The number of guidance messages from other STUDENTS viewed by me in the discussion forum is _____.

For each item in questions 12-17, please indicate your view by choosing ONE of the following options:

a.	Strongly agree	-	means that I strongly agree with the specified statement.
b.	Agree	-	means that I agree with the specified statement.
c.	Agree somewhat	-	means that I agree somewhat with the specified statement.
d.	Neutral	-	means that I am neutral with the specified statement.
e.	Disagree somewhat	-	means that I disagree somewhat with the specified statement.
f.	Disagree	-	means that I disagree with the specified statement.
g.	Strongly disagree	-	means that I strongly disagree with the specified statement.
h.	Not available	-	means that the specified statement is not available (NA) to me.

12. Please indicate your views on **classroom teaching** as follows:

(These questions are about your views on the learning effectiveness of classroom teaching for the introductory IT course.)								**NA**
• I have found that the materials (e.g. handouts, notes, assignments, tests, cases and projects) conducted by the teachers in class are effective for my learning.	a	b	c	d	e	f	g	h
• Teaching and learning activities in class (e.g. teachers' explanation, demonstration, discussions, case studies and projects) can help my learning effectively	a	b	c	d	e	f	g	h
• I have found that I have effectively achieved knowledge, concepts or ideas from the teachers in class.	a	b	c	d	e	f	g	h
• I have difficulty in learning effectively in class.	a	b	c	d	e	f	g	h
• I have found the teaching materials and activities in class useless for my effective learning	a	b	c	d	e	f	g	h

13. Please indicate your views on **on-line education with no lectures and no tutorials** as follows:

(These questions are about your views on the learning effectiveness of on-line education only with no lectures and no tutorials for the introductory IT course.)								**NA**
• I have found that the on-line materials (e.g. handouts, notes, assignments, tests, cases and projects) are effective for my learning.	a	b	c	d	e	f	g	h
• The on-line activities (e.g. explanation, demonstration, discussions, case studies and projects for the on-line materials) can help my learning effectively	a	b	c	d	e	f	g	h
• I have found that I have effectively achieved knowledge, concepts or ideas from the on-line materials.	a	b	c	d	e	f	g	h
• I have difficulty in learning effectively in on-line education with no lectures and no tutorials.	a	b	c	d	e	f	g	h
• I have found the materials and activities in on-line education useless for my effective learning	a	b	c	d	e	f	g	h

14. Please indicate your views on **on-line education with tutorials but no lectures** as follows:

(These questions are about your views on the learning effectiveness of on-line education with instructors' guidance in tutorials only but without lectures for the introductory IT course.)								**NA**
• I have found that the on-line materials (e.g. handouts, notes, assignments, tests, cases and projects) and the materials presented by instructors in tutorials are effective for my learning.	a	b	c	d	e	f	g	h
• The on-line activities with instructors' guidance in tutorials (e.g. instructors' explanation, demonstration, discussions, case studies and projects for the on-line materials) can help my learning effectively	a	b	c	d	e	f	g	h
• I have found that I have effectively achieved knowledge, concepts or ideas from the on-line materials with the help from instructors in tutorials.	a	b	c	d	e	f	g	h
• I have difficulty in learning effectively in on-line education even with the guidance from instructors in tutorials.	a	b	c	d	e	f	g	h
• I have found the materials and activities in on-line education and instructors' guidance in tutorials useless for my effective learning	a	b	c	d	e	f	g	h

15. Please indicate **how English as a medium of instruction affects your learning** as follows:

(These questions are about how English medium of instruction affects your learning for the introductory IT course.)								**NA**
• I can understand the materials (e.g. handouts, notes, assignments, tests, cases and projects) in class/on-line education in English.	a	b	c	d	e	f	g	h
• Presentation in English such as step-by-step instructions and explanations in class/on-line education can help my learning	a	b	c	d	e	f	g	h
• The teaching and learning activities in English in class/on-line education are useful for my learning.	a	b	c	d	e	f	g	h
• I have difficulty in learning the materials in English in class/on-line education.	a	b	c	d	e	f	g	h
• Using English as a medium of instruction makes my learning hard.	a	b	c	d	e	f	g	h

16. Please indicate **how instructors' guidance in discussion forum helps your learning** as follows:

(These questions are about how instructors' guidance in discussion forum in on-line education system helps your learning for the introductory IT course.)								**NA**
• There are sufficient opportunities for me to ask questions/raise issues and obtain help from the instructors through the discussion forum.	a	b	c	d	e	f	g	h
• The comments, explanations and feedback from the instructors on my coursework in the on-line discussion forum are helpful to my learning.	a	b	c	d	e	f	g	h
• I can extend my learning in the course through discussing with instructors on the on-line discussion forum.	a	b	c	d	e	f	g	h
• I have found the messages posted by instructors in discussion forum useless for my learning.	a	b	c	d	e	f	g	h
• I think I can learn by myself, so the instructors' guidance in discussion forum is unnecessary.	a	b	c	d	e	f	g	h

17. Please indicate **how students' collaboration in discussion forum helps your learning** as follows:

(These questions are about how students' collaboration in discussion forum in on-line education system helps your learning for the introductory IT course.)								**NA**
• It is easy for me to ask questions/raise issues and obtain help from the students through the discussion forum.	a	b	c	d	e	f	g	h
• The comments, explanations and feedback from other students on my coursework in the on-line discussion forum are helpful to my learning.	a	b	c	d	e	f	g	h
• I can extend my learning in the course through discussing with other students on the on-line discussion forum.	a	b	c	d	e	f	g	h
• I have found the messages posted by other students in discussion forum useless for my learning.	a	b	c	d	e	f	g	h
• I think I can learn by myself, so the other students' help/guidance in discussion forum is unnecessary.	a	b	c	d	e	f	g	h

For questions 18-19, please indicate your ranking of the teaching methods/variables by putting the following rank number on the boxes provided e.g. [1]:

1. The most helpful - means that the specified teaching method/variable is the most helpful to me.
2. Helpful - means that the specified teaching method/variable is the helpful to me.
3. The least helpful - means that the specified teaching method/variable is the least helpful to me.

18. In your opinion, what are the ranks for the following three teaching methods?

☐ Teaching method 1 - classroom teaching

(In this method, students attend lectures in classroom and are taught by teacher. Instructor's guidance is available in tutorials. On-line discussion forum is available.)

☐ Teaching method 2 – on-line learning with NO LECTURES and NO TUTORIALS

(In this method, students learn independently by reading on-line materials by themselves and they could learn through peers and instructors in the discussion forum.)

☐ Teaching method 3 – on-line learning with TUTORIALS but NO LECTURES

(In this method, students learn independently by reading on-line materials by themselves and obtain instructor's guidance in tutorials. They could learn through peers and instructor in the discussion forum.)

19. In your opinion, what are the ranks for the following three variables/factors related to learning effectiveness in on-line education?

☐ Students' own language proficiency

☐ Instructors' guidance (or help from instructors) in discussion forum

☐ Students' collaboration (or help from students) in discussion forum

20. Other comments/suggestions:

_____

_____

_____

_____

_____

_____

- Thank you for completing the questionnaire -

APPENDIX 4: INTERVIEW PROTOCOL

Interview No:
Interviewer:
Interviewee:
Date of Interview:
Start Time of the Interview:
End Time of the Interview:
Venue of Interview:

Introduction

Give brief introduction about myself and the purpose of the interview. Also mention that the data collected in this interview will be used for this research study only and kept in strict confidence.

Questions

1. Please tell me something about yourself such as the following:
   - Age
   - Ethnicity
   - Education background (e.g. IT education, English training)
   - English subject grade in your previous examinations (e.g. Hong Kong Certificate of Education Examination or equivalent like General Certificate of Education O Level, Hong Kong Advanced Level Examination or equivalent like General Certificate of Education A Level)
   - Language used in your daily life
   - Teaching method you used for the introductory IT course in the college

2. I would like you to do is to describe as much as possible your experiences in using on-line education?

3. What difficulties and benefits did you have when using on-line education?

4. How would your English proficiency help you to learn in on-line education?

5. How would you use discussion forum to learn in on-line education?

6. How would the instructors help you to learn through on-line discussion forum?

7. How would the other students help you to learn through on-line discussion forum?

8. In your opinion, would the following be the factors affect your learning in on-line education? If yes, how would you rank their importance (3 for the most important, 1 for the least important)
   - Students' own language proficiency
   - Instructors' guidance on the use of learning language
   - Students' collaboration on the use of learning language

9. In terms of learning effectiveness, how would you compare the on-line education to classroom teaching?

10. How can one learn effectively in on-line education?

APPENDIX 5: PARTICIPANT CONSENT FORM

School of Education
University of Leicester
21 University Road
Leicester
LE1 7RF
United Kingdom

Participant Informed Consent

Project: Exploration of the factors related to the use of learning language and investigation on how these factors affect the pre-university students' learning effectiveness in on-line education

Principal Investigator: Simon Wong
(Phone No: [redacted], Email: [redacted])

Purpose of the Research: This research is intended to explore the factors related to the use of learning language which affect students' learning effectiveness in on-line education.

Procedures of the Research: This research consists of two phases. For the both phases, the participants must be 18 years of age or older and are willing to participate in this research. In the first phase, you will be asked to complete short questionnaire about your personal background (e.g. age, ethnicity, education) and your experience in the use of learning language in classroom teaching, on-line education without instructors' guidance or on-line education with instructors' guidance. You will not be asked to fill the information that will identify you in the questionnaire. It will take approximately 40 minutes to complete the questionnaire. In the second phase, participants will be selected and scheduled for 45-minute interview. If you are selected for the interview, I will contact you to explain the details about the interview.

Ethics of the Research: There are no identified risks in this research as it won't involve any risky treatment or experiment. The participants will only share their views either in the questionnaires, interviews or both. Any personal information obtained in this research will be kept strictly confidential. The participants will remain anonymous in any publications or whatever media related to this research. Aliases will be used if needed in the report of this research.

Consent and Rights: You have the rights to decide to participate or not to participate in this research or withdraw from the research at any time. Your decision will not affect your relationship with the investigator and your academic standing in the college. If you have read and understood the information presented in this form, and you voluntarily decide to participate in this research, please sign on the space provided below:

_____ _____

Signature of the Research Participant **Date**

APPENDEX 6: CORRELATION MATRICES

		Test Score	SEP Marks	IGD	SCD
Pearson Correlation	Test Score	1.000	.609	.494	.331
	SEP Marks	.609	1.000	.391	.151
	IGD	.494	.391	1.000	.263
	SCD	.331	.151	.263	1.000
Sig. (1-tailed)	Test Score	.	.000	.000	.002
	SEP Marks	.000	.	.000	.098
	IGD	.000	.000	.	.011
	SCD	.002	.098	.011	.

Correlation Matrix in Teaching Method 1

		Test Score	SEP Marks	IGD	SCD
Pearson Correlation	Test Score	1.000	.839	.586	.405
	SEP Marks	.839	1.000	.451	.234
	IGD	.586	.451	1.000	.318
	SCD	.405	.234	.318	1.000
Sig. (1-tailed)	Test Score	.	.000	.000	.000
	SEP Marks	.000	.	.000	.022
	IGD	.000	.000	.	.003
	SCD	.000	.022	.003	.

Correlation Matrix in Teaching Method 2

		Test Score	SEP Marks	IGD	SCD
Pearson Correlation	Test Score	1.000	.689	.459	.339
	SEP Marks	.689	1.000	.315	.202
	IGD	.459	.315	1.000	.201
	SCD	.339	.202	.201	1.000
Sig. (1-tailed)	Test Score	.	.000	.000	.001
	SEP Marks	.000	.	.003	.041
	IGD	.000	.003	.	.042
	SCD	.001	.041	.042	.

Correlation Matrix in Teaching Method 3

APPENDEX 7: REGRESSION COEFFICIENTS

Coefficients (Dependent Variable: Test Score)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	19.481	7.345		2.652	.010	4.836	34.126		
SEP Marks	6.634	1.283	.480	5.171	.000	4.076	9.191	.845	1.184
IGD	.285	.106	.256	2.688	.009	.074	.497	.805	1.242
SCD	.289	.134	.192	2.163	.034	.023	.556	.928	1.077

Coefficients in Teaching Method 1

Coefficients (Dependent Variable: Test Score)

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	-11.266	5.015		-2.246	.028	-21.266	-1.267		
SEP Marks	11.067	.977	.702	11.327	.000	9.119	13.015	.788	1.269
IGD	.316	.094	.214	3.366	.001	.129	.503	.749	1.335
SCD	.264	.089	.173	2.967	.004	.087	.442	.889	1.125

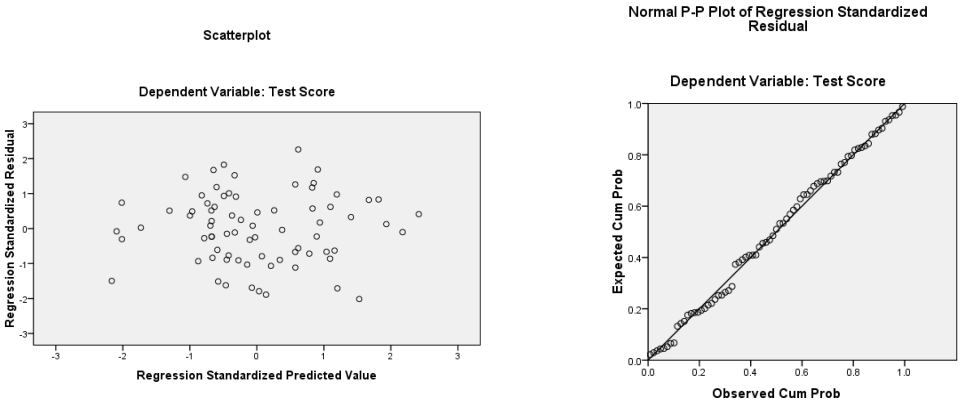
Coefficients in Teaching Method 2

Coefficients (Dependent Variable: Test Score)

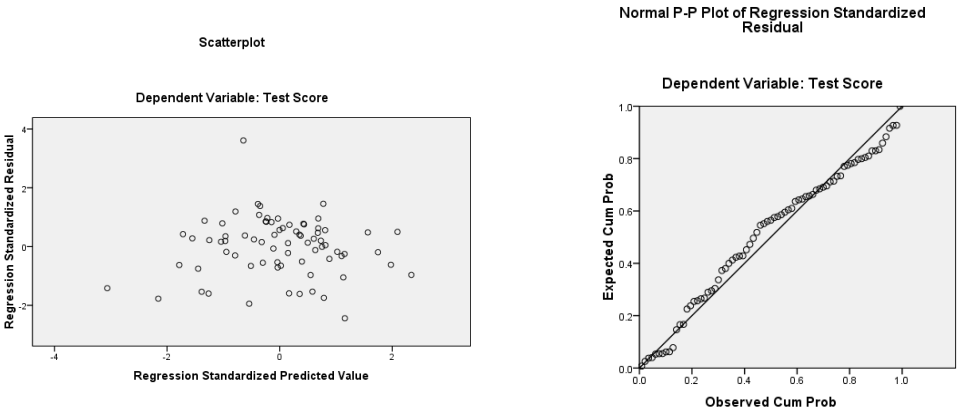
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tole-rance	VIF
1 (Constant)	19.633	5.541		3.543	.001	8.585	30.681		
SEP Marks	6.803	.978	.578	6.957	.000	4.853	8.753	.881	1.135
IGD	.292	.100	.242	2.910	.005	.092	.492	.881	1.135
SCD	.172	.080	.174	2.162	.034	.013	.331	.938	1.066

Coefficients in Teaching Method 3

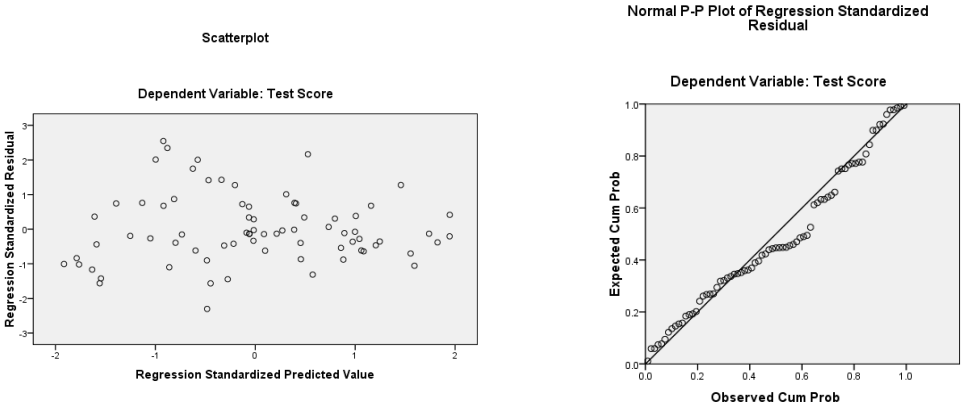
APPENDEX 8: SCATTERPLOT AND NORMAL PROBABILITY PLOT OF THE REGRESSION STANDARDIZED RESIDUALS



Scatterplot and Normal Probability Plot in Teaching Method 1



Scatterplot and Normal Probability Plot in Teaching Method 2



Scatterplot and Normal Probability Plot in Teaching Method 3

APPENDEX 9: RESIDUALS STATISTICS IN TEACHING METHOD 2

Residuals Statistics (Dependent Variable: Test Score)

	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	27.47	87.77	61.65	11.166	75
Std. Predicted Value	-3.062	2.339	.000	1.000	75
Standard Error of Predicted Value	.710	2.287	1.330	.363	75
Adjusted Predicted Value	28.93	88.37	61.67	11.127	75
Residual	-14.576	21.544	.000	5.844	75
Std. Residual	-2.443	3.611	.000	.980	75
Stud. Residual	-2.524	3.671	-.001	1.008	75
Deleted Residual	-15.553	22.268	-.017	6.196	75
Stud. Deleted Residual	-2.626	4.050	.000	1.036	75
Mahal. Distance	.060	9.891	2.960	2.103	75

APPENDEX 10: MODEL SUMMARIES AND ANOVA

Model Summary (Dependent Variable: Test Score)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.695[a]	.482	.461	6.728	.482	22.064	3	71	.000

ANOVA (Predictors: (Constant), SCD, IGD, SEP Marks)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2995.901	3	998.634	22.064	.000[a]
	Residual	3213.486	71	45.260		
	Total	6209.387	74			

Model Summary and ANOVA for Teaching Method 1

Model Summary (Dependent Variable: Test Score)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.886[a]	.785	.776	5.966	.785	86.391	3	71	.000

ANOVA (Predictors: (Constant), SCD, IGD, SEP Marks)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	9225.643	3	3075.214	86.391	.000[a]
	Residual	2527.343	71	35.596		
	Total	11752.987	74			

Model Summary and ANOVA for Teaching Method 2

Model Summary (Dependent Variable: Test Score)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.754[a]	.568	.550	6.424	.568	31.161	3	71	.000

ANOVA (Predictors: (Constant), SCD, IGD, SEP Marks)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3857.403	3	1285.801	31.161	.000[a]
	Residual	2929.717	71	41.264		
	Total	6787.120	74			

Model Summary and ANOVA for Teaching Method 3

APPENDEX 11: SEQUENTIAL MULTIPLE REGRESSIONS

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.609[a]	.371	.363	7.313	.371	43.095	1	73	.000
2	.670[b]	.448	.433	6.897	.077	10.075	1	72	.002
3	.695[c]	.482	.461	6.728	.034	4.677	1	71	.034

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2304.950	1	2304.950	43.095	.000[a]
	Residual	3904.437	73	53.485		
	Total	6209.387	74			
2	Regression	2784.232	2	1392.116	29.264	.000[b]
	Residual	3425.155	72	47.572		
	Total	6209.387	74			
3	Regression	2995.901	3	998.634	22.064	.000[c]
	Residual	3213.486	71	45.260		
	Total	6209.387	74			

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	18.421	7.729		2.383	.020	3.018	33.824		
SEP Marks	8.414	1.282	.609	6.565	.000	5.860	10.968	1.000	1.000
2 (Constant)	22.441	7.398		3.033	.003	7.693	37.189		
SEP Marks	6.785	1.313	.491	5.166	.000	4.167	9.403	.847	1.180
IGD	.337	.106	.302	3.174	.002	.125	.548	.847	1.180
3 (Constant)	19.481	7.345		2.652	.010	4.836	34.126		
SEP Marks	6.634	1.283	.480	5.171	.000	4.076	9.191	.845	1.184
IGD	.285	.106	.256	2.688	.009	.074	.497	.805	1.242
SCD	.289	.134	.192	2.163	.034	.023	.556	.928	1.077

a. Predictors: (Constant), SEP Marks

b. Predictors: (Constant), SEP Marks, IGD

c. Predictors: (Constant), SEP Marks, IGD, SCD

d. Dependent Variable: Test Score

Sequential Multiple Regression in Teaching Method 1

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.839[a]	.704	.700	6.900	.704	173.877	1	73	.000
2	.871[b]	.758	.752	6.281	.054	16.084	1	72	.000
3	.886[c]	.785	.776	5.966	.027	8.803	1	71	.004

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	8277.707	1	8277.707	173.877	.000[a]
	Residual	3475.279	73	47.607		
	Total	11752.987	74			
2	Regression	8912.292	2	4456.146	112.945	.000[b]
	Residual	2840.695	72	39.454		
	Total	11752.987	74			
3	Regression	9225.643	3	3075.214	86.391	.000[c]
	Residual	2527.343	71	35.596		
	Total	11752.987	74			

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	-13.026	5.719		-2.278	.026	-24.425	-1.628		
SEP Marks	13.225	1.003	.839	13.186	.000	11.226	15.224	1.000	1.000
2 (Constant)	-10.006	5.261		-1.902	.061	-20.493	.481		
SEP Marks	11.377	1.023	.722	11.124	.000	9.338	13.416	.797	1.255
IGD	.384	.096	.260	4.011	.000	.193	.575	.797	1.255
3 (Constant)	-11.266	5.015		-2.246	.028	-21.266	-1.267		
SEP Marks	11.067	.977	.702	11.327	.000	9.119	13.015	.788	1.269
IGD	.316	.094	.214	3.366	.001	.129	.503	.749	1.335
SCD	.264	.089	.173	2.967	.004	.087	.442	.889	1.125

a. Predictors: (Constant), SEP Marks

b. Predictors: (Constant), SEP Marks, IGD

c. Predictors: (Constant), SEP Marks, IGD, SCD

d. Dependent Variable: Test Score

Sequential Multiple Regression in Teaching Method 2

Model Summary[d]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.689[a]	.475	.468	6.986	.475	66.080	1	73	.000
2	.735[b]	.540	.527	6.586	.065	10.142	1	72	.002
3	.754[c]	.568	.550	6.424	.028	4.674	1	71	.034

ANOVA[d]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3224.707	1	3224.707	66.080	.000[a]
	Residual	3562.413	73	48.800		
	Total	6787.120	74			
2	Regression	3664.543	2	1832.271	42.248	.000[b]
	Residual	3122.577	72	43.369		
	Total	6787.120	74			
3	Regression	3857.403	3	1285.801	31.161	.000[c]
	Residual	2929.717	71	41.264		
	Total	6787.120	74			

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1 (Constant)	20.872	6.009		3.473	.001	8.895	32.848		
SEP Marks	8.113	.998	.689	8.129	.000	6.124	10.102	1.000	1.000
2 (Constant)	20.462	5.667		3.611	.001	9.165	31.758		
SEP Marks	7.118	.991	.605	7.181	.000	5.142	9.095	.901	1.110
IGD	.324	.102	.268	3.185	.002	.121	.527	.901	1.110
3 (Constant)	19.633	5.541		3.543	.001	8.585	30.681		
SEP Marks	6.803	.978	.578	6.957	.000	4.853	8.753	.881	1.135
IGD	.292	.100	.242	2.910	.005	.092	.492	.881	1.135
SCD	.172	.080	.174	2.162	.034	.013	.331	.938	1.066

a. Predictors: (Constant), SEP Marks

b. Predictors: (Constant), SEP Marks, IGD

c. Predictors: (Constant), SEP Marks, IGD, SCD

d. Dependent Variable: Test Score

Sequential Multiple Regression in Teaching Method 3

APPENDEX 12: AN EXAMPLE OF CONSISTENT CODING IN PARTIAL S4T2'S INTERVIEW TRANSCRIPT

STRUCTURAL CODE		THEMATIC CODE AND MEMOS	
Interview Topic	Speaker	Transcript	Label
Factors affecting on-line learning	Interviewer	**So, you think you can learn it by yourself just by reading the materials in WebCT?**	
	S4T2	No. This course requires us to know the IT concepts and skills. I can read the materials in WebCT to have the concepts. It is hard for me to follow the steps in the study guide [this study guide shows the tutorial exercises and use of software tools for the students to follow in the computer lab] in WebCT to learn how to use Microsoft Excel, Microsoft Access [the software applications covered in the introductory IT course].	IMPROVE.PRACTICE
	Interviewer	**Why?**	
	S4T2	It is hard to follow the words. I think if there is a video or animation showing me the steps of using software, it would be good. I just asked my friend to show me how to do it. We also needed to use the software to write reports, do assessments [these are the formative assessments like self-test exercises posted in WebCT]. My friend helps me on these.	IMPROVE.PRACTICE
	Interviewer	**So, you think the on-line discussion forum is not that helpful?**	
	S4T2	No, I don't mean this. It is helpful but not for me. Because I like asking my friend to help. My friend is computer genius.	
	Interviewer	**So, you don't learn from discussion forum?**	
	S4T2	I mainly learn from my friend. He seems to be my teacher.	
	Interviewer	**Though you don't usually use discussion forum, once you use it, which language did you usually use in discussion forum?**	
	S4T2	I used English. I don't know how to type Chinese. I have to type English. But other students like to use Chinese there. Sometime there is helpful for me to understand some points.	
	Interviewer	**Like what?**	
	S4T2	Like Chinese explanation of some concepts.	
	Interviewer	**Do you think it is hard to understand Chinese IT terms?**	
	S4T2	Yes, it is hard. So, we usually use English IT terms.	
	Interviewer	**How did your English proficiency help you to learn in WebCT?**	
	S4T2	Good English would be easy to read the English words in WebCT by myself. My English is not that good.	FACTPR.S_EP, FACTOR_EXP.S_EP.ENG_INSTRUCT
	Interviewer	**Besides English, do you think instructors' guidance in discussion forum and students' collaboration in discussion forum are factors that influence your on-line learning?**	
	S4T2	I think instructors' guidance is more helpful. They can clarify the concepts we misunderstood. The instructors can show us the right way to type out the formulas in Excel.	FACTOR.I_Gui_DisF, FACTOR.S_Col_DisF, RANK_EXP.I_Gui_DisF_MORE.I_MORE_KNOW

APPENDEX 13: AN EXAMPLE OF CONSISTENT CODING IN PARTIAL S6T3'S INTERVIEW TRANSCRIPT

STRUCTURAL CODE		THEMATIC CODE AND MEMOS	
Interview Topic	Speaker	Transcript	Label
Importance Ranking of Factors	Interviewer	**OK! Among English proficiency, instructors' guidance and students' collaboration in discussion forum, which factor is more important?**	
	S6T3	English proficiency.	IR1.S_EP
	Interviewer	**Why?**	
	S6T3	Without it, learning is not smooth.	
	Interviewer	**Among instructors' guidance and students' collaboration in discussion forum, which factor is more important?**	
	S6T3	Students' collaboration is more important.	IR2.S_Col_DisF, IR3.I_Gui_DisF
	Interviewer	**Why?**	
	S6T3	Instructors just give more information or repeat the information given in WebCT. An instructor has many students to handle. Students who are my close friends and I am familiar with the willing to give support. Instead of discussing in the forum, I can just call him to help.	RANK_EXP.I_Gui_DisF_LESS.I_INFO
Classroom Teaching vs On-line Education	Interviewer	**In terms of learning effectiveness, how would you compare the on-line education to classroom teaching?**	
	S6T3	On on-line education is effective provided that the students have the ability to learn by themselves. They must have good English and basic IT skills to use it and learn it by themselves. In classroom, teachers can use Chinese and see our responses. If the teachers find that we don't understand in English, the teachers will use Chinese. Classroom teaching is something I … we are used to, but on-line education is not.	IMPROVE.S_SELF-LEARN, IMPROVE.S_EP IMPROVE.S_IT-SKILLS
	Interviewer	**What do you mean by basic IT skills?**	
	S6T3	I mean knowing how to connect to Internet and browse at e-Learning web site. They know how to use the operating system like Windows, how to upload files, how to start up programmes.	
Suggested Improvement on On-line Education	Interviewer	**How can one learn effectively in on-line education system?**	
	S6T3	One must have self-learning ability, good English ability and good basic IT skills.	IMPROVE.S_SELF-LEARN, IMPROVE.S_EP, IMPROVE.S_IT-SKILLS
Other Comments about On-line Education	Interviewer	**Any comments about the on-line education?**	
	S6T3	One can learn effectively in on-line education system if one has self-motivation and control. There are many things attractive in Internet like on-line games and films. When students take on-line course, they might go to on-line games and films instead.	IMPROVE.S_SELF-CONTROL