Exploring Quality Teaching of Information and Communication Technology in New South Wales and Yenbai High Schools: A Comparative Case Study

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Dedication

This thesis is dedicated to my parents for my upbringing and their support throughout my studies, and to my wife Trinh Lan Huong for her love, support, and confidence in me throughout the creation process of this thesis.

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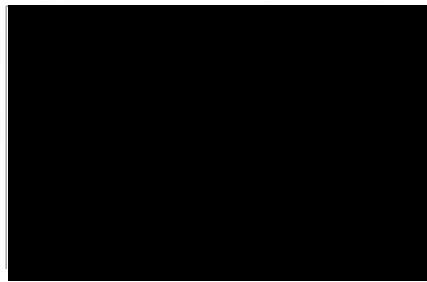
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This thesis has had the benefit of professional editorial advice regarding language, completeness and consistency (standards D and E of the *Australian standards for editing practice*) from Dr Richard Johnson.

Statement of Authentication

The work presented in this thesis is submitted in fulfillment of the degree of Doctor of Philosophy at the School of Education, University of Western Sydney. It is wholly my own work, except when references are acknowledged in the text. I hereby declare that I have not submitted this material, either in full or in part, for a degree at this or any other university or institution.

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Abbreviations

ACARA	Australia Curriculum, Assessment and Reporting Authority
BOSTES	Board of Studies Teaching and Education Standards
CIES	Comparative and International Education Society
DEEWR	Department of Education, Employment and Workplace Relations
DER	Digital Education Revolution
DERN	Digital Education Research Network
HSC	Higher School Certificate
ICT	Information and Communications Technologies
ICT-CST	ICT Competency Standards for Teachers
IDT	Information and Digital Technology
IEA	International Association for the Evaluation of Education Achievement
IPT	Information Processes and Technologies
IT	Information Technology
KLAs	Key Learning Areas
MCEECDYA	Ministerial Council for Education, Early Childhood Development and Youth Affairs
MCEETYA	Ministerial Council on Education, Employment, Training and Youth Affairs
MOET	Vietnamese Ministry of Education and Training
NSSCF	National Secondary Schools Computer Fund
NSW	New South Wales
OECD	Organisation for Economic Co-operation and Development
PISA	Programme for International Student Assessment
SDD	Software Design and Development
SITES	Second Information Technology in Education Study
UNESCO	United Nations Educational, Scientific and Cultural Organization
US	United State
VET	Vocational Education and Training
YDET	Yenbai Department of Education and Training
WSR	Western Sydney Region

Abstract

This study compares ICT policy and curriculum and assessment practices between Australian and Vietnamese secondary schools, and investigates differences between these two school systems. Document analyses and case studies were used to examine the key differences in ICT curriculum and policy and assessment practices between Australian and Vietnamese secondary schools. The document analyses focused on the intended ICT policy and curriculum and assessment, as presented in official documents in both countries. Using a case study approach for in-depth examination, two secondary schools were selected (one from Yenbai province, Vietnam and one from Sydney, New South Wales, Australia). Two principals and three teachers were interviewed. Classroom teaching and assessment practices were observed, and principals and teachers' views were obtained through semi-structured interviews and extensive discussions. Findings from the two case studies were compared with the findings from the document analysis.

This study explored and analysed differences in ICT teaching, learning, assessment, and achievement between Vietnamese and Australian secondary students. It was found that that Australian ICT school curricula and assessment differed markedly from the Vietnamese system. Student ICT achievement in these Australian and Vietnamese schools could not only be attributed to higher standards of intended ICT curricula and assessment, or teacher knowledge or classroom practices. These differences are better explained by economic and cultural factors, ICT policies and their degrees of implementation, and extra ICT curricula.

In order to bridge the gap and implement adequate ICT curricula and policies, rigorous professional training in teaching and assessment is essential for both Australian and Vietnamese teachers. In order to improve Australian students' ICT achievement, achievement motivation must be addressed. Many challenging aspects were found in ICT policies and classrooms in the Vietnamese educational system that calls for immediate change and improvement. In order to implement reforms in Vietnamese education, the impact of cultural influence must be considered more

seriously. In particular, this study highlights the need to integrate case study with large-scale study in international comparative studies.

Chapter 1 Introduction

Information and Communications Technology (ICT) has been accepted as a component of general education. One of the core aspects is software programming, which requires extended literacy and numeracy skills. As well, being able to understand various aspects of practical and theoretical ICT skills, enable students to make a valuable contribution to the development of generalised literacy and numeracy skills (Tyner, 2014). ICT education has therefore become a fundamental component of general education, and provides students with opportunities to develop widely valued skills and abilities such as literacy and numeracy around computing and communications devices, software, applications and systems.

ICT and good teaching also combine to produce generic skills, including team work and problem solving, that are important not only to daily life in the information age but also for lifelong learning. For instance, Miller and Akume (2009) show that the impact of ICT on education is becoming increasingly pronounced worldwide. It is rare for anything to be said in any area of human endeavour that makes no explicit or implicit reference to technology, in the sense of its decades of development and accumulated social and technical impact. Across many countries worldwide, ICT education is either implicitly or explicitly present in the natural and social sciences, in education and in the study of the humanities in general (Scheuermann & Pedró, 2010). In this thesis, ICT curricula will be used to describe both the use of computer technology and the teaching of programming.

The introduction of ICT over recent decades has gradually affected the nature of learning and the production of knowledge (Opara & Onyije, 2014). ICT education includes a sophisticated set of higher-order skills and cognitive abilities in areas of information technology and information systems and in knowledge management (Tolani-Brown, McCormac, & Zimmermann, 2010). ICT as a subject has been introduced in schools and has transformed teaching and learning processes in strategies to improve educational attainment (Sunkel, 2007). As Sarkar (2012) states, in entering in the 21st century, teachers and students need to have adequate ICT knowledge and skills. In the context of growing amounts of information being

transferred and transformed with increasing efficiency, educators around the world are increasingly concentrating on making ICT teaching and learning more effective (Ubulom, Enyekit, & Onuekwa, 2011). At the international level, educators are interested in the state of progress of their education systems and how these compare with the systems of other countries. The focus has been placed on international comparisons of ICT achievement and factors accounting for the differences in achievement.

This has led to a proliferating research agenda in the field of comparative ICT education. Such comparative education can be carried out quantitatively to a certain extent (Fairbrother, 2014). Studies of school policies and practices as well as a range of standardised methods to assess educational attainment in various countries have shed light on global education, and certainly, shortfall in educational achievement, even in one particular area, can be a matter of social and political concern. Yet, education involves multifarious issues that are influenced by the nature of a society and its culture (Kumar & Ahmad, 2007). These are often explored by using qualitative methods, and given the fact that different countries will have different aims and methods of education, a qualitative study comparing different educational systems can be instructive. As such, this thesis deploys qualitative methods in order to explore multifaceted aspects of similarities and differences between two different countries that have very different national educational systems. In this sense, ICT is a subject common to the curricula of Australia and Vietnam, but with quite different implementations and rules within ICT educational contexts. The motivation for this study is to compare in detail the teaching and learning of ICT as a school subject in senior secondary education in these two countries. As teachers and administrators have an essential role in providing educational quality (Fullan & Langworthy, 2013), this study focuses on presenting aspects of the teaching practices and policies of both countries.

1.1 Background

Quality teachers are recognised as a key determinant of students' learning and outcomes of schooling (Rowe, 2007; Velayutham & Aldridge, 2013). Specific qualities that characterise an effective teacher are a matter of debate, mainly because

teacher quality is extremely difficult to measure. As a result, most studies resort to measurable proxies, such as certification, academic degrees, and years of experience (Khan, 2014). Most of these characteristics bear some relationship to student scores. Yet, the contribution of the teacher remains difficult to quantify: in quantitative analysis it appears to explain as little as 3 per cent of the overall variation in students' test scores (Khan, 2014). However, this ongoing question is clear in general: good teaching produces good learning. Harris and Sass (2011) point out that teaching experience has consistently been linked to students' scores. On average, beginning teachers produce smaller learning gains in their students compared with more experienced teachers. Sawchuk (2011) states that factors such as family background can predict most variation in student achievement, but as a school-based factor, teacher quality is probably the most important element.

The role of ICT as a subject has become increasingly important in secondary schooling. More than this, as an emerging trend to relate the use of technology in contemporary life to education processes, from computer searches to visual displays, and to an ability to write algorithms, ICT education plays an important role in secondary education, especially in the process of empowering teachers and using a wider variety of teaching techniques in all educational activities (Kaka & Pd, 2008). As such, giving full attention to ICT education could promote student literacy across a range of issues where no one should remain ignorant of scientific method, computer applications or even the broad question of efficient technological approaches to learning (Evans & Nation, 2013).

Teachers of ICT as a subject have an important role in promoting inductive methods of analysis among their students. That is, they can encourage students to generate theories and hypotheses to explain difficult events, ask questions, generate data, and put their ideas to empirical and logical tests. Teachers of other subjects who employ ICT in their didactic methodology also convey a widespread power for the application of scientific and technological knowledge to provide greater opportunity for teachers and students communication and collaboration; offer the opportunity for more student centred teaching. ICT does not claim to offer all the answers in every subject, but in any subject. It can provide the means for teaching students, for the development of school learning cultures, and study skills to expand educational

options; it can also provide open sources of education, and support schools in sharing information and experiences with other schools. ICT has already attained a position in international education circles where it cannot be ignored (Kaka & Pd, 2011).

Australia has taken advantage of its established education system to participate in the global shift from material production to a knowledge economy, where intellectual resources are the basis for economic growth. The knowledge economy is driven by the requirement of rapid innovation in competitive global markets. This is not only enabled by the capacity of ICT to store, process and deliver information but also by the use technologies as part of day-to-day innovation. Educators across Australia recognise that children must have an education that enables them to participate successfully in school and to compete with and contribute to the whole world. In this sense, all state, territory and federal Australian governments support major programs to increase the use of ICT in schools (Convery, 2009).

In relation to the teaching of ICT, the Federal Department of Education, Science and Training (2002) sets out Australian quality ICT teaching standards in terms of the knowledge and understanding of ICT, not only in an educational environment, but also in government, industry and the wider society. Teachers need an understanding of how ICT use affects their students, communities and society. They also need to know what society needs from them, so that they can make sense of ICT as it relates to the life and future of their students. Teachers need to be able to identify ways that ICT can challenge their way of teaching in the classroom, the way they need to develop professionally, and ultimately how they function in a rapidly changing society.

In Vietnam, ICT has become a major subject and is being taught in high schools (senior secondary schools, teaching Years 10, 11 and 12). However, the majority of high school ICT teachers in Vietnam have not yet met the requirements of renewed teaching methods and teaching quality. In 2008 the Vietnamese Ministry of Education and Training (MOET, 2008), the ministry responsible for general academic education and higher education, indicated a low level of quality and efficiency in ICT education and training. The curriculum essentially failed to promote creative thinking and self-initiated student learning; some curriculum

content was also considered not to be appropriate for students from highland ethnic minorities. The ministry also expressed the concern that teaching methodologies were generally not innovative. MOET concluded there were not enough ICT teachers, and they were often unqualified, as most had been transferred from other subjects. In addition, MOET considered that there were insufficient policies to attract students to ICT teaching courses at the provincial level.

In 2011, MOET issued specific directions to improve the quality of ICT teaching in high schools, as four major objectives: 1) Retraining ICT teachers to ensure an adequate basis for teachers; 2) Retraining unqualified ICT teachers for transfer to other duties; 3) Encouraging self-study to improve ICT teacher professional qualifications; and 4) Requiring annual training with surveys of ICT teacher qualifications.

Until now, neither the Vietnamese Government as a whole, nor MOET in particular, have acknowledged and designed official evaluations of the ICT education or National Professional Standards for Teachers (NPST) at schools, including the schools in Yenbai Province. By contrast, in Australia in 2010 the NPST was endorsed by the Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA). This entity looked to develop the pedagogical implementation of ICT teaching through expanding student curricula and integrating ICT with selected content, in order to make it relevant, meaningful, useful, and effective in teaching. In 2014, the National Assembly of Vietnam passed a resolution requesting the upgrading of curricula and textbook, in order to enable comprehensive and efficient innovation in general education. ICT and foreign languages were to be a focus for development of independent and creative student ability and practical skills. This program is to be implemented in the 2018-2019 school year.

1.2 Case Study

Case study is the method used for comparison. This thesis reports a comparative case study exploration of the quality teaching of ICT in one secondary school in New South Wales (NSW), Australia and one high school in Yenbai Province, Vietnam. The study is based primarily on the teachers' views of teaching ICT and their

perceptions of quality teaching and learning of ICT. Data collected used document reviews, interviews, questionnaires and classroom observations. Data were analysed using content analysis and emerging understanding, categories, and themes are formed for each case. The findings of this study are applied to the policies and views of ICT teacher professional development, ICT teaching and assessment practices in the two countries at the senior secondary school level.

This study can provide direction for the future development of high school ICT teaching in the province of Yenbai, Vietnam. The comparison with the Australian classroom can also demonstrate the effectiveness of ensuring a holistic view of ICT in life outside the classroom, together with the value of ICT not just as a subject studied for the sake of its content, but as an educational environment where learning in various subjects is made more relevant to life in the 21st century. The value of reducing teacher-student ratios and the importance of stimulating creative student thinking are part of the Australian model that unfolds from the research process.

Australia for its part may need to take a mental step back from the often distinctly postmodern view of education that has characterised education in recent decades, and on occasion could result in a view of constructivist education where subjective, reflexive thinking can be opposed to scientific values. Australian education needs to be able to recognise that within Marxist education is a strong stream of scientific reasoning that, while it may not always coincide with Western scientific reasoning, tends to produce graduates with good technological skills. Although ICT education in Vietnam is not conducted using the extensive variety of ICT practices found in Australia, it achieves good specific results in programming. There is also evidence of strong student motivation to succeed in the study of ICT that can serve as a model for Australian education, where access to university is not as difficult. To take the value of Internet access as a general example, the provision of information and equipment does not necessarily result in proportionate student development, and Vietnamese education's orientation towards nation building emerges from this study as a model that Australian students could emulate to their advantage.

Thus, this thesis argues that understanding the Vietnamese system of ICT education could potentially be of considerable value to Australia, and at the same time Vietnam

could benefit from observing the creative thinking of Australian students in a broad ICT context. For Australia, such understanding could similarly apply to the system of ICT education in the People's Republic of China, where underlying Marxist values similarly exist.

This thesis outlines the results of two case studies based on a comparison of ICT teaching and learning in one secondary school in Vietnam and one Australian school, between 'Yenbai School' in Yenbai Province, Vietnam, and 'Sydney School' in New South Wales (NSW). The study investigates similarities and differences in pedagogies, policies and views of quality of ICT education between the two schools and cautiously compares and questions the two countries. The Yenbai School and Sydney School case studies are a first step in making a comparison between the two countries. After some difficulty in obtaining permission to observe Year 11 classes at a NSW State school that was approximately equivalent in relative socio-economic terms to Yenbai School, 'Sydney School' was selected. Sydney School is a private school located in the City of Sydney. The question of the validity of the comparison between the two schools is taken up Chapter Three, where the concepts of representativeness and generalisability are discussed.

1.3 Problem Statement

This section offers a brief description of ICT education in both countries. In Vietnam, ICT has become a major subject, and is being taught in all secondary schools. However, the majority of ICT teachers in Vietnamese secondary schools struggle to meet the quality requirements for ICT teaching. According to MOET (2008) only 40 per cent of teachers have an ICT academic background while the other 60 per cent are primarily qualified in mathematics and sciences and have only recently received a degree of information technology training. This presents serious challenges to ICT education and training. Vu (2008) reports a shortage of ICT teachers, that their training is not synchronous with school structure, and that their knowledge is limited, not suited to teaching requirements. Significantly, Vu finds that most ICT teachers in high schools are aware of the need to renew their teaching methods. He finds that reluctance to teach informatics, for example, relates to their lack of basic knowledge, limited pedagogical strategies and inadequate English

language skills. Teaching tends not to be innovative. Accordingly, students are not learning because they perceive the subject as not important. Further, some curriculum content is not appropriate for ethnic minority students from the highland area. Reforming ICT education is an important challenge facing Vietnamese educators.

The situation is different in Australia. The importance of ICT education is established among Australian educators, and all Australian governments are supporting major programs to increase its use in schools. The development of ICT education in Australia has taken important steps. Many teachers have an ICT background, and computing resources are widely available (De Bortoli & Thomson, 2010). According to the Australian Government (2013), it has made major achievements in ICT teaching and learning: Schools provide 1:1 student to computer ratios for all Year 9 to 12 students across the country; teachers generally recognise the importance of professional learning in ICT, and ICT teachers are confident and competent in using ICT and digital resources in the classroom.

1.4 Objective of the Research

In recent years, education and training in Vietnam's Yenbai Province has focused on directing development teams to gradually increase the quality of teaching for high school teachers. However, the high school teachers have limited expertise in building a capacity for technological applications and for developing pedagogical techniques. At the same time Yenbai Province has specific geographical problems, with mountainous terrain and a population scattered across a wide area. Thus, expanding the school network as well as attracting and arranging for team teachers in regional districts and remote areas are difficult tasks.

Resolution 10 of the Yenbai Provincial Committee (YPC) (2009) shows an improvement in the quality of teaching and learning of ICT in schools. It predicts that by the year 2015, 100 per cent of secondary schools will be able to accommodate school computers, 100 per cent will have internet connections, and 50 per cent of secondary schools will have a website aiming to support ICT education

and boost the application of ICT service management. Given this situation, and the proposed measures taken to develop high school teacher teams in Yenbai province, dedicating special attention to the development of quality high school ICT teachers is justifiable and essential to ensure uniform teacher quality and an adequate supply of qualified teachers. In this context, this comparative study of the development of ICT teachers in Australia and Vietnam will address the research questions below.

The main research question is: What are the key characteristics of the quality teaching and learning of ICT education in NSW and Yenbai Province?

The study is guided by the following three sub-questions:

> 1. What standards and criteria are used to evaluate ICT teaching and to assess student learning in NSW and Yenbai secondary schools?
> 2. What do teachers consider to be factors that contribute to quality ICT teaching and learning in NSW and Yenbai secondary schools?
> 3. What are the current ICT teaching strategies in NSW and Yenbai secondary schools?

Background of the Researcher

The researcher, Manh Thang Tran, has sixteen years of school teaching experience in Vietnam schools. He is currently employed in the Yenbai Department of Education and Training (YDET), and has developed a solid working relationship with a number of academics, principals and teachers in Yenbai. In 2006 the researcher participated in a Vietnam-Belgium Education Project, which focused on improving the quality of the training of primary and secondary school teachers in the mountainous northern provinces of Vietnam. In 2009, he was directly involved in assessing the quality of ICT teachers in Yenbai province, where teachers were surveyed and tested, although no report was ultimately compiled.

The researcher has chosen the research topic: "Exploring Quality Teaching of Information and Communication Technology in New South Wales and Yenbai Secondary Schools: A Comparative Case Study" with the expectation that a comprehensive comparison of the similarities and differences in teaching, learning

and assessment in ICT in NSW and Yenbai secondary schools may lend further direction to the progress in the secondary schools of Yenbai Province.

1.5 Significance and Aims of the Research Project

The study aims to make a significant contribution to knowledge, policies and practices in ICT education in both countries. It is hoped that this project in comparative education will make definite contributions to the advancement of ICT in high school teaching and learning. It endeavors to determine more precisely the distance between the current ICT requirements for ICT secondary school teachers and the actual level of performance by teaching staff. This study also aims to propose specific ways to facilitate quality training of high school ICT teachers which are consonant with the organisation of ICT teacher training. A comparison of ICT education involving examination of their domestic practices will hopefully provide a deeper understanding of factors that will achieve a higher level of ICT achievement by Vietnamese students.

Recommendations derived from this study will provide valuable insights for policies and curriculum reform in Vietnam. It is hoped that results from this study may also benefit Australian educational policy and curriculum developers, general secondary teachers, and ICT teachers in particular. It is hoped that the education community in both countries may benefit from suggestions on raising standards and teaching methodology in ICT to contribute to their development as knowledge-based economies and societies of the 21st century.

From this comparative research on the theory and the practice of quality ICT teaching in Sydney School and Yenbai School, solutions are proposed to improve the quality of ICT teaching in senior secondary schools in both Australia and Vietnam. Particular aspects of research concern the following: a) Views of ICT teachers in Australia regarding recruitment and training; b) The institutional and policy bases of quality teaching in each country; c) Evidence-based information on policy making in education; d) The Australian policy on developing international partnerships in education; e) Teaching methodologies in Sydney School and Yenbai School as a

basis for comparison between the two countries; and f) Suggested applications of innovative ICT teaching methods in both countries.

1.6 Definition of Key Terms

Nine key terms used in this study are defined as follows:

- *Information and communication technology (ICT):* The combination of informatics technology with other, related technologies, specifically communication technology.

- *ICT education:* Teaching and learning with ICT. *ICT teaching strategies:* ICT can transform the teacher role, teacher pedagogies, creating new learning environments and integrating ICT in the curriculum.

- *Comparison or comparative studies in ICT education*: A process where a comparison of ICT polices, curricula and teaching and learning in the different contexts are investigated with a view to revealing their differences and similarities.

- *Quality teaching*: Teaching that is widely recognised by policymakers, practitioners, and researchers, as having the capacity to be a powerful school-related influence on a child's academic performance.

- *ICT curriculum: T*o teach students a sound basic understanding of available software applications and to ensure students are ICT literate. The curriculum is planned and delivered by individual teachers.

- *ICT subjects:* Secondary subjects dedicated to the teaching and learning of ICT subjects in secondary school. In this thesis, ICT subjects will be used to describe both the use of computers and the teaching of programming.

- *Vietnamese secondary (high) schools*: Vietnamese secondary schools generally, as represented by a school in Yenbai city, Yenbai province, Vietnam, selected for this study.

- *Australian secondary schools*: Australian secondary schools generally, as represented by a school in Sydney, New South Wales, Australia, selected for this study.

1.7 Outline of Chapters

This first chapter has presented the background to the study and described the problem, purpose, key terms, and research questions. Chapter Two reviews the literature pertaining to the field of comparative studies of ICT achievement and provides further background to the study, leading to the research design and methodology described in Chapter Three. Chapters Four and Five present an overview of Australian and Vietnamese secondary ICT teaching and learning policies and ICT curricula. Chapter Six compares ICT policies, curricula and assessment at secondary schools in Australia and Vietnam. Case studies on teaching and learning practices in Australian and Vietnamese secondary schools are reported in Chapters Seven and Eight. Chapter Nine discusses the main findings of the study, and provides a theoretical account to explain the findings and their relationship to an achievement gap. This final chapter goes on to consider the implications of these findings for policy, curriculum reform and teaching and learning practices.

1.8 Summary of Chapter One

This study is a comparative education report on the quality teaching of ICT in Australia and Vietnam based on a) document analysis of several governmental curricula from both countries; b) a case study of one secondary school in New South Wales, Australia, and c) one secondary school in Yenbai, Vietnam. In the first part of the findings, the study presents a detailed document analysis from the two countries. In the second part, it concentrates primarily on the teaching experiences of three teachers and their perceptions of quality teaching and learning of ICT. Data will be collected using document reviews, interviews, questionnaires and classroom observations. The data are analysed using content analysis, and emerging understandings, categories, and themes are formed for each case. The findings of this study have application to the policies and views of the professional development of ICT teachers, and ICT teaching and assessment practices in Vietnam and Australia at the secondary school level. This is a valuable study which could provide direction to the development of senior secondary ICT teachers in the province of Yenbai in the years ahead. For Australia, the study of a different model of teaching ICT that concentrates on programming may well present a challenge in the development of a knowledge economy in the 21st century.

Chapter 2 Theoretical Framework of International Comparison of Quality Teaching of ICT

The major purpose of this thesis is to examine similarities and differences in ICT policy, curriculum, teaching, learning, and assessment practices between senior secondary education in Vietnam and Australia respectively, and to identify significant factors accounting for these similarities and differences. This chapter provides a general, lengthy view of comparative education perspectives on the teaching and learning of ICT in Vietnam to Australia. It will then specifically investigate questions regarding the validity of comparisons in this case study and discuss critical factors that will touch on the basic nature of the enquiry. Several research questions address intended and implemented ICT policies, curricula and assessments in Vietnamese and Australian senior secondary schools, respectively. These questions are explored through documentary analysis and case studies. The main findings are discussed in terms of the research questions.

A rationale for comparative education will be presented in this chapter. Comparative studies of the qualities of teachers and teaching are then reviewed. Next, comparative studies about various aspects of the quality of teaching, learning, and curricula will be discussed, as well as details of some specific aspects of educational quality in ICT education. Also, relevant literature regarding factors contributing to achievement gaps in ICT education will be introduced. Next will be a presentation of concepts and theoretical frameworks related to the quality teaching of ICT in secondary schools and the relationship between teaching, learning and assessment. Finally, there will be a summary of the literature review provided in this chapter.

2.1 A Rationale for Comparative Education

Bray (2010) states that comparison in education is an intersection of social science, education and trans-national research theory to use national data to understand the relationship between education and social assembly and between teaching and learning outcomes. Comparative education theory is set out in this chapter as a foundation for the holistic characterisation of the educational framework in Vietnam and Australia with regard to ICT, and the specific ways in which senior secondary

ICT education is reflected in the Yenbai School and Sydney School case studies. A rationale for comparative education in general is first discussed in this section in terms of its educational importance and purpose.

2.1.1 The origin of comparative education

Comparative education claims its origin in the world of Marc-Autoine Jullien, who first developed it as a field of study in 1817. As (Gautherin, 1993) reports, Mac-Antoine Jullien, revered by many academics as the "father of educational comparison", defined comparative education as the act of contrasting the features and methods of education in different countries. In this case, the way education is developed and taking place in different countries and sociocultural contexts would be compared, to make use of it for the greatest practical education outcomes of the research, with the aim of creatively adapting various aspects found in these comparative studies in more countries (Embozi, 2010).

In 1968 the Comparative Education Society changed its name to The Comparative and International Education Society (CIES). The annual CIES conference creates a social space, where people from different places in the world connect on topics of mutual interest and to learn from others (Swing, 2008). Bray, Adamson, and Mason (2007) indicate that the CIES could help not only researchers but also politicians and practitioners have a wider view in this rapidly changing globalised world with its multidisciplinary foundations, its long-established concern with international agencies' policies and its sensitivity towards culture and context. According to Heyneman (2009), in comparative and international education all orientations are useful, such as world systems, progressive economic theory, cultural reproduction theory and theories of critical pedagogy.

Comparative education has been renewing and developing since the 1990s. Eckstein and Noah (1992) define comparative education in a most general sense to mean inspecting two or more education operations, and referring to any act associated with learning and teaching, in order to discover the differences and similarities between them. Graf and Leung (2000) would later report that comparative education connotes

the analysis of education similarities and differences in two or more national habitats in terms of social, governmental, cultural and further contexts.

Furthermore, Adamson (2012) shows that there are variety of units of analysis covered by the field of comparative education including locations, systems, policies and policymaking processes; cultures, values, conflict resolution and citizenship; educational achievements, international indicators and student performance; curricula, educational organisations, governance and accountability, ways of knowing and learning, ways of teaching, economics of education, assessment, teacher education and professionalism; ideologies, goals and purposes of education, social equity and access to education.

In this study, similarly, comparative studies in ICT education is defined as a comparison of ICT education in different countries or contexts to identify differences and similarities, and to interpret and explain the similarities and differences identified (Al-Debei & Al-Lozi, 2012).

2.1.2 The concept and importance of comparative education

According to Embozi (2010), the comparison in education can be defined in numerous ways but what is common in the definitions is the emphasis on the use of data from another educational system. In the late 1960s, Noah and Eckstein (1969) identified comparative education as capable of being more than a pile of data and viewpoints from the social sciences applied to education in dissimilar countries. They assert that a fundamental premise of comparative study is that people can truly comprehend themselves only in the context of secure knowledge of other societies (Eckstein & Noah, 1992).

Adeyinka (1994) defines comparative education in terms of four objectives: 1) A study of two or more education systems; 2) A research of how the philosophy, goals and objectives, policy and educational practice in different countries affect the overall development in a particular country; 3) A research of how the process of developing education in the past through the ages and continents, has impacted on the change of education in specific countries; and 4) A research of two or more

nations' school systems, and the set up the organisational equipment to accomplish or to control the implementation of government policies in the different levels of the education systems.

The study of comparative education allows the researcher to have a better understanding of the system of education outside his own country in terms of the policy behind educational programs, curricula, teaching methods and activities at high schools in NSW, Australia and Yenbai, Vietnam. Thus, the importance of comparative education is related to its possibilities to contribute to understanding quality education through analysis of educational issues in national, international, and global contexts (Schweisfurth, 2011).

According to Crossley and Watson (2003), comparing education can primarily explain the impact of the characteristics and effects of education systems, policies and practices in the context of national history and cultural difference. For instance, Cowen, Kazamias, and Unterhalter (2009) show the importance of a comparative study in education research focused on recent historical trends and contemporary issues. Moreover, Arnove (2001) points out three educational dimensions of comparison namely: 1) A scientific dimension: Theorise better and more comprehensive level of analysis, more powerful insights and conclusions; 2) A practical and ameliorative dimension: updating and refining educational policy and providing greater international comprehension; and 3) A global dimension: nurturing critical conscience, analytical abilities, ethical sensibilities and tolerance of diversity, as well as the desire to contribute to the well-being of others not only at home but around the world.

Watson et al. (2001) point out the potential contributions of comparative education this way: "In what ways could comparative educationists help to suggest and pioneer new approaches to education? New ways of funding education have been studied comparatively, but new ways of learning and teaching are growing apace." (p.36). Moreover, Smith (2013) suggests that there is something of a resurgence of interest in international comparative education which is largely a byproduct of the growth of international league tables, policy borrowing and policy initiatives being primarily justified by reference to what goes on elsewhere. This might provide a more critical

perspective on the intercultural processes involved in the transfer of educational systems of governance and accountability, pedagogies and educational concepts in the context of an increasingly interconnected world, and help to ensure that any change is for the better (Evans & Robinson-Pant, 2010).

The recent popularity of comparative education might be explained through this internationalisation of educational policies, leading to a diffusion of global patterns and flows of knowledge that are assumed to be applicable in various places. It is important to emphasise that international indicators and standards are not created spontaneously (Nóvoa & Yariv-mashal, 2007). Cowen (2009) points out that "we have 'comparative educations' because what we call comparative education, in its growth, in its shape-shifting, is itself part of international, political, economic, cultural and educational relations" (p.1289). Therefore, comparative education becomes more important because it is used in the development of educational understanding and the creation of new education programs and frameworks (Sellar & Lingard, 2013). An important aspect of comparative education is contextualisation. A nation's education system cannot be viewed in a vacuum, as social, political, and economic pressures are all involved in shaping education systems and determining outcomes. Nations with a strong national tradition of education can have better outcomes with less funding than nations that have not historically valued education (Hans, 2013). Understanding cultural influences is also important when developing assessment and comparison techniques or working on education programs to introduce in new regions.

Zhao et al. (2008) indicate that comparative education can help educators and policymakers to become increasingly aware of the importance of understanding the educational practices of other nations for three main purposes: 1) To assess the relative standing of their own education outcomes as an indicator of global economic competitiveness; 2) To learn from other nations' policies and educational practices in order to improve their own; and; 3) To understand their own strengths and weaknesses in relation to other nations in order to identify areas of improvement. However, it may problematic for researchers to gain benefits from the local literature of another nation as linguistic barriers can be a significant problem. Thus, a more essential difficulty lies in distinctions in research methods and approaches. People

believe that the results of research from different models or may have difficulty to interpreting them (Zhao et al., 2008).

The importance of comparative dissimilar education's systems can supply educationalists with ideas for renewing a system by joining the essentials of others, and will acknowledge people to follow progression over time. This can give strength of an education's system and to provide the significant data of educational results (Hans, 2013).

2.1.3 The purpose of comparative education

Embozi (2010) argues that the aim of educational comparison is to condense critical thinking regarding the education systems of the countries to be compared; the successes and failures, strengths and weaknesses. Noah (1985, as cited in (Phillips & Schweisfurth, 2014)) indicates that comparative education consists of four key objectives: 1) To define the education systems, procedures or results; 2) To support the evolution of educational organisations and implementations; 3) To point out the relationship between education and civilisation; and 4) To set up generalised declarations about education that are legal in many countries.

In discussing the purpose of comparative education, Hans (2013) shows that comparative studies analysed factors from a historical perspective and compared the solution to the problem and tested the result, which is the main purpose of comparison. In addition, he suggests that the aim of comparative education is to explore the basic principles governing the development of all national education systems. In contrast, Kazamias (2001) raises questions related to the purpose of comparative education, the first of which is in regard to the definition itself: Is comparison of education defined as an interest in learning that takes place on a theoretical level to gain new insights? Or is it defined as an object associated with the use of actual political orientation? The second question is related to the value of comparison: Is it intended to help to understand your own system or to change and improve your own system?

In addition, the usage of comparative education is to make easier the preparation of

educational programs, curriculums, teaching approaches and actions. Therefore, the study of different educational systems can simplify educational development at the national level as well as in the classroom. From there, and before educational policies are completed, policy makers need to assess the expected importance of the policy and identify its likely limitations. The study of education systems also shares alike issues or people have created policies to get the better of similar problems to make available for use information for studying the consequences can happen. Case studies on the education systems of different countries may afford data regarding what other countries are doing, planning or changing in their education system, as well as supply necessary information to assist the decision-making process regarding what to accept, amend or evade (Embozi, 2010).

However, Cowen (2009) offers a selection of essential thoughts for an intellectual framework for educational comparisons; that is, space, time, the country, the system of education, educational identity, social context, transmission, and practices. He also determined in educational comparison, as well as the university-based research of the educational model as part of the political relations and international economy. Moreover, García Garrido (1996, as cited in Manzon (2011)) enumerates a number of applications of comparative education, such as how comparative education supports the comprehension of educational activities in other societies, nations, and regions; comparative education is an absolutely necessary tool for the design and the process of coming to decisions regarding educational reforms and innovations; educational comparisons can contribute to international empathy and accord, and the gradual dissipation of ethnocentric attitudes. It can therefore be an influential tool in support of technical education in underdeveloped countries. Some excellent work has been done within comparative education on the processes associated with how policies become culturally translated in new contexts (Beech, 2006; Popkewitz, 2012).

In summary, in addition to the main purposes of comparative education as presented, comparative education also serves other ends as well: 1) To support an understanding of the educational systems of different countries in their educational practices; 2) To support an understanding of the factors that contribute to educational change; 3) To concentrate not only upon the educational growth of a civilisation, but also on the all-

inclusive development of humanity; 4) To contribute as a field of study; 5) To support the advancement of international relationships, and to give to the development of the educational systems in each country.

According to Wolhuter, Likando, Wolhuter, Matengu, and Mushaandja (2011), the importance of comparative education is that it is able to distinguish between a number of functions and applications, such as functions of evaluation, interpretive functions, applications to serve the educational reform, applications to improve teaching and practice.

The purpose of this comparative study is to explore the quality of ICT teaching at high schools in NSW and Yenbai. The researcher will evaluate the status of ICT teachers and offer solutions for the development of ICT teaching in Yenbai high schools.

2.2 Comparative Studies on Qualities of Teaching and Learning

The United Nations Educational, Scientific and Cultural Organization (UNESCO) (2004) reports that: "agreement about the objectives and aims of education will frame any discussion of quality and that such agreement embodies moral, political, and epistemological issues that are frequently invisible or ignored" (p.37). Moreover, Alexander (2008) points out that "quality is at the heart of education and this should satisfy basic learning needs and enrich the lives of learners and their overall experience of living" (p.6).

2.2.1 The nature of educational quality

The nature of quality in education is not easily defined. According to UNESCO (2004), there are two values characterising most efforts to define educational quality: 1) To recognise learners' intellectual development as the major explicit objective of the education systems; 2) To emphasise education's role in promoting worth and viewpoints of citizenship, in fostering creative and psychological development. Leu (2005) shows that the significant factor in promoting the development of education is quality, but the approach to quality education can be very different in each country. Moreover, according to Kubow and Fossum (2007), policies and

development programs of each country always have explicit or implicit educational quality embedded therein because the quality of education will directly impact its potential and promote positive change of society or individuals.

2.2.2 The importance of teacher qualities in education

The National Academies of America (NAA) on its Study of Teacher Preparation Programs: Science, Technology, Sciences, Engineering, and Medicine (2007) shows that the significance of teacher quality is appreciated by researchers, policy-makers and experts. It is important to improve the quality and skills of teachers for teaching.

Desforges (1995) emphasises that teachers spend a lifetime improving on their professional practices, and it is of great significance to continuing development. Moreover, Rivkin, Hanushek, and Kain (2005) suggest that teacher quality is an important factor in predicting academic performance of students, however, constructing measurements of the quality of teachers is a challenging task because of the lack of consensus on what constitutes a qualified teacher. Thus, many empirical studies have been conducted to determine students' academic achievement related to teacher quality (Akiba, LeTendre, & Scribner, 2007). Furthermore, Rice (2003) and Wayne and Youngs (2003) have identified several syntheses of teachers' certification, the knowledge of subject and pedagogy, and experience of teaching as meaningfully associated with higher student achievement of student.

Consortium (2011) shows that a positive and helpful environment will aid in the development of teacher quality, and an annual report on teacher quality of the US (Holdren, Lander, & Varmus, 2010) indicates that in order to strengthen the nation's competitiveness in the global marketplace, the high quality teaching abilities in mathematics, science, technology, and foreign languages is enough to enable America's students to achieve at grade level and above in these subjects.

Though there is a consensus among nations that the quality of teachers and teaching is an important resource, there is a consistent concern surrounding how fairly resources are distributed in the education systems (Ingersoll, 2007). Many countries experience educational innovation and reform based on a positive approach to

teaching and learning but education systems continue to face many challenges, especially in terms of the quality of teachers. In this context, the issue of recognising and strengthening the leading role of teachers in promoting quality is considered the most important (Leu, 2005). The quality of teaching and learning improvement are increasingly becoming a focus of experts, policy-makers, implementers, and evaluators (Leu & Price-Rom, 2006).

Overall, the important factors in determining the quality of education are the characteristics and skills of teachers, such as good knowledge and confidence in subject teaching, suitable teaching methods and variations, good presentation and a capability to work with different people to establish good relationships in the school and community (Craig, Kraft, & Du Plessis, 1998).

2.2.3 Comparative studies on the qualities of teaching and learning

What goes on in the classroom, and the impact of the teacher and teaching, has been identified in numerous studies as the crucial variable for improving learning outcomes. "The way teachers teach is of critical concern in any reform designed to improve quality" (UNESCO, 2004, p.172). Across the world's education systems, few issues have received more attention in recent years than to ensure that school classrooms have teachers with good quality of teaching (Organisation for Economic Co-operation and Development (OECD), 2005), because schooling is compulsory in almost all nations and students are legally placed in the care of teachers for a significant portion of their lives (Ingersoll, 2007).

Craig et al. (1998) discuss new views of the nature of learning, and where the powers and responsibilities for education have combined to change how teachers are considered and how teacher support programs are designed and carried out. Moreover, Ingersoll (2011) points out that improving teacher quality has been central to educational reform because the quality of teaching and learning is one of the most significant factors to help the growth of student during the past 50 years.

Teaching experience of the teacher affects the quality of the teacher. If the teacher has taught many years, improving the academic achievement of the students will be

more effective than with novice teachers. There are many studies that show an important and positive relationship between the number of the teacher teaching years and student achievement (Haider & Hussain, 2014). However, this is not continuous. One study indicates that teachers' success in improving student achievement appears to increase most in the first three years of teaching, but no major improvement in their effectiveness was observed beyond three years of teaching experience (Boyd, Lankford, Loeb, Rockoff, & Wyckoff, 2008). Notwithstanding this, educational policy makers around the world have been interested in the quality of teachers as a major vehicle to improve the quality of student learning (Statistics, 2006).

Recently, the focus of educational reform in systems around the world has been to attract more qualified candidates to the teaching profession, improving their quality by providing support and incentives (OECD, 2005). However, the OECD report of 2005 stated that in different countries, policy-makers were experiencing continuing difficulties with a lack of qualified teachers, especially in the areas of science and mathematics. Teachers' low salaries of teachers and poor working conditions are said to be the main reasons for this, but others are the absence of program induction systems and an unfair distribution of qualified teachers between high-poverty and low-poverty schools. Moreover, the measurements of teacher quality within the contexts of different countries pose methodological challenges. Countries define qualified teachers differently (Akiba et al., 2007). National models of school organisation and political priorities also affect the role of teachers' work and their teaching methods (Cochran-Smith, Feiman-Nemser, McIntyre, & Demers, 2008).

Leu and Price-Rom (2006) report that many countries are implementing education reform based on various approaches to teaching and learning, but education systems continue to be challenged, especially in the recognition of teacher quality and the strengthening their important role. Parkes and Griffiths (2009) advise that comparative education as a pedagogy in teacher education provides an excellent vehicle for developing an alternative agenda in the internationalisation of education, and which stands to make a substantive contribution to the quality of teacher education.

2.3 Comparative Studies on Qualities of ICT Teaching and Learning

ICT education in schools has been affected by the rapid development of ICT literacy among individuals. ICT literacy describes the ability to develop the potential which is inherent in ICT for its creativity in teaching and learning activities (Livingstone, 2012).

2.3.1 The importance of ICT teaching and learning at schools of the world

The emergence of the various technologies and applications systems available in ICT has had a profound impact on societies, revolutionising the ways people access, process, save and spread information within organisations across the world (Ubulom et al., 2011). This revolution is affecting the nature of learning and the manufacture of knowledge, and transforming the world in surprising ways (Arunachalam, 2005), with its influence becoming increasingly pronounced on global scale (Miller & Akume, 2009). Its impact is rapidly being felt everywhere, with more and more necessary ICT products coming into existence (Ikenga, Akiti, & Onyemah, 2009). Thus, ICT education includes more sophisticated higher-order skills and cognitive abilities (Hadjerrouit, 2009).

According to Rautopuro, Pöntinen, and Kukkonen (2006), ICT functions in school education in three respects. Firstly, it is used as a kind of teaching and learning facility, making use of databases in subject areas such as mathematics or science. Secondly, its many learning materials enable it to work as a beneficial learning environment. Thirdly, it is considered as a subject in itself, in which its knowledge, concepts, skills and processes can be learnt. Though there are varying definitions of ICT, many researchers believe that it is nonetheless quite a new field, different from mathematics, engineering, and science in its conception (Hadjerrouit, 2009; Mingers, 2006; Tedre, 2007; Whitaker, 2007).

The teaching of ICT in schools is to achieve the goal of training students who will become ICT experts in the future, to change the socio-economic state to connect with globalisation (UNESCO, 2005). Sansanwal (2009) reports that teaching ICT in schools focuses on imparting information which is beyond the sole objective of teaching. However, it is hard to determine a consistent instructive framework, due to

limited research work into its consideration as a school subject (Markauskaite (2007). Hadjerrouit (2009) points out that there are five problems related to the lack of ICT research: 1) ICT in secondary education suffers from misunderstanding and disagreements about its theoretical foundations. For example, how to define the distinction between ICT as a subject and ICT as a tool, and as a consequence there has not yet been found a coherent theory that takes into consideration the manifold aspects of ICT; 2) Woollard (2005) states that the instructing of ICT is still in its early stages, and an expanded research base of publications on the teaching theory of mathematics is required; 3) a big problem for ICT teachers is the difficulty with using software. Continuing software development resulting in newer and newer versions leaves teachers unable to grasp all the specifications in the software packages; 4) Some ICT subjects are more difficult to teach than others, as they may require ICT teachers to have knowledge and understanding of other science subjects; 5) Whether or not the learning of ICT should be obligatory like mathematics or science affects its nature as a school subject in terms of determining its content, methodology and assessment. ICT as a subject is increasingly important by high school because it can help students to understand computer science and the concept of algorithms. To achieve better results in other subjects and for students to know how to use information in particular ways, it is important that they become familiar with ICT at an early age.

This is easier said than done. Farrell et al. (2007) point out that ICT teaching and learning in secondary schools face many difficulties in the provision of infrastructure, curricula, teachers, content and methods of teaching and learning:

1) Infrastructure: One of the serious problems in the teaching and learning of ICT that schools face is insufficient infrastructure. For example, the teaching of some programmes and manipulation of some software applications are difficult due to a lack of computers for practical lessons and didactic materials which can help students learn ICT;

2) Pedagogic resources: A lack of textbooks and reference books for teachers and students;

3) Teacher training: Most of those teaching ICT still lack the benefits of a well-structured training programme for ICT pedagogy;

4) Motivation: Most students do not recognise the importance of ICT learning in schools;

5) Curricula: The development of curricula for the teaching of ICT as a subject is still at an early stage and have not been clearly identified in response to a programme and the time allocated for its teaching;

6) Teaching approach: ICT is being taught using traditional teaching methods which need to integrate new ICT pedagogy; and

7) Finance: The finance essential for the sustainable teaching and learning of ICT is lacking.

2.3.2 Comparative studies on ICT achievement

The International Association for the Evaluation of Education Achievement (IEA), established in 1959, is a cooperative network of research centres that conduct international comparative studies on schools and aid the research community in developing international tests and statistical analyses (Husén, 1967). Today, membership of IEA consists of institutions from more than 63 counties and 14 benchmarking entities (regional jurisdictions of countries such as states) to enable international comparisons among the key policy variables in curriculum, instruction, and resources that result in higher levels of student achievement (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009).

In 1997 the IEA decided to conduct the Second Information Technology in Education Study (SITES). SITES focused on assessing the current situation of ICT in education against the presence of pedagogical practices considered important for ensuring that citizens acquired the skills necessary to function well in the Information Society. This project consisted of three stages: 1) Module-1: A school survey (1997-1999) (Pelgrum & Anderson, 2001); 2) Module-2: Case studies of innovative ICT practices (1999-2002) (Kozma, 2003); and 3) Module-3 or SITES 2006 (2002-2005) (Carstens & Pelgrum, 2007): A statistical survey of schools, teachers, and students. The modules are explained.

SITES Module 1
In this phase, 26 countries participated at the primary, lower secondary, and upper secondary educational levels. The data collections and comparisons included

curricula and pedagogy, infrastructure, staff development, and management/organisation. In terms of comparative curricula and pedagogy, the contents of comparison included: *Pedagogical Practice Paradigm, ICT-Related Instructional Objectives, Perceived ICT-related Learning Outcome Expectations and Learning*. The findings revealed a considerable difference between countries in both rising and traditional ICT orientations. It seemed that schools in some countries had chosen and carried out the introductory practices in a broader scope than other countries. Further work needs to be done to identify how much ICT may be devoted to the restructuring of schools in order to enable them to take up and employ this model easily.

In terms of comparative infrastructure, the contents of comparison consisted of *Hardware, Software, and Schools' Investments in Hardware and Software.* The results to emerge from the data indicated fast action by most countries in equipping their schools with computer hardware and software. However, how schools in different countries gained access to ICT equipment and facilities was substantially different. Such differences may be explained logically in that some governments were given to more inspired expansion of ICT-infrastructure in schools than others.

In terms of staff development, the comparison included: *Problems with Regard to Staff Qualifications, Policies with Regard to Staff Development and its Realization, Methods of Transferring ICT-Related Knowledge, Availability of ICT Training Courses, and Respondents' Self-Ratings*. Questionnaire survey results showed that the lack of ICT-related knowledge among teachers created major interference in fulfilling the targets of the schools linked to ICT use. It was not amazing at all from the data that the policy of training teachers in employing ICT in their actual practices was applied by most schools.

In terms of management/organisation, the contents of comparison included: *Attitudes and Beliefs of School Principals toward ICT, Explicit School Policies, Use of ICT for Monitoring Student Progress and for School Administration, and Problems Realizing ICT Goals*. Major efforts to promote their policies, visions, and attitudes concerning ICT, resulted in significant accomplishments in using computers for monitoring students and governing at schools. Nonetheless, much progress remained to be made

not only in countries performing at the lower levels but also those at above-average levels. In spite of the variation in opinions, most schools' principals displayed positive attitudes toward the use of ICT in their schools.

SITES Module 2

In this phase, the study examined the findings from 174 case studies of innovative pedagogical practices using technology from 28 participating countries. The research focused on four main objectives: 1) identify and describe innovations that were considered valuable by each country and that might be considered for large-scale implementation in schools in other countries, 2) provide policymakers with information to use for making decisions related to ICT and its role in advancing national educational goals, 3) provide teachers and practitioners with new ideas about using ICT in the classroom, and 4) identify factors contributing to the successful use of innovative technology-based pedagogical practices.

The results indicated that there were similar aspects in using technology for enhancing innovation in classroom practices in many countries. It can be observed in these cases that ICT use for teaching and learning improvement as well as integrating technology into the curriculum was being conducted by teachers. For instance, teamwork was required for students in taking advantage of computer tools and resources for searching information, publications and product creation. With ICT use, the teachers switched their roles from being the primary source of information to facilitators who offered students tools and techniques, tracked their changes and improvement, and gave assessments of their achievements.

SITES Module 3 (SITES 2006)

In this phase, the study aimed to provide international benchmarks of: 1) how in the information society pedagogical practices were changing, 2) the extent to which ICT was used in education, and 3) how the use of ICT was associated with (changing) pedagogical practices. The data was collected from 22 countries and education systems. The study focused on a survey of schools and teachers, who were using ICT in their practices.

In summary, the IEA studies, especially SITES, tested a considerable number of variables related to ICT achievement, thereby providing a basis for this study. Case studies, then, might be used to explore the factors accounting for achievement differences between East Asian and Western countries (Stevenson & Nerison-Low, 2002). In addition to the IEA studies, there have been a number of other large-scale and small-scale comparative studies: The OECD in 2000 launched a major study on the importance of ICT in education. The study focused on ICT's impact on educational innovation and reform, student learning and experiences, the role of the teacher, ICT partnerships and market developments and, the issue of access to ICT for all.

2.4 Factors Contributing to the "Achievement Gap"

Comparative studies such as SITES and that of the OECD produced survey data indicating that there may be some system-based reasons for differences in achievement between East Asian countries and Western countries. To explain the achievement gap, researchers described various contributing factors.

2.4.1 Teachers' ICT knowledge

According to Okolocha and Nwadiani (2015), the generation that has grown up with ICT has developed intuitive means of absorbing and exploiting the capacities that ICT offers, sometimes to the bewilderment of the older generation. Therefore, ICT teachers need to have ambition, enthusiasm and passion about ICT subjects to transfer to students. They need a high level of confidence and expertise, both in terms of their specialist knowledge and practical skills and their understanding of effective learning in the subject (Doherty & Brennan, 2014). ICT teachers experienced additional problems because ICT was a new learning area (Potgieter, 2004) in which the teachers were neither trained to teach nor sure of what the curriculum expected of them (Ankiewicz, 2003; Engelbrecht, Ankiewicz, & De Swardt, 2007).

Although there were many new textbooks available, their approach and the content presented varied considerably, complicating their selection for schools, as well as the teaching pedagogies of ICT. According to Amengor (2013), it is recommended that

teachers get thoroughly involved in the learning process, which will bring them more confidence, competence, experience and comprehension of the technology and its didactic implications before transfer to students. ICT education in schools has been affected by the rapid development of ICT literacy of all individuals. ICT literacy describes the ability to develop the potential inherent in ICT and the creative use ICT in learning activities and social work (Erstad, 2006; Krumsvik, 2006). Thus, teachers of ICT need to research and learn because it is an important element for the implementation of the potential of ICT teachers in better teaching. However, another difficulty for ICT teachers is that they could not know detailed features of the numerous software packages that they are requested to use, because the software programs continued to be developed and improved (Hammond, 2004).

UNESCO (2011) considers that teachers in ICT education should have the following competencies: understanding of how ICT tools will contribute to the learning objectives; choosing suitable ICT tools to stimulate students' learning and to integrate ICT into the entire curriculum; using ICT tools for planning of learning programmes; and emphasising the quality of the products students create and the contribution to personal learning goals and levels of attainment.

An important implication of this study is that both teacher education and teaching practice in secondary schools need to emphasise knowledge and qualifications that enable trainee teachers to identify the underlying principles of software using multiple forms of representations, especially visualisations (Cohen, 2009). Teacher training and an environment that promotes reflection on teaching practice are vital to support the beneficial pedagogical integration of ICT. However, through a comparative study of the qualities of ICT teachers, Allen, Potter, Sharp, and Turvey (2012) found that teachers of ICT understood how to maintain pupils' interest in the subject. They had a sound level of subject expertise which they used in their planning and teaching. As a result, they used a range of resources and teaching strategies to promote a satisfactory level of learning across most aspects of the subject.

2.4.2 Classroom teaching

Researchers in comparative education are increasingly becoming aware of the need

to examine instructional practices in the classroom (not what teachers *say* they do in the classroom). In this section, the SITES are reviewed. As is globally accepted, the computer in ICT education enters the classroom in order to enhance the quality and effectiveness of so-called traditional teaching, promote students' motivation in learning and provide people with computer skills to carry out productive learning.

Computers in classroom teaching are interconnected in a local network. For example, most of the secondary schools in the Czech Republic are also connected to the Internet (SITES-Module 1, 1999). However, computing lessons always focus on user software and informatics, and the external network is rarely used for obtaining information relevant to other subjects. In addition, ICT classroom teaching will have to be reorganised to accommodate new equipment, and other "material" tasks associated with the introduction of ICT will need to be undertaken at the local level. Involving the relevant people at all levels, especially the local level, is particularly important, given that no one solution or type of ICT equipment will suit all local settings.

ICT offers the chance for using up-to-date media and visuals in the instructional process. As such, the classroom process can be organised in a close-to-reality context. For example, classroom size may make sense at first glance. A second look may consist of a comparison with all other entries of the country's classroom sizes. It then may turn out that the figures of some classrooms seem either too big or too small. To detect these questionable entries, descriptive analysis is performed. Some outliers or weird distributions of scores of some variables can only be detected if they are compared with the statistics of other "unbiased" countries. Several limitations of these studies need to be acknowledged as comparative classroom factors are targeted but the ones outside the classroom are ignored. Therefore, more research is needed to determine their impacts on students' accomplishment by using the data of how students study at home.

2.4.3 Out-of-School curricula

According to Wellington and Britto (2004), the time students spend on ICT at home greatly exceeds that at school. Moreover, learning ICT outside of school is positively

associated with students' achievement in specific subjects, as well as bringing wider benefits including motivational effects, raising the student's confidence (Valentine, Marsh, & Pattie, 2005). Learning ICT out-of-school is less boring because students using computers find interactive and multimodal texts more interesting than books. The Internet is a good source of information (range and depth) and educational materials; ICT may enable multitasking and is perceived by students to improve grades (Valentine et al., 2005) . In addition, ICT study at home is growing rapidly and reflecting parents' desire to provide educational opportunities for their children (Holloway & Valentine, 2003; Turow & Center, 1999).

2.4.4 Standards and content of curriculum

As published comparative studies of ICT achievement include curriculum analysis in the early stages of designing instruments for testing students' achievement, a comparison of standards and curriculum content between countries is a natural process in comparative studies of ICT achievement.

Hadjerrouit (2009) shows that a comparative study of the quality of ICT teachers through ICT didactic shows that there are six basic stages for facilitating teaching and learning processes: 1) Planning: It is important to plan ICT didactic for teaching and learning processes, to allow for effective teaching and learning, such as determining the subject matter, themes, relevant skills, teachers and students behaviour, learning and pedagogic strategies and assessment procedures; 2) Design: This stage could help teachers to bridge the gap between general didactical knowledge and specific ICT knowledge; 3) Instruction: Instruction involves the performance of a variety of teaching and classroom management activities such as proper rearrangement of didactic materials to assist students to better understand the subject taught in classrooms; 4) Assessment: The summative assessment takes place at some periods of the course or year to summarise students' study and examine their comprehension; 5) Evaluation: This phase helps teachers to develop their own ability to self-evaluate their own ICT teaching; and 6) Feedback: This stage gives global information on the failures and successes in teaching and learning ICT in a classroom (theory or practical) to assist the teachers in redesigning their teaching material and making it better in relation to the results.

However, the debate on the relationship between curriculum standards and ICT

achievement can not be resolved by current comparative studies, because the test iterms in these studies assumed common standards of ICT across countries.

2.4.5 Form and content of assessment

Jerrim (2015) indicates that the superior performance of East Asian students might be related to the form and content of tests. He shows that Western students performed better than their Asian counterparts in aspects such as using visual and graphical representations and solving open-ended problems. But he suggests that the uses of manipulative or concrete experience do not guarantee students' conceptual understanding and high performance in paper-pen examinations, in which more efficient and generalised solution strategies are needed.

2.4.6 Cultural context

According to Leung (2014), East Asian countries by and large can be regarded as sharing a Confucian culture. In contrast, Western countries can be broadly identified as countries sharing a Greek/Latin/Christian culture. Moreover, teachers' beliefs and attitudes, and their confidence and competence with ICT, remain centrally important in the pedagogical adoption of ICT, but teachers are not "free agents" and their use of ICT for teaching and learning depends on the inter-locking cultural, social and organisational contexts in which they live and work (Somekh, 2008).

Miyakawa and Casco (2007) report that ICT education has benefited from the comparative studies performed on traditional education of a request endorsed by a growing number of recent publications describe the experience from different areas of the world. Thus, ICT education refers to a process of gathering, accessing and disseminating data for enhanced learning (Miller & Akume, 2009). In addition, comparing the quality of teaching and learning ICT between countries may help teachers fully appreciate the importance of ICT in the implementation of teaching objectives as well as qualifying them to handle ICT as instructional delivery (Ayeni & Ogunbameru, 2013)

Besides the cultural- historical nature of social practices and the mediating role tools play in their development, the proposition will be made that radical structural change

to education systems and schools are needed if schooling is to be transformed by ICT. This approach draws on the insights of a number of other researchers (Cole, 1998; Crook, 2001; Saljo, 1999; Sutherland, 2004). Following Alexander (2001) pedagogy is conceptualised as a set of culturally contextualised social practices, which requires holistic analysis: "Culture both drives and is everywhere manifested in what goes on in classrooms, from what you see on the walls to what you cannot see going on inside children's heads" (p.266).

2.5 Current Literature on Concepts and Framework Related to Quality Teaching of ICT in Secondary Schools

In this section, the advantages and disadvantages of some current studies are discussed in terms of their research frameworks and methodologies.

2.5.1 Research frameworks

ICT comprises knowledge creation and system development processes for solving problems and boosting human competence (Afshari, Bakar, Luan, Samah, & Fooi, 2009). To put it another way, technology can change the way people access, gather, analyse, present, transmit, and simulate information. (See, 1994). The impact of ICT is one of the most critical issues in education (Webber, 2003). Moreover, Aypay (2010) reports that the technological revolution has spurred a new society marked by global changes and innovation in ICT, so that all countries are affecting the economy, politics, labor market, education strategies, and new academic structures. Therefore, a new model is being developed by a global ICT society, which crosses transversally all the communication fields (Salomón, 2010). However, reviews from recent research show that the influence of ICT-related learning on primary and secondary education does not sound promising. (Scheuermann & Pedró, 2010). Earlier, Ungerleider and Burns (2003), at the end of a meta-analysis of over 1000 studies indicated that that there were simply too few studies of sufficiently rigorous design to permit informed policy choices. In this part, key concepts and theoretical framework-related quality teaching of ICT is reviewed to provide a framework of this proposed research.

There are three different approaches for teaching ICT at schools in Asia Pacific countries (Farrell & Wachholz, 2003): 1) Teaching ICT as a subject in its own right,

usually starting in high school, to develop a workforce skilled in ICT; 2) Integration of ICT across the curriculum to improve teaching and learning; and 3) Using ICT to promote learning anywhere and anytime as part of the development of a knowledge society in which all citizens have an understanding of ICT.

To develop an integrated model of ICT in teacher development, Ng, Miao, and Lee (2009) present four approaches with a model that depicts an approach *continuum* in which the skills of teachers run from *emerging* to *applying* to i*nfusing* to *transforming* stages of ICT integration. As teachers move through each stage, they develop an increasing capacity to integrate ICT in day to day activities, from which teachers master effective ICT in teaching. This includes four objectives: 1) In the emerging stage, focusing on the development of teachers to use ICT as a communication gadget and standardised test systems. Teachers and learners often know how to use ICT with basic ICT literacy and skills; 2) In the applying stage, focused on the development of digital literacy and how to use ICT to improve professionally in different disciplines, especially in the teaching and learning; 3) In the infusing stage, focusing on the development of teachers on the use of ICT to guide students through complex problems and manage a dynamic learning environment; and 4) In the transforming stage, teachers are themselves master learners and knowledge producers who are constantly engaged in educational experimentation and innovation to produce new knowledge about learning and teaching practice.

UNESCO (2008) designed the ICT Competency Standards for Teachers (ICT-CST) to help educational policy-makers and curriculum developers identify the skills teachers needed to harness technology in the service of education. The ICT-CST framework was created by crossing three approaches to ICT integration in education with six components of the educational system that included Policy and Vision, Curriculum and Assessment, Pedagogy, ICT, Organisation and Administration, and Teacher Professional Development. The UNESCO ICT-CST project set four standards: 1) To constitute a common set of guidelines that professional development providers can use to identify, develop or evaluate learning materials or teacher training programs in the use of ICT in teaching and learning; 2) To provide a basic set of qualifications that allows teachers to integrate ICT into their teaching and

learning, to advance student learning, and to improve other professional duties; 3) To extend teachers' professional development so as to advance their skills in pedagogy, collaboration, leadership and innovative school development using ICT; and 4) To harmonise different views and vocabulary regarding the uses of ICT in teacher education.

The ICT competency framework (UNESCO, 2008) has five of advantages: 1) Clarity: It will be clear for everyone to see what is required of a qualified teacher as knowledge, skills, behaviors and attitudes to ICT use in the education environment; 2) Comprehensiveness: It is essential for all pre-service teacher education institutions to set up graduation requirements to meet the criteria of capability, and in-service providers will need to assure the competency framework publicly through their ICT professional development programs as well; 3) Minimum standards: student teachers, practicing teachers, administrators will be able to see the minimum ICT competencies required of them and will be able to make efforts in order to achieve and maintain standards; 4) Content and pedagogy: A competency framework can focus ICT integration on practice changes at the classroom level, where integrated technology change contents and pedagogy; and 5) Confidence in teachers: The general public can be confident that students are being taught by educators who have achieved agreed and transparent ICT competency standards.

In Australia, Gill and Dalgarno (2008) indicate that in ICT learning for pre-service teachers, curriculum and personal aspects which comprise attitude, motivation and confidence are crucial. The Australia Curriculum, Assessment and Reporting Authority (ACARA), (2010) reports that to determine the development of ICT competence and assist teachers based on support in the provision of appropriate information and experiences, ICT knowledge, skills and attitudes are manifested in interrelated areas. Hooker, Mwiyeria, and Verma (2011) also report that maintaining an ICT competency framework has the following advantages: Requirements for a qualified teacher in terms of knowledge, skills, behavior and attitudes for ICT use in educational context; ICT integration can be targeted at transformative practices at the classroom level in which content and teaching methods are changed, and at the systemic level where changes in the organisation and structure of the course provision are made.

The NSW Institute of Teachers sets out seven elements of teacher's standards: 1) Teachers know their subject/content and how to teach that content to their students; 2) Teachers know their students and how students learn; 3) Teachers plan, assess and report for effective learning; 4) Teachers communicate effectively with their students; 5) Teachers create and maintain safe and challenging learning environments through the use of classroom management skills; 6) Teachers continually improve their professional knowledge and practice; and 7) Teachers are actively engaged members of their profession and the wider community.

Cavanagh and Mitchelmore (2011) offer three possible attitudes towards ICT. First, technology is regarded as a master, where the teacher is subordinate to the technology due to limited knowledge of its functioning or the influence of the classroom context. Second, technology is treated as a servant, where technology is used to support preferred teaching approaches. Last, technology is used as an extension of self, the highest level of implementation characterised by powerful and creative uses of technology aligned to sophisticated pedagogical skills.

The ICT Competency Framework for Teachers (2009) reports that government, experts and practitioners in the field of education must recognise that ICT can play an important role in supporting educational improvement and reform. A high-quality education serves to advance the goals of social development and economics. Also, in an evaluation by UNESCO of an ICT competency framework, researchers studied the Programme for International Student Assessment (PISA) of ICT literacy. The PISA science assessment consists of a continuum of scientific knowledge and cognitive abilities associated with scientific research, a combination of solving the relationship between science and technology. Moreover, Co-operation and Development (2010) offers a definition of scientific literacy that can be described as consisting of four related aspects: context, knowledge, competencies and attitudes.

The NSW department of education and training gives three major aims for its ICT strategy plan 2010-2011: 1) Provide an innovative, agile and cost effective information technology service that enables and enhances the delivery of quality education; 2) Promote, develop and provide the ICT environment and initiatives that

facilitate, foster and improve teaching and learning to meet individual student needs; and 3) Develop and ensure the assignment of appropriate inputs, decision rights and accountabilities to ensure appropriate investment in ICT and encourage desirable behavior in its use.

2.5.2 Limitation in methods

IEA activities have made a significant contribution to methodologies and the use of tools available. According to Fensham (2007), the design and development of IEA studies were complex, involving a variety of representatives from participating countries, technical advisors, ICT educators and subject matter specialists, as well as major funding agencies. IEA researchers employed multiple research methodologies, including assessment, questionnaires, curriculum analyses and videotapes to enrich the public's understanding of the findings.

There are considerable challenges associated with designing large-scale comparative studies. According to Eckstein and Noah (1992), the IEA tests were required to be internationally uniform and acceptable, to make possible comparisons of levels of cognitive achievement across nations. Moreover, IEA tests may have omitted important elements of policy, curriculum and assessment in particular nations. Other researchers have noted that in the effort to make the studies comparable across nations, methodological and content sacrifices have been made at the expense of a more complete understanding of variations within individual countries. That is, if more carefully researched, these data might better inform national policies designed to improve the educational status of children (Adams, 1993). Furthermore, Fensham (2007) confirms that "among the major components of IEA that posed methodological challenges were curriculum analysis, achievement testing and estimation of proficiency".

In addition, most former international comparative researchers only focused on the attained curriculum by using their uniform examinations to test student achievement, but neglected assessment practices already completed at the local school and classroom level. However, there is a lack of in-depth research that investigates policy, curriculum and assessment factors contributing to apparent differences in

student achievement. There is especially a lack of comparative study incorporating descriptive knowledge of assessment practices and examining similarities and differences in authentic settings. This requires qualitative studies of cases of apparent differences in curriculum and assessment practices, internationally.

In summary, current comparative studies have attempted to address most of the concerns related to students' ICT achievement which were raised in the study community by using a variety of methods. Although a mindful position was taken by researchers to downplay the "horse race" feature of comparative studies on ICT achievement, due to limitations of large-scale studies and the comparison focus on achievement, little attention has been paid to problems of assessing empirical factors in educational contexts. Therefore, there is a real need to use case studies to compare the apparent differences in policy, curricula and assessment practices across cultures, in order to comprehensively understand the achievement gap.

2.6 The Relationship between Teaching, Learning and Assessment

It is widely acknowledged that student achievement is affected not only by officially prescribed curricula, but also by classroom teaching (Lockhart, 2015). Moreover, according to Leung (2001), East Asian education systems are characterised by highly competitive examinations. Teachers and parents attach great importance to education, and there are high expectations for their students and children to succeed. Academic achievement has been considered a means of bringing honour to one's family. This high expectation to succeed provides another important source of motivation for student learning. In addition, the difference in social and economic status between the academically high qualified and low qualified is much greater in East Asia than in the West. This sends a message to students about the importance of academic achievement, and constitutes another source of motivation for student learning.

2.7 Summary of the Broad Literature Perspective

In summary, the literature reviewed in this chapter covers a wide range of studies concerned with comparative studies on ICT achievement. It is suggested that due to limitations of large-scale assessment, there is a need to use qualitative study to

explore policy, curricula and assessment practices in authentic settings cross-culturally. This review has provided a background and framework for designing a comparative study on ICT policy, curricula and assessment between Australian and Vietnamese secondary schools, which will be described in the following chapters.

The comparison between ICT education in Vietnam and Australia does have particular characteristics that will guide research into specific aspects that will offer valid conclusions regarding similarities and differences between the two systems and the teaching methodologies used in senior secondary schools in both countries.

Contextual Factors

What this thesis refers to as contextual factors need to be set out here in general terms, because the context of the syllabus and educational philosophy that underlies ICT teaching and learning in each country will influence the gathering of information and the interpretation of that information. Each case study needs to reflect the ideological and material situation where the teaching and learning process takes place. Adamson (2012) shows that when it comes to the question of a comparison between the two educational systems, it is important to clarify the following areas of potential contrast that may apply:

- Intended curriculum versus the actual practice of the curriculum;
- The application of pedagogical theory in each country in relation to dominant ideological concerns;
- Relative funding questions;
- Student access to electronic equipment;
- The value of general ICT education versus occupational expectations.

Kalenda and Schwartzhoff (2015) discuss the application of "cultural sociology" to the study of education. Culture is not often a meaningful part of analytical studies on education, and existing studies in their view are "mostly based on utilitarian and materialistically oriented approaches."(p.1). Yet in a comparison between Vietnamese and Australian schools, it would be very hard to deny that students and teachers alike begin with very different cultural perspectives.

Constructivist aspects in ICT Teaching and Learning

Vygotsky and the social construction of knowledge can naturally fit into a Marxist perspective. However, the result of the 1990s introduction of Vygotsky into the postmodern/ post-structuralist West, where all knowledge is sometimes held to be just a construct. Of course, this is opposed to a scientific view, but in education it has great potential to help students to think. This is the kind of over-simplification that we need in this research thesis, where constructivism is at the heart of ICT teaching and learning in Vietnam and Australia, but where constructivism itself arguably not only has its particular local connotations but actually means different things in each context.

In the simplifying process that is the aim here, article by Wertsch (1985) is a useful overview of Vygotsky's thinking, where his view that individual mental is shaped by social and historical context. Individual agency remains central, but interaction with society is also fundamental. In his model of cognitive development cultural tools may be accessed equally or unequally. Vygotsky also argued that individual thinking had social origins.

As a general proposition, Vygotsky's ideas have had great influence on the West in discussions of cognitive development in the West, though the transmission of his ideas was delayed until the beginning of the Postmodern era, when the nature of the impact of his concepts went beyond his original thinking in important ways. In considering constructivism in education in Vietnam, it is important to keep in mind that in Vietnam, as a socialist society, the governing party is the Communist Party and there is a dominant role of State and collective property. In Western societies, however, the history of the introduction of Vygotsky's thinking in a climate of Postmodernism and Post-structuralism have meant that constructivism has acquired a different image.

The approach may be seen as characterising ICT teaching and learning in New South Wales schools. The approach is that in the design of science learning environments, it is necessary to have learning activities that acknowledge the centrality of

difference/diversity in learner's interests, motivations and goals, as well as the importance of the social and political context of science education (Zembylas, 2015).

Syllabus and Educational Principles

It is a question, with any (educational) comparison, how one system validly or fairly compares to another system, when the case studies clearly differ on certain basic issues. Two articles on generalisability solve the question of how the two different case studies can be usefully compared. This now apply to comparative education in the present study.

Sharp (1998), in discussing the logic of arguing from case studies that are not demonstrably representative samples, puts forward the idea that empirical method in itself has serious difficulties when it comes to generalising from data. Statistical generalisation is essentially quantitative, and there needs to be a clear justification for specific conclusions. If a logical argument is used to make a case from specific examples, it still needs to be shown that the case in question is typical of the relevant general phenomena. Sharp argues that models, theories and concepts are the theoretical elements that are needed to show the value of a case study, in fact through grouping conclusions from various case studies.

This research provides a systematic and rigorous research procedure for deriving hypothetical statements from multiple case studies in the consumer studies discipline as well as other academic disciplines. This method offers a way to overcome the limitation of individual, data-burdensome case studies bounded by context. It extracts conceptual trends across individual case studies and eliminates these contextual boundaries.

Socio-Economic Factors in a Comparative Perspective

Methodology is needed to enable selective comparison but this should be a cogent and logical comparison by considering the following:
- A rationale to justify the Sydney School-Yenbai School comparison
- A comparison between a developed and developing country,

- A comparison of very different societies and educational systems that has excellent value includes: limitations; teacher qualifications; funding; class size; and cultural factors.

The construction of a model that is proven to be valid and that actually works would be a lengthy and difficult process. This case study is a step in the construction of such a model, and the focus on constructivism with its two different meanings is an indication of the underlying similarities and differences that make comparison difficult. Whether ICT education in Vietnam and Australia show a tendency to run parallel to each other, or to converge, or to diverge further, has not been clearly established. This literature review has shown some of the complexity involved in a comparative study such as this, but at the same time it has shown the workings of positively directed teaching in both countries.

Chapter 3 Research Methodology

The previous two chapters have provided the background to this study and the rationale for an in-depth qualitative study to compare quality teaching of ICT between NSW and Yenbai high schools. This chapter describes the details of the research methodology. First, the relationship between the research questions and the research approach will be discussed. Second, the case selection and sampling are presented. Then, a description of the instruments for data collection including documents review, interview and classroom observation is provided and the process of data analysis is discussed. Finally, the validity, truth-value, traceability and ethics are described and a summary of the chapter is presented. The structure of this section consists of the following five parts: 1) Research approach; 2) Data collection; 3) Data analysis; 4) Validity, truth-value, traceability and ethics of the study; 5) Summary.

3.1 The Interpretive Research Approach

Qualitative research is an approach that seeks to describe and analyse the cultural characteristics and behavior of people and groups of people from the perspective of researchers. Moreover, qualitative research is multi-method in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret phenomena in terms of the meanings people bring to them (Denzin & Lincoln, 2009). However, there is no universal definition of qualitative research. In the literature of social science and applied professional fields, such terms as interpretive, naturalistic, constructivist, ethnographic, and fieldwork are variously employed to designate the broad collection of approaches that we call qualitative research (Locke, Silverman, & Spirduso, 2009). In addition, according to Mack, Woodsong, MacQueen, Guest, and Namey (2005) qualitative research is a kind of scientific research, which aims to find answers to a question, use a system of predefined procedures to answer questions, gather evidence, produce findings that are not predefined, and produce findings that can be applied immediately beyond the boundary of the study.

The advantages of qualitative methods in exploratory research are to use open-ended questions and to explore opportunities for participants to freely answer, rather than forcing them to choose from fixed reactions, as in quantitative methods. Open-ended questions can evoke responses that are meaningful and culturally important, unexpected by researchers, and an explanation in the richness of natural context. Creswell (2012) indicates that by using qualitative research, the researcher builds a complex picture, a comprehensive analysis of the detailed report from the perspective of providing information and conducting research in a natural setting. The choice of research methodology is closely related to the research questions (Yin, 2013). As mentioned in Chapter 1, the main research question for this study is:

What are the key characteristics of the quality teaching and learning of ICT education in NSW and Yenbai Province?

This research question aims to explore factors contributing to differences and similarities in ICT teaching and learning at high schools between two countries. It is believed that a qualitative approach will provide the rich description that will enable a deeper understanding of the teachers' perceptions of the innovation that has affected the teaching and learning of ICT in each particular organisation (Rampersad, 2011). Using a qualitative research methodology, document analyses and case studies were selected as key methods for collecting data (Creswell, 2013; Yin, 2013).

3.1.1 Document analyses

As discussed in Chapter 1, the first sub-questions of the study relate to policies and curriculum standards of ICT teaching and learning: What standards and criteria are used to evaluate ICT teaching and to assess student learning in NSW and Yenbai secondary schools? To answer this question, document analyses will be used (Brown & Thompson, 2011). As discussed in Chapter 2, the important documents associated with government policies and intended curriculum addressed in international comparative research as well as IEA (SITE 1, SITE 2, SITE 2006) studies include government policies and guidelines on ICT teaching, learning and assessment, and ICT content and related teaching programs that find to produce specific ICT outcomes. By using document analysis, explicit descriptions of Australian and

Vietnamese ICT curriculums can be analysed. This is focused on the secondary school ICT policies, curriculum, its content, and teaching, learning and assessment guidelines.

To explore the research question relevant to Australia's intended ICT policy, curricula at both national and state (NSW) level are described and analysed in Chapter 4. To investigate the research question in relation to intended Vietnamese ICT policy, curricula at the national level are described and analysed in Chapter 5. Following these analyses, Chapter 6 focuses on a comparison of Australian and Vietnamese documents, with is implemented to answer the research question focused on similarities and differences between intended ICT policy, curricula and assessment of both countries.

The document analyses encompass two main components: First, a highly detailed description of policy, curriculum guidelines, syllabus, assessment and textbooks; second, a critical evaluation of the policy and curriculum rationale; and the limitations and strengths of the documents. The process of document analysis consisted of three steps. The first step was to select appropriate documents. The Vietnamese ICT policies, curricula and textbooks are highly controlled, and issued by the Vietnamese Ministry of Education and Training. In Australia, the most difficult aspect of document analyses was choosing the most influential documents that represented authentic ICT policies, curricula and assessment practices (Prestridge, 2012), as the country has different organisations that have various roles and play by different rules. In contrast to Vietnam, curriculum implementation in Australia is largely a matter for individual schools, even though mandated state documents are required. The second step was to categorise each document into key segments on which more detailed analysis could be completed. The last step was to compare key differences and similarities between the documents and discuss the rationale underlying the similarities and differences identified.

3.1.2 Case studies

The case study is a research methodology common in social science. It is based on an in-depth investigation of a single individual, group, or event and explores causation

in order to find underlying principles. According to Yin (2013) a case study design should be considered when the focus of the study is to answer "how" and "why" questions. Moreover, case study research excels at bringing us to an understanding of a complex issue or object and can extend experience or add strength to what is already known through previous research (Soy, 1997). In this research, a qualitative case study is employed. As mentioned earlier, the study will be guided by the following two subsidiary questions:

1. What do teachers consider to be factors that contribute to quality ICT teaching and learning in NSW and Yenbai secondary schools?
2. What are the current ICT teaching strategies in NSW and Yenbai secondary schools?

To answer these questions explicitly, case studies were selected as the most appropriate research method. As discussed in Chapter 2, in the field of comparative studies of ICT achievement, Husen (1967b) recommended that in order to investigate classroom instruction and the relation between learning at school and home, it would be especially fruitful to apply the case study method. Moreover, Stevenson and Nerison-Low (2002) suggest the use of case studies in international comparative studies on achievement, so as to interact with the respondents, to probe for details, and to elaborate answers.

According to Yin (2011, 2013), a proponent of case studies in the social sciences, indicated that the essence of the case study is enquiry in a real-life context, as opposed to the contrived contexts of experiment or survey. He describes the case study method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. Merriam (2014) shows that qualitative case study can be defined as an intensive, holistic description and analysis of a single entity, phenomenon or social unit. Case studies are particularistic, descriptive and heuristic, and rely heavily on inductive reasoning in handling multiple data sources. In fact, the qualitative case study is a methodology to research for an image of the macrocosm from study of the microcosm. Two case studies were considered appropriate for the study.

3.1.3 Case selection

In this research, two high schools (one from Australia and one from Vietnam) were selected for case studies. One high school in Australia was chosen from the State of NSW and one high school in Vietnam was chosen from the Yenbai metropolitan region. The selection of the two schools for the study was based on access, location and background of the researcher, and a unique relationship and comparability between the two cities. The researcher has more than sixteen years teaching and working experience in Vietnam high schools and Yenbai Department of Education and Training. The researcher also has a good relationship with a number of scholars, principals and teachers in the Yenbai region. This close relationship enabled access to system collected data in Yenbai which would not have been possible for other international researchers or even researchers from other areas of Vietnam. In Sydney, to familiarise himself with the Australian education system, the researcher has been living in Western Sydney Region (WSR) for more than two years. He has been building a close relationship with the Vietnamese community in WSR.

In terms of comparability, both schools are situated in the capitals of a large state or province: Sydney is the capital of NSW in Australia and Yenbai the capital of Yenbai Province in Vietnam. However, the differences in culture make simplistic competitive comparisons problematic if the comparison seeks to assign value, such as this is better than this. This study will avoid such competitive comparisons and using two case studies to promote understanding while using differences as opportunities for enrichment and future direction. The selection of the individual schools for case study involved purposeful sampling (Schwandt, 2007). Two schools were chosen to illuminate particular differences and similarities between educational settings relevant for exploring the quality of ICT teaching. Sydney School was selected as a large metropolitan school in Sydney in NSW. Yenbai School was similar to Sydney School in Yenbai Province in Vietnam. In principle, the selection of two schools is based on five conditions: First, two high schools were selected with stable ICT infrastructure. The meaning of "stable" is that computers must be functional for effective teaching and learning to occur. Second, the schools had to have effective administrative management of ICT computer laboratories. Good

management implies that the computer facilities and equipment should be functional and effectively maintained for optimum use of the technology resources.

Third, the schools had to integrate ICT in the curriculum as an accepted practice in teaching and learning. This criterion became evident through scrutiny of the prospective school's timetable and by observing whether the use of the computer labs or ICT centres was a dedicated curriculum delivery activity (Kozma, 2008). Fourth, the schools had to be sufficiently well resourced in order to facilitate and sustain the use of ICT in teaching and learning (Kozma, 2008). Fifth, the selected schools had to adhere to and implement education policy acoording to the National Curriculum Statement (Kozma, 2008). In Yenbai school, ICT curriculum in teaching and learning implemented "fixation" by MOET's decision from 2007. By contrast, in Sydney school, ICT curriculum is implemented by BOSTES and every year the ICT curriculum is updated and innovated. This is a major difference between the two countries. The issues are presented clearly in Chapter 4 and Chapter 5.

3.1.4 Selection and indentification of participants

In this study, purposeful sampling will be used to select participants for the study (Rampersad, 2011). Without unlimited time and resources, researchers are unable to study or observe all people in all settings (Kawulich, 2005). In addition, Creswell, (2012) reports that participants with these characteristics will be able to purposefully inform an understanding of the research problem and central phenomenon in the study.

In this research, the sample will consist of one teacher from NSW and two from Yenbai high schools, who will be selected based on the criteria that they teach ICT, and deliver the curriculum at both the upper and lower levels of the school. The researcher purposefully (Berg, 2007) selected three teachers at the two secondary schools following four criteria:

1. The teachers had to be professionally qualified. This information was determined from an initial introductory interview with the principals;
2. The identified teachers were selected by their willingness to participate in the study;

3. Three teachers were teaching ICT subject at Year 11; and

4. The selection of teachers was not based on race, gender or age as these criteria were irrelevant to the study.

The principals of the two schools voluntarily agreed to participate in the study. According to Berg (2007), the principal is apparently the gatekeeper of policy implementation. Table 3.1 gives the demographics of principals and teachers that are being investigated.

Table 3.1 Summary of principals and teachers

School	Unit of analysis	Participants	Profile of participants
Sydney School	Principal	1	Age: Approximate 60 Designation: Principal Qualification: Master degree Teaching experience: 35 years
	Teacher	1	Age: Approximate 50 Designation: Teacher Currently teaching: Years 9, 10, 11 and 12 Qualification: Master degree Teaching experience: 26 years
Yenbai School	Principal	1	Age: Approximate 55 Designation: Principal for the past 8 years Qualification: Master of Education Management Teaching experience: 33 years
	Teachers	2	Teacher 1 Age: Approximate 45 Designation: Teacher Currently teaching: Years 10, 11, and 12 Qualification: Bachelor of Mathematics and ICT Teaching experience: 21 years. Teacher 2 Age: Approximate 40 Designation: Teacher Currently teaching: Years 10, 11, and 12 Qualification: Bachelor of ICT Teaching experience: 18 years.

3.2 Instruments for Data Collection

Higgins (2014) shows that qualitative research encompasses a range of philosophies, research designs and specific techniques including in-depth qualitative interviews, participant and non-participant observation, focus groups, document analyses, and a number of other methods of data collection. Thus, the data for qualitative research consists of detailed descriptions of situations, people, and observation (Silverman, 2013). In this research study, in order to collect authentic and valid data on the quality of ICT teaching in the two high schools, triangulation of the data sources was used, involving document reviews, interviews, and classroom observations. In the following section, a detailed account of each data collection source is described.

3.2.1 Review of documents

Document review uses a variety of existing sources (e.g., documents, reports, data files, and other written artifacts) with the intention of collecting independently verifiable data and information. Yin (2013) reports that documentation can include many different forms: personal documents such as a diary and email, reports of meetings and events, administrative documents, formal studies or evaluations of the same "case", and articles from the mass media. Moreover, Bowen (2009) shows that document review has advantages such as being relatively inexpensive, a good source of background information, unobtrusive, provides a behind-the-scenes look at a program that may not be directly observable, and may bring up issues not noted by other means. However, it has some disadvantages such as information that may be inapplicable, disorganised, unavailable, or out of date, or it may be incomplete or inaccurate (Garner & Scott, 2013).

Document review was used as a data collection method for evaluating the quality teaching of ICT. It includes a basic overview of the official documents used to inform the teaching of ICT in the schools and includes when to use it, how to plan and conduct it, and its advantages and disadvantages in this study.

Table 3.2 gives an indication of artifacts that were sought for data capturing, namely policy documents, curriculum documents, and innovations in ICT teaching and learner outputs.

Table 3.2 Documents gathered for analysis

Policy Documents	National Curriculum Policy and ICT teaching and learning policy in Australia and Vietnam. ICT teaching and learning with circulars, policies, mission and vision statements in NSW and Yenbai.
Curriculum Documents	Worksheets/ICT syllabi and schemes of work
Innovations in ICT teaching and learning	Experience initiatives/Mid-term or annual report

After documents are collected from the two high schools, the researcher will use content analysis to examine the data. According to Silverman (2006), documents represent social constructions and need to be treated seriously. However, Grbich (2012) shows that document analysis is also unobtrusive, and interaction errors between the researcher and participant are avoided. In addition, in the research process, the researcher does not affect the construction of extant documents such as government or school policy, and documents of extant texts often complemented interview and observation data garnered in the study.

To answer the first subsidiary question, documents from two government-policies, the policies of state (NSW-Australia) and province (Yenbai-Vietnam), teachers and principals will be selected for review. To answer the second and third subsidiary questions, documents will be collected from teachers' interviews, principals' interviews, and classroom observation.

3.2.2 Semi-structured interviews

Besides document reviews, interviews are a frequently used method for collecting qualitative data in education research (Atkins & Wallace, 2012) and the most common form of data collection in case studies of educational practices (Bassey, 1999; Yin, 2013). Moreover, interviews are particularly useful for getting the story behind a participant's experiences (King & Horrocks, 2010). Yin (2013) shows that interviewing methods range from highly structured, with the interviewee's responses coded according to pre-determined categories, to open-ended, exploratory conversations between the interviewer and interviewee.

Semi-structured interviews, which are widely used (DiCicco-Bloom & Crabtree, 2006), provide a very flexible technique for small-scale research (Kothari, 2011). They also allow thematic analysis of the qualitative data (Marshall & Rossman, 2010). For this study, semi-structured interviews were considered necessary. The main purpose of using semi-structured interviews was to find out detailed information about the quality of ICT teaching at high schools experienced by the interviewees, and their views about the influence of assessment on students' ICT learning.

Specifically, in this study, the researcher designed 12 questions (Q1 to Q12) for the principals. These questions are divided into two groups (group 1: four questionnaire questions; group 2: eight interview questions). For teachers, the researcher designed 27 questions (Q1 to Q27). The questions are based on the practicality and relevance to the research questions in this study. Table 3.3 shows how the principal's questions and teacher's questions are linked to the research question.

Table 3.3 Interview questions linked to the research questions

Research questions	Principal's questions	Teacher's questions
RQ1	Q5, Q6, Q7, Q9, Q12	Q16, Q17, Q20 to Q27
RQ2	Q6, Q7, Q8	Q6 to Q27
RQ3	Q1 to Q12	Q1 to Q14, Q18, Q19, Q21 to Q27

Mode of interviewee's selection

In Australia, the University of Western Sydney ethics approval, and approval by the NSW Department of Education and Training in Sydney were sought and gained, and copies were sent to the principal of the high school (Sydney School). The letter requesting permission to conduct the research included an outline of the proposed study and a draft of the interview schedule (see Appendix A).

After the researcher has had an initial discussion with the Principal, the Principal was asked to nominate one teacher (teaching of ICT year 11) as a potential volunteer interviewee. After talking with the Principal, individual teachers were approached separately and were given an information sheet and a voluntary participation consent

form (see Appendix B). After the consent form was signed then an available time was negotiated in order to conduct the interviews.

Key personnel of the NSW Department of Education and Training were given an information sheet and a voluntary participation consent form, and after consenting were also interviewed. The rationale underpinning the selection of these interviewees was focused on those who had power and /or influence over the quality of ICT teaching in the school. Their reflections would provide factors and strategies for quality ICT teaching and learning at one high school in NSW and contribute to a better understanding of quality teaching in that high school. The interviewees were those who understood the culture of the school and could reflect on it.

In Yenbai, a similar process was followed. First, an officer from the Department of Education and Training in charge of the high school ICT teaching (Yenbai School District) was approached and interviewed. Secondly, as recommended by this person, the researcher approached, gained consent and interviewed the Principal of Yenbai School. Then two ICT teachers (teaching year 11) were nominated by the Principal, and they gave voluntary consent to be interviewed. All teachers' interviews were collected after satisfying the conditions such as there being no existing relationship between the participants and researcher, their participation was voluntary and they could withdraw at any time.

The interview process

Semi-structured interviews, using open-ended questions were consistently used for all interviews. These questions provided the informants with a frame of reference yet allowed them to answer as they chose. In this type of interview, the advantage was that it could provide a descriptive account of key informants' opinions, an explanation of relationships and culture interpretations (Cohen & Crabtree, 2006).

In order to approach the principals, the researcher obtained the names and email addresses from the website of NSW Department of Education and Training and the Yenbai Department of Education and Training. The principal will receive an invitation, including teacher material. The teacher material that is passed on by the

principal includes an information sheet, a voluntary consent form and a reply, with a pre-paid addressed envelope. The teachers' details will be taken from the consent form. Prior to any interviews, all participants will be phoned or contacted by email to confirm the correct times and places.

Before the interview, the participants were recruited to participate in the research study through sending them information sheets via email about this project. Then the participants will be invited to fill consent form to take part in the research. The research will continue if no Year 11 teachers agree to participate because the researcher's research panel has long standing relationships with the local schools and this should not occur. However, if it does occur then another Year Teachers cohort will be recruited, such as a Year 10 in Australia, as the researcher will not have difficulty in Yenbai recruiting the desired cohort of teachers. In both countries the principal will be sent an invitation letter containing material to be passed on to the teachers. The letter to the principal will stress that this is a voluntary process whereby teachers may withdraw at any time without penalty and that the researcher will not communicate to the principal which teachers are participants. In the teacher material again it will be stressed that it is a voluntary process whereby teachers may withdraw at any time without penalty and that the researcher will not tell the principal who are participants.

Each interview was audio recorded with the consent obtained from interviewees, ensuring that the content of the interview was conserved for checking and analysis. Where applicable, interviews were conducted in Vietnamese and an independent and professional translator later provided translations. After the interviews, a draft of the transcript was sent to the relevant interviewees and they were asked to confirm the accuracy and provide additional comments or information. Some of interviewees did not have time to verify the transcript of the interview and so the recording was considered representative of their responses. Translations of transcripts from Vietnamese to English were checked by an independent researcher and linguist at the University of Western Sydney. Transcripts in English were checked against digital audio records by two academic supervisors and by a research assistant.

Principals' interviews

Before the interview with the Principal of each school, some general information related to ICT teaching and learning at the school was obtained from the internet and other sources.

Semi-structured interviews with open-ended questions (see Appendix C) were used to collect the school's background information, as well as policies of the school, the curricula and special programs, the recruitment criteria of teachers, and general information about ICT education. The key information explored in the interviews related to the quality of teaching and learning of ICT, assessment policies at the school level and the principal's views of these issues. There were 12 questions in total designed by researcher; usually the interview lasted 50 minutes. Interviews of the two principals (one form Sydney school, one from Yenbai school), took place in the interviewees' offices and lasted approximately 50 minutes. All interviews were audio recorded with given consent and after the interviews, drafts of the respective interview transcripts were checked by the relevant interviewees themselves.

Interviews with Teachers

As recommended by the Principal of the school, teachers from Year 11 were selected as interviewees. The teachers' interviews consisted of 27 questions (see Appendix D) designed by the researcher and included demographic information on the class, interviewee's teaching experience, and knowledge related to ICT teaching and learning. In the planning and preparation to conduct the interviews, the researcher had to consider various aspects and conditions for data collection such as the identification of the participants, pre-meetings with participants, permission to conduct the interview, duration, location and the constant scheduling and rescheduling for each interview. The researcher conducted a semi-structured interview with each of the three teachers at their respective schools during the course of their normal professional activity. Since this study was exploratory in nature, an open-ended interview protocol was deemed appropriate (King & Horrocks, 2010). The key information sought from teachers was related to "what", "how", and "why" quality of ICT teaching and learning. Generally, it took approximately 40 minutes to conduct each interview. Most interviews with teachers were conducted in the

classroom during lunchtime, because the teachers were too busy to take time away from their everyday practice. All interviews were audio recorded with consent having been obtained.

3.2.3 Classroom observation

Classroom observation is used to gather information and detail information of what is actually happening in high school classrooms. It is often a good way to begin to explore a situation that the researcher wants to know about. It can also add information to other sources of data that the researcher may be collecting (Rubin & Rubin, 2011). Moreover, Silverman (2013) shows that the observational data gleaned was for the rationale of giving a description of the classroom activities, teaching and learning, socio-cultural settings, and most important, the meaning of what is observed from the perspective of the participants. Classroom observation not only afforded the researcher an opportunity for deeper understanding of the interviews (particularly to observe issues that participants were not willing to discuss or participants themselves were not aware of), but also provided knowledge of the context in which policy implementation unfolded.

The qualitative approach, on the other hand, typically uses participant observation during which observers immerse themselves in the classroom situation that they are observing for long duration, interacting with the subjects (called informants) and also interviewing them formally (Merriam, 2014). Thus, using classroom observation allows educators to do such things as permit the researcher to study the processes of education in a naturalistic setting; providing more detailed and precise evidence than other data sources; and stimulating change and verifying that the change occurred.

The descriptions of classroom observation that are provided by this method have also been found to lead to improved understanding and better models for improving teaching and learning. During the whole process, detailed field notes on the focus of the study, as well as other background information, and transcripts of the informants are taken in full and some of the excerpts quoted verbatim in the research report. Flyvbjerg (2006) asserts that a high level of research validity can be achieved using this methodology. However, classroom observation has disadvantages, namely three issues: 1) Research has shown that observers often misunderstand what they see, and

base their decisions upon their own biases or ideas about what is going on in the classroom; 2) The presence of an observer may alter or distort the behavior of the person being observed (in other words, the student might act differently when he/she knows that the observer is in the classroom); and 3) Observations can be time-consuming (Ary, Jacobs, Sorensen, & Walker, 2013).

Nevertheless, classroom observation serves many valid and important educational purposes. There are three important purposes or areas where systematic classroom observation has been widely used: 1) Description of instructional practices; 2) Investigation of instructional inequities for different groups of students; and 3) Improvement of teachers' classroom instruction based on feedback from individual classroom or school profiles.

According to Ary et al. (2013) the observation format consists of four main parts: 1) Contextual issues, 2) Classroom management, 3) Instructional issues, and 4) Student interaction. The purpose of classroom observation in this study is to investigate the pattern of ICT teaching and learning at two schools, and to describe the general approach to teaching and learning adopted at the schools. Using this methodology can help to determine whether what participants say is the same as what they actually do in practice. During the process of observation, the researcher focused on well-defined categories of pedagogy, policy, student involvement, ICT skills, time management and ICT teaching and learning in the classroom. For example, in observations from the commencement of the lesson, the researcher used a pre-designed observation sheet (Ritchie, Lewis, Nicholls, & Ormston, 2013) to make notes and record both verbal and non-verbal cues. Moreover, the researcher also used the observation sheet as a formal structure to record anything that was noteworthy, interesting, unusual, or "most-telling" (Charmaz, 2014). In addition, to general background information (data, time, class, number of students), the ICT classroom observation record focused on teacher and student behavior and their interaction through the process of teaching and learning in sequence from the start to the finish of the lesson. The key information sought from observation was focused on activities related to quality teaching, such as teacher analyses of students' responses, noting strategies that students used, or asking students to explain the process of problem solving.

The purpose of classroom observation in this study was to investigate the pattern of ICT teaching, learning and assessment at the two schools, and to describe the general approach to teaching and learning adopted at the school. The ICT classroom observation focused on teacher and student behavior and their interactions through the process of teaching and learning in sequence from the start to the finish of the lesson. The key information sought from observation focused on activities and assessment, such as teacher analyses of students' responses and adjustment of the lesson according to students' responses, noting strategies that students used, or asking students to explain the process of problem solving.

Immediately before the classroom observation, there was a de-briefing between the researcher and the teacher involving the ICT concepts, skills, ideas, or procedures intended for the lesson. After the class, in a post-observation interview, the teacher was asked to explain the rationale underlying the classroom teaching and learning and evaluate the lesson. It was anticipated that 10 ICT lessons (Year 11) in both schools would be observed. Before teachers were interviewed, at least one ICT lesson taught by the teacher was observed. A full description of the lesson observation process is provided in Chapters 7 and 8.

3.3 Data Analysis

The analysis of data in a general way involves a number of closely related operations, which are performed with the purpose of summarising the collected data and organising them in such a manner that they answer the research questions. In this study, the qualitative data obtained will be analysed by application of the condensation analysis method. As Ritchie et al. (2013) show, this analysis approach is used to express the situation from the subject's point of view. Moreover, it develops the meanings of the interviews, provides emphasis on the respondents' understanding and the researcher's own perception. The researcher has applied this approach to analyse the data collected from the interviews, though other data was collected in the form of documentation.

In the following section, the analysis of data from documents, observations and interviews will be described.

3.3.1 Analysis of data from review of documents

From the literature review in Chapter 2, published large-scale comparative studies of ICT achievement, such as the IEA studies, normally use a coding system to analyse and report data about policy and curriculum documents. There is extensive literature to support the coding and categorising of qualitative data (Bogdan & Biklen, 2007). However, a number of authors have challenged the singular focus on these procedures. For instance, Maxwell (2012b) agrees with the value of coding and categorisation for identifying general themes and theoretical concepts to gain general understandings and to test ideals, but states that an exclusive focus on coding runs the risk of neglecting contextual relationships among the data, relationships based on contiguity rather than similarity. When research finds similarities and differences across settings, coding will help address these questions, but if the research asks about how the ways and factors in a specific area are connected, contextualising analysis is required. The conceptual framework developed in Chapter 2 strongly underpinned the documents review, interview schedule and classroom observations. This framework defined the need for both categorisation and contextual analysis. Therefore, in Chapters 4 and 5, these will be used to review and describe the Australian and Vietnamese documents.

3.3.2 Analysis and reporting of data from case studies

From the case studies, the processes of data collection and analysis were simultaneous. Data analysis began with the interviews, classroom observations and review of documents. Emerging insights, themes, and tentative hypotheses were formed over the data collection period for each case. When all the audio-recorded interviews were transcribed, and the classroom observation sheets and documents collected , a more holistic approach to data analysis in each of the caases was adopted. Two cases are reported individually in Chapters 7 and 8 in the order of data collection.

3.3.2.1 Analysis of data from interviews

The analysis of data captured from conversational interviews was coded in the same manner as that of the interview data. The audio recordings of informal conversation (where this was done) and the field notes of the conversations were

transcribed and subjected to the same analysis process as the data from the face-to-face semi-structured interviews. The researcher performed a manual process of coding and categorisation of the data (Miles, Huberman, & Saldaña, 2013). Finally, the researcher began classifying the data to base them on existing theories regarding the topic, and remained "open-minded" about new categories that might emerge from the data (Zacharias, 2011).

3.3.2.2 Analysis of data from observations

In this data collection method, the researcher documented classroom observations of ICT teachers in high schools, as these practices proved helpful in generating data on the implementation of the education policy and about ICT teaching methodology. The rich images of the classrooms provided an opportunity to analyse ICT teaching and learning issues with particular attention to the manner in which ICT teachers used their teaching practises and the explicit teaching strategies they adopted in ensuring that learning outcomes were achieved (Vandeyar, 2010). Moreover, the major advantage of a qualitative approach to audio recordings is that it more easily allows for the discovery of new ideas and unanticipated occurrences. The researcher used classroom observation notes and was watchful for any additional codes or categories that may have emerged. Vandeyar (2010) and Ritchie et al. (2013) suggest that any writing, both in the field and there after, is a representation or a construction of events by the researcher. In addition, field notes often tend to govern where they are constructed and the researcher often attempted to make notes at the research site before leaving. The field notes were then written up in more detail in a private space. The researcher wrote up events as they happened in real time, and distinguished between descriptions that portrayed the physical environment, participants, other people and actions which made up a setting.

In this study, class field notes were used to capture the teaching pedagogy, learning, ICT curriculum content, classroom events and activity visuals (such as writing on the blackboard, or smartboard), as well as verbal communications and content. Therefore, the cases are presented in detail so as to provide a representation of rich data to support the finding of this study. Each case study consists of six sections that forcus on context and coding of classroom practice. The background information on

the school is reported first, then beliefs about the quality of ICT edcation are presented. In third section, the practicality of ICT teachng and learning are provided. The analyses of ICT assessments and factors influencing the quality of ICT teaching and learning are included in section 4 and 5. In the last section, the major themes emerging from each case study are highlighted.

As the major research question of the study was about seeking a rationale to expalin quality teaching and learning of ICT education between Vietnam and Australia, a comparative method was used to analyse the data both within and between the cases.

3.4 Validity, Truth-value, Traceability and Ethics of the Study

According to Kvale and Brinkmann (2009), "the trustworthiness, the strength, and the transferability of knowledge are in the social sciences commonly discussed in relation to the concepts of reliability, validity" (p. 241). To ensure the validity, truth-value, traceability and ethics of the research, special and appropriate methods were used in the study, and will be discussed in the following two sections.

3.4.1 The Validity, Truth-value, Traceability

3.4.1.1 Validity

The validity of the research is not an abstract philosophical concept but a matter of craftsmanship and credibility of the researcher. "Validation does not belong to a separate stage of an investigation, but permeates the entire research process" (Kvale & Brinkmann, 2009). In research, validity has three essential parts: construct, internal and external. These aspects are discussed in the following sections.

Construct validity

Construct validity is a device commonly used in educational research. It is based on the logical relationships among variables. According to Maxwell (2012a), construct validity refers to whether the operational definition of a variable actually reflects the theoretical meanings of a concept. In other words, construct validity shows the degree to which inferences are legitimately made from the operationalisations in one's study to the theoretical constructs on which those operations are based. In

order to ensure construct validity of the study, the participants' data was checked and triangulation of data was used. In terms of participants, all interview transcripts and draft reports were confirmed as accurate, without any change to the meanings of the responses. Moreover, translation of transcripts from Vietnamese was conducted by an independent translator and linguist, and corroborated by two academic supervisors at the University of Western Sydney.

In terms of triangulation, data were selected from differences sources (including different types of informants such as principals, teachers and experts from two countries) and from different methods of enquiry (including interviews, document reviews and classroom observations) to confirm the findings were used. Further the interviews of the educational policy-makers from the two countries ensured that a range of sources was used so those findings of the study were representative and authentic.

Internal validity

According to Charmaz (2014), internal validity increases the problem of whether conceptual categories are understood to have shared meanings between the participants and the observer. Case studies can declare internal validity in data collection and data analysis for three reasons: Firstly, researchers using case studies commonly practice living among participants and collecting data over long periods. This provides opportunities for continual data analysis to refine constructs, and to ensure equality between researcher categories and participant realities. Secondly, observation as the key source of data for case studies is conducted in natural settings reflecting the life experiences of participants more accurately than do more manufactured or laboratory settings.

In terms of each case study and its context, observation is used in the explicit analysis of each individual case, including extensive use of the informant's own words, to enable the reader's access to informants' authentic experiences and an understanding of their beliefs about the quality of ICT teaching. Moreover, description of documents at the system level provides a background to the context of the study. Finally, informant interviews are a major data source for case studies; they

are interpreted in the empirical categories of the participant, which are less abstract than many instruments used in other research design.

External validity

External validity refers to the ability of a research design to provide results that can be generalised to other situations, especially to natural ("real-life") situations. In this study, the issue of external validity relates to the question of whether the findings are representative of the school's cultural context. In terms of the researcher's theoretical stance and research techniques, a detailed explanation has been provided in Chapter 2. The comparative nature of this study enhances the transferability of findings as the data comes from two high schools from two countries, selected on the basis of contextual and structure differences.

3.4.1.2 Truth- value

Truth-value of the findings was accomplished through in-depth data collection that was sought using a wide range of independent and different means; for example, document review, interviews, observations, member checking, and panels of expert judges. According to Marshall and Rossman (2010) obtaining adequate truth-value refers more to the accuracy of the researcher's explanation of the research position than to his or her understanding of what the findings mean or how they relate to other research and theories. Moreover, Zhang and Wildemuth (2009) show that the trustworthiness construct of confirmability is achieved by employing a strategy in which the interview transcripts and the findings were fed back to participants. The process of member checking was to ensure that the findings represented a reasonable account of the participants' experiences. This study approaches the issue of truth-value by ensuring explicit and systematic steps in the interview process and by documenting the process carefully. This study followed the same procedures so a comparision could be made between the data obtained from classroom observation schedules and the teachers' interviews in the main case studies. Thus, the investigation process for each school was made consistent.

3.4.1.3 Traceability

Traceability is the ability to chronologically interrelate uniquely identifiable entities in a way that is verifiable. Traceability is the ability to verify the history, location, or application of an item by means of documented recorded identification (Cohen, Manion, & Morrison, 2007). To improve the traceability of this study, the researcher will systematically document the research process by writing detailed research field notes and recording the cases using rich descriptions.

3.4.2 Ethics of the study

Nduku (2013) indicates that ethical consideration may be closely associated with both moral and political considerations in social research work. Since this study is in the social science area, the researcher has taken into consideration the issue of ethics. In accordance with the ethical requirements of the University of Western Sydney, the research proposal and instruments were submitted to an Ethics Review Committee (Human Research) and approval was received in December 2012 (see Appendix E). Subsequent renewals of this approval were granted. In Australia, the NSW Department of Education and Training gave approval for the study in Sydney Schools and granted permission to review documents and interview curriculum personnel. In Vietnam, the YDET granted permission to conduct a study in Yenbai School.

The participation of the schools and informants was voluntary. The participants were notified that they could withdraw from the study at any time. The identity of the informants and their schools were protected (the schools and informants were given pseudonyms with their locations and names disguised). The transcripts and reports of interviews were shown to their interviewees as soon as possible after the event and were only included in the case record in a form agreed to by the interviewee, and with a pseudonym. This was to ensure the confidentiality of the material and privacy of the key informants (Orb, Eisenhauer, & Wynaden, 2001). Additionally, the schools involved in the study will receive a report on the findings of the study.

3.5 Summary

This chapter dealt with the research design and methodology of this study. The qualitative data collection methods were discussed and a rationale was given for

choosing this particular research approach. The strategies implemented to ascertain trustworthiness were discussed and the data analysis processes were outlined. The ethical considerations and the limitations of this study were outlined. In Chapters 4, 5 and 6, document analysis techniques are employed. In the Chapters 7 and 8, comprehensive descriptions of the case studies are presented from interviews, classroom observations, and document reviews from two high schools.

Chapter 4 ICT and Australian Secondary Schools

Unlike Vietnam, Australia does not have Provinces but States; the States formed the Commonwealth of Australia in 1901 but, as recorded in the Constitution, retained control over the function of education (Harrison, Morgan, & Verkuil, 2004). However, since the late 1880s there has been encouragement from the Commonwealth Government in Canberra for interstate collaboration on school policies, curricula, and assessment and reporting matters (Lacey, 2012). This has increasingly taken the form of a movement towards a nationally coordinated education policy.

In 2008, the Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA), comprised of the Ministers of Education of the five Australian States, with the Federal Minister of Education and the Ministers of Education of the Northern Territory and the Australian Capital Territory jointly issued the Melbourne Declaration, which noted the need for the skilled use of ICT as "in this digital age, young people need to be highly skilled in the use of ICT. While schools already employ these technologies in learning, there is a need to increase their effectiveness significantly over the next decade" (Barr et al., 2008, pp.4-5). The Declaration noted the need for "practical knowledge and skills development" in ICT "as a foundation for further learning and adult life", and saw ICT as central to Australia's skilled economy, providing "crucial pathways to post-school success" (MCEETYA, 2008) .

It is important to note that ICT is "information and communication technology," and will include various related disciplines. There is strong emphasis on the use of technologies in practice. In this chapter, the analysis of Australian ICT policies, curriculum and assessment documents cover both national and state levels, but with NSW as the focus for the analysis. The components of the document analysis comprise both the content and context of the document.

At the national level, the documents are described in the following sections:

> 1) Statements of Learning for ICT at Australian Schools (Australian Education Systems Officials Committee (AESOC), 2006);

2) ICT: The Shape of the Australian Curriculum for Schools (Australian Curriculum, Assessment and Reporting Authority (ACARA), 2012);

3) National Planning for ICT in education (Digital Education Revolution (DER)- Program Review, Final Report, 2014) (White, 2014).

In the second part, the curriculum at the state level, key ICT curriculum, and assessment documents are discussed. These documents are:

1) ICT curriculum year 11 to year 12 (NSW Department of Education, 2013);

2) ICT curriculum year 11 to year 12: Outcomes and Indicators (Board of Studies, 2012);

3) ICT assessment in year 11to year 12 ICT (Board of Studies, 2013).

4.1 Documents at National Level

Nationally, there are three documents that informatively portray ICT in the Australian school curriculum. Together they are a kind of map to guide understanding of ICT education across the country. Following this outline of the three documents, an analysis is provided of the knowledge, skills, understandings and capacities that all students in Australia should have the opportunity to learn, from the point of view of educational instrumentalities nationwide, and what could be taught to achieve educational outcomes.

Statements of Learning for Information and Communication Technologies (ICT) were developed in 2006 for the MCEETYA by the Curriculum Corporation. Curriculum developers can use the statements for various grades to lessen the impact of varying State-level curriculum divergences on increasingly mobile students. These Statements define common outcomes to balance inconsistent curricula across the nation for an increasingly mobile student population. Common curriculum points need to match what all students need to know of a generic "technology" , to enable them to apply what they know and can do to meet their needs or of "ICT" as a specific group of technologies linked by software.

ACARA in 2012 issued a paper on the national role of Technologies in *The Shape of*

the Australian Curriculum, assessing progress in the subjects "Design and Technologies" and "Digital Technologies." It is worth noting that ACARA uses the term *technologies* rather than *ICT*, possibly to include design-related technology and also ensure a broad field of digital technology application rather than information and communication technologies, which may imply more specific uses of technology. ACARA's "Technologies" are discussed below. The third document concerns the *Digital Education Revolution (DER)*, a 2008 initiative of the Australian Government designed to enhance ICT integration in schools through giving students access to the tools to handle new technologies. The DER 2013 impact report is discussed by White (2014).

The following analysis of the three key policy and curriculum documents at the Australian national level considers content, rationale, limitations and strengths.

4.1.1 Statements of Learning for ICT

AESOC (2006) adopted a definition of ICT literacy as: "The ability of individuals to use ICT appropriately to access, manage and evaluate information, develop new understandings, and communicate with others in order to participate effectively in society" (p.2).

Nature and goals of ICT for learning

The nature of ICT for learning is the assertion that ICT has the potential to develop student ability and active engagement in learning processes, and so enable change in thinking. Based on fundamental beliefs about the nature of ICT learning, the goals for all students in Australia expect that students have good chances for enquiry through accessing, selecting and interpreting information. They can go on to ICT solutions for generating ideas and planning effective ICT use for communication and collaboration. Moreover, students need to become ethical, safe and responsible users of ICT. Students are encouraged to go beyond content to study process, and hopefully find this a pleasurable experience.

ICT curricula across Australia

The Statements framework explains the relations between the five conceptual "organisers" which include: Inquiring with ICT; Creating with ICT; Communicating with ICT; Ethics, issues and ICT; and Operating ICT. These are illustrated in Figure 4.1

Figure 4.1 Context for learning and ICT
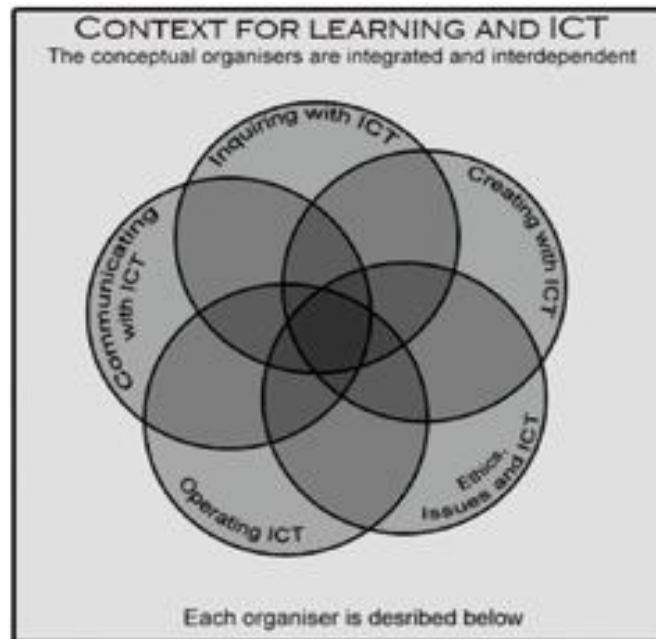
The figure shows both integration and interdependence. Organiser prominence will vary according to context. These features emphasise the active role of students in acquiring ICT knowledge and in the social construction of knowledge. ICT teaching and learning are placed in a meaningful context that includes awareness of the global impact of ICT.

The Statements of Learning focus on five broad aspects of ICT across the curriculum where all students can have the opportunity to acquire abilities, skills, understanding and knowledge including five major objectives: 1) Students use ICT in methods of inquiry and research. They classify access and retrieve data and information. Students organise, operate, structure and adjust information to increase their analyses and conduct new exploration. They use information and data from different sources; 2) Designing Learning Settings with ICT, students create an area of ICT learning solutions to develop understanding, creativity, and supporting thinking processes across the ICT curriculum. They analyse problems, finding ideas and concepts and

assessing learning for ICT solutions. Students know how to select suitable ICT for their plans and to express themselves; 3) Communicating with ICT, students use ICT to improve communication. They develop, interact, and share information and data. They use ICT in face to face communication or across distance with individuals, or local, and global communities; 4) Regarding ethics and issues with ICT, students know the increasingly prominent role of ICT in society and its influence on the self and others. They understand discrimination, ethics, legitimation, and responsibilities when working with ICT. They reflect on ICT issues of the past and can apply future thinking when exploring the impact of ICT developments; and 5) Practicing with various ICT devices, students use ICT functions and applications for the exploration and management of information and data. They competently perform operational sequences with a range of ICT and use features of ICT to achieve curriculum outcomes. Students consistently apply standards and conventions when using ICT. They apply preventative strategies for maintaining ICT and solve basic ICT-related problems as end-users.

The statements aim to provide a systematic framework for students to acquire the skills, knowledge and confidence to make ICT work at school, at home, and in their communities now and into the future (MCEETYA, 2008). There is a link with outcomes-based education, and the Statements are the framework of what might be taught to achieve these outcomes. Essentially the curriculum should help students construct meaning from their ICT learning processes.

4.1.2 The Shape of the Australian Curriculum for Schools: Technologies

The Technologies curriculum, like the Statements, was also a joint project of the States, Territories and Commonwealth of Australia initiated by ACARA. Like the Statements of Learning for ICT, the Shape of the Australian Curriculum is closely linked with outcomes-based education. The Technologies Curriculum illustrates typical progress in achieving teaching and learning outcomes. However, while the Statements were concerned with curriculum input, the Technologies Curriculum was concerned with curriculum output. The Shape of the Australian Curriculum covered Design and Technologies and Digital Technologies; in this section, the structure,

scope, and capabilities and priorities of the ICT curriculum are described in terms of Digital Technologies.

The structure of the Digital Technologies curriculum

The Curriculum for Digital Technologies focuses on engaging students to learn how to think critically, creatively and innovatively when they create, use and manipulate digital technologies. The curriculum is presented as two related strands of skills: knowledge and understanding, and processes and production skills. It is intended that teachers will select technology-specific content from the knowledge and understanding strand and ask students to apply these skills in the processes and production skills strand.

In pedagogical terms, students are to use digital systems, digital information and computational thinking to investigate and explore solutions in various domains of knowledge. Students are expected to understand the relations and interconnection between digital system components and curriculum content in authentic situations. They are to develop and use increasingly sophisticated computational thinking skills and digital technologies processes and techniques to create digital information products, systems or software instructions to address specific problems or requirements.

The scope of the ICT Curriculum

The curriculum for ICT subjects includes 200 to 240 hours of learning across Year 11 and Year 12. The senior secondary curriculum provides students with increased opportunities to make choices about pathways through school and beyond. The curriculum for this stage offers a range of specialised courses that have explicit pathways for more depth of study, multidisciplinary collaborative approaches and sophistication of engagement. There are potential pathways for tertiary study, vocational training or employment.

The Years 11 and 12 Digital Technologies curriculum demands knowledge and understanding, to explore how the design of digital systems can impact on the techniques used. The document also stipulates that students investigate specialised

digital systems. They are to perceive how their studies relate to practical occupational requirements. In terms of processes and production skills, students are be able to create detailed designs and use adequate methods of communicating thinking, symbols, graphics, and technical language. The document also encourages the use of computational thinking to develop increasingly sophisticated digital solutions and digital problems so that students can use software programs in safety, using secure and ethical policies, strategies and protocols.

The aims of Curriculum

ACARA (2012) shows the significant role of ICT in the subject of Digital Technologies: ICT general capability implies that students need to become effective users of ICT and confident developers of information solutions. They can do this by applying computational thinking skills and learning how digital technologies work. In terms of teaching, the curriculum expects that key ICT concepts and skills are to be taught across a wide range of ICT-supported learning activities, as students apply appropriate social and ethical protocols and the various specific practices that effective ICT users need to know.

Digital Technologies asks teachers to show students how to take into account social, cultural and environmental factors in digital systems when using digital information and when thinking in computational terms. Teachers need to show students methods of logical analysis of data and problems and development of problem solving strategies: featuring algorithmic logic and optimal data combinations to generate effective digital solutions. In this curriculum, students are to learn specific software tools and digital hardware devices in order to develop innovative and creative design solutions.

To summarise, Technologies in the ACARA (2012) is an active, creative learning area where students focus on the purposeful use of technological knowledge and skills, as in the creative processes of utilising materials, data and equipment to design and realise solutions. These technological solutions respond to individual, personal, community, national and global needs and opportunities. They are informed by ethics and by personal and social values, and take into account

economic, environmental and social sustainability.These solutions aim to improve quality of life.

4.1.3 National Planning for ICT in education

In 2008, the Australian Government decided to carry out a major intervention in the form of the DER project. This initiative provided computers and software, school-based infrastructures, ICT leadership, and ICT professional development, across all Australian education systems and sectors. There were four driving forces that the initiative made clear: 1) Leadership, infrastructure, teacher capability, and learning resources for students, all vital for ICT in education; 2) The need for all Year 9-12 students to have ICT access in order to use the ICT educational tools of the 21st century; 3) Effective and consistent national distribution of learning resources; 4) Teacher preparation for classroom ICT work through initial teacher education and in-service training.

In 2013, the DER issued a Final Report about Assessing Progress and Potential Future Directions. ICT in education is described in terms of its key objectives, followed by discussions of its achievements to date and of its challenges.

Objectives and scope of the DER review

The 2013 DER report assesses progress and sets out future directions. The report assesses the influence and achievements of the DER initiative as well as progress made toward the objectives, and records stakeholder views on how well the DER is on track in meeting its objectives. Further, it identifies trends in educational technology, including changes in ICT in education since the initiation of DER in 2008.

In terms of scope, a retrospective view assesses the impact to date at the national level, and then looking to the future, the report examines the need for effective technology in education, emerging trends in educational technology, and going beyond DER, implications for future policy directions. The report also includes a review of DER program management by the DEEWR. The development of an ICT strategy through specific projects and the deployment of computers to students

under the National Secondary Schools Computer Fund (NSSCF) is considered through considering the financial value, quality of implementation, and outcomes in particular State level educational jurisdictions.

Achievements to date

Four strands of change are described: infrastructure, leadership, teacher capability, and learning resources. In regard to infrastructure, since first term 2012, the report confirms that the Australian Government has provided one to one computer-student access for all Year 9-12 students nationwide. In terms of leadership, the report confirms that the DER has raised ICT profile among school leaders: leaders have established school ICT committees and leadership groups and have involved parents and students in selecting ICT devices and other technologies. As far as teacher capability is concerned, teaching practices have helped to create effective ICT learning environments and teacher competencies. Regarding learning resources, teacher focus on digital teaching and learning has sparked innovation around digital technology use, and development use and the sharing of online teaching and learning resources have increased.

DER-Associated Challenges

The Report notes five major challenges:

1) A DER-style initiative could also help students to learn from an earlier age, since ICT learning is likely to have important pedagogical value, whereas pedagogical effects are less likely to occur in the higher levels of secondary school where there is more need for up-to-date electronic equipment;

2) Government investment is necessary for ICT infrastructure and equipment, and is a key precondition to attract teachers to upgraded practice and professional development in the digital education scene. It follows from stakeholder recommendations for new ICT-related pedagogy that personalisation of learning is likely to enhance individual learning capacity;

3) Greater broadband connectivity will improve digital learning in some schools, particularly where rural and remote locations are "black spots" for broadband connectivity;

4) The DER has improved technical support in schools. This was difficult in some cases due to complications in finding ICT support professionals to work in school environments, mainly in regional and remote locations; and

5) The DER emphasised the need to engage parents more in their children's technological education. Although existing technology has not always been utilised to achieve optimal communication between parents, school leaders and teachers on curriculum, performance and behavioural issues, the technology now exists for virtual teacher-parent meetings.

The DER initiative was a largely programmatic response to the need for improved infrastructure and capability of education in the field of modern technology. DER succeeded in establishing equity through ubiquitous one-to-one computer access. DER has had a catalytic impact on digital education in schools. However, to truly create and sustain a digital education revolution, a focus on future investments will need to leverage the major shifts in technology and education that are occurring now.

4.2 Documents at New South Wales State Level

Educational reform in NSW, which took place after the election of a Liberal Party Government in 1988, can be traced to the release of three reports in 1989:

The first, the Carrick Report (Committee of Review of NSW Schools, 1989) by education, parent, union and business representatives reviewing NSW school education, recommended the establishment of a Board of Studies reponsible for the K-12 curriculum, and six key learning areas (KLAs) in primary school: English; Mathematical Studies; Science and Technology; Human Society and its Environment; Creative and Practical Arts; and Health, Physical Education and Personal Development.

The second, named the Metherell Report, (NSW Ministry of Education and Youth Affairs, 1989), organised the *secondary* curriculum into eight KLAs: English; Mathematics; Science; Human Society and Its Environment; Modern and Classical Languages; Creative Arts; Personal Development, Health and Physical Education; and, of particular concern here, Technological and Applied Studies.

Finally, the Scott Report (NSW Government, 1989) recommended that the role of the central executive should be confined to policy, management and planning activities.

The major secondary school ICT subjects can be usefully described in terms of content, outcomes, labels and language used, as represented in the graphic pathway for students from the primary to senior secondary level, below:

Figure 4.2 ICT subjects pathways in New South Wales – Australia
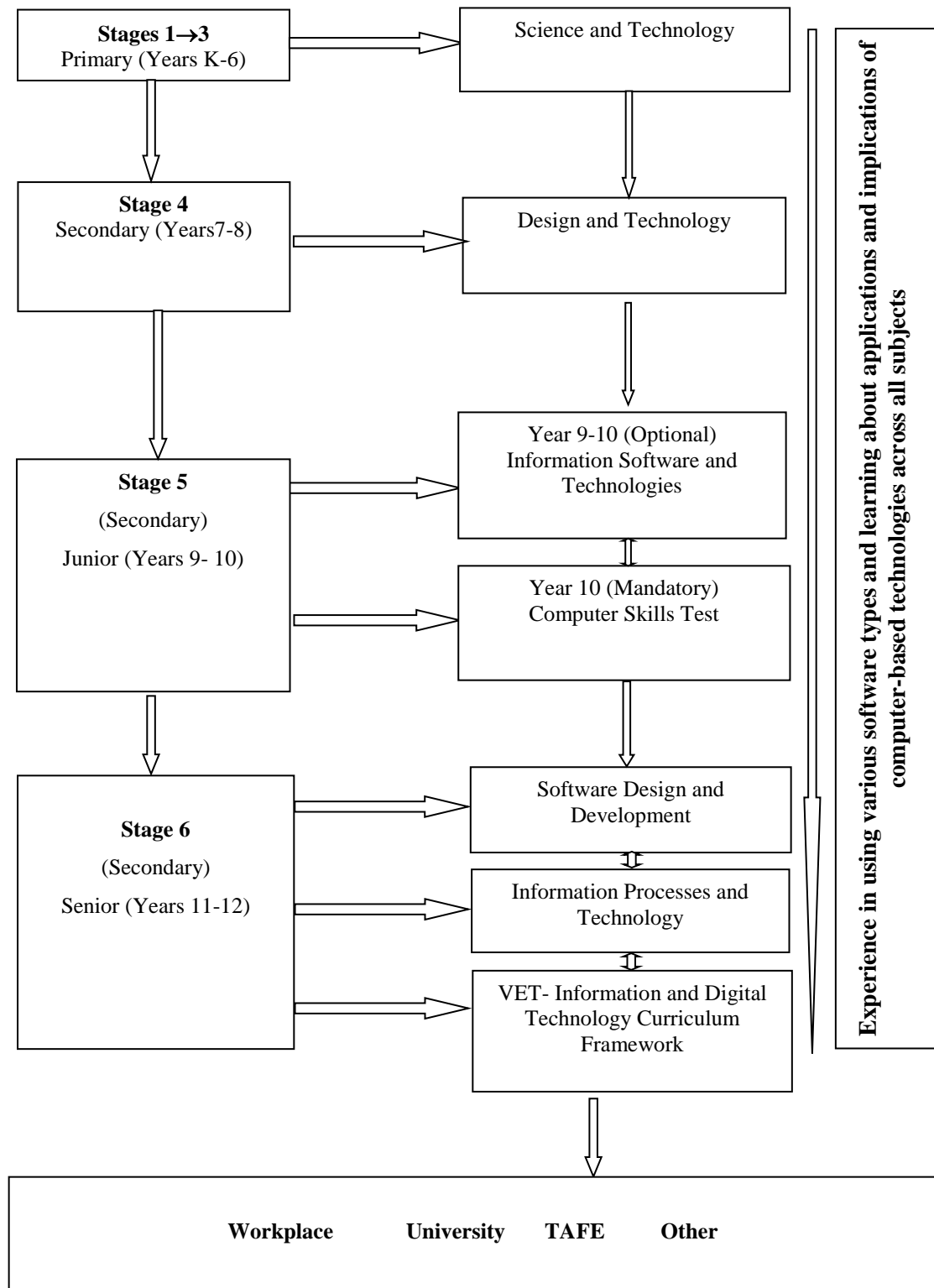
Thus, in Stage 6, Years 11 to 12, three ICT subjects are offered: Software Design and Development, Information Processes and Technology, and (the VET Curriculum Framework) Information and Digital Technology. Students may choose to undertake one, two or all three ICT subjects and can undertake Stage 6 subjects without having completed the relevant Stage 5 elective.

4.2.1 ICT Year 11 and Year 12

The structure and content of the syllabus

The following documents discuss key ICT-related curriculum and assessment issues at the NSW state level:

      1) ICT curriculum year 11- year 12 (NSW Department of Education, 2013)

      2) ICT curriculum year 11- year 12: Outcomes and Indicators (Board of Studies, 2012)

      3) ICT assessment in year 11- year 12 ICT (Board of Studies, 2013)

Here, we undertake an analysis of the structure, content and level of NSW syllabuses for ICT-related subjects (copies available from the NSW Board of Studies), regarding subject structure in terms of year studied, number of study units and nature of assessment regime. The analysis will note whether assessment involves an external examination and the calculation of subject contribution to total university entrance score. The major ICT subjects reflect the subject regulations for final certification as well as the curricular framework itself.

There are only two secondary ICT subjects, Software Design and Development (SDD), and Information Processes and Technologies (IPT). However, the Vocational Education and Training (VET) Curriculum Framework contains a subject called Information and Digital Technology (IDT), an optional subject available from 2013 and which replaced the Information Technology Curriculum Framework for Year 11. In the NSW Board of Studies, each ICT-related subject consists of two full-year units of study across Year 11 and Year 12. For assessment purposes, only Year 12 SDD and IPT subjects with only Year 12 topics are externally examined. The IDT is an optional external examination (see Table 1, Appendix F).

Software Design and Development (SDD) in Year 11 is comprise of Concepts and Issues in the Design and Development of Software; Introduction to Software Development; and Developing Software Solutions. The Year 12 SDD has four main components: Development and Impact of Software Solutions; the Software Development Cycle; Developing a Solution Package (this is practical programming); and "Options," (a choice of Evolution of Programming Languages, or Software Developers' View of Hardware).

Information Processes and Technologies (IPT) in Year 11 also has three main components: Introduction to Information Skills and Systems; Tools for Information Processes; and Developing Information Systems. In Year 12, IPT covers Project Management; Information Systems and Databases; and Communication Systems, as well as Options.

The VET subject Information and Digital Technology (IDT): focus areas are: working in the industry, operating system software; diagnostic testing; and safety. (see Table 2, Appendix F).

In three ICT subjects, recommendations by Hubwieser et al. (2011) on structuring the ICT content fields in computer literacy, computer fluency, information technology, software engineering, and computer science.

There is a wide range of terminology within the general field of "technology" that will often spill over into "ICT", and is a useful reference for terminological definitions over a range of ICT issues. "Computer Literacy" is defined as the capability to independently use current technologies. "Computer Fluency" adds to Computer Literacy the capability to independently learn and use new technologies as they evolve through one's lifetime, and which includes the active use of algorithmic thinking, including programming, to solve problems. This term also refers to skill in abstract thinking in relation to computers and computing in general, as well as Information Technology (IT) specifically, where "IT" is an applied field of study that involves the effective use of technologies processes, systems and tools to manipulate information in the form of text, graphics, sound and video. Another of these

terminologies is Software Engineering, an important concept in the practice of designing and implementing large software systems/programs.

Despite the generally useful general term "ICT", there can be a problem with terms that have specific definitions. "Computer Science" is one such term. It means the study of computers and algorithmic processes, including principles, hardware and software designs. It exposes students to the scientific and mathematical theory that underlies the practice of computing. Computer Science also relates to the social impact of computers. The subject has some overlap with IT and Software Engineering but extends well beyond these two fields.

Approaches to teaching and learning: Syllabus revision

This section will describe the SDD syllabus revision. In 1999, the teaching of this subject began in high schools of NSW, and during the following 16 years the NSW Board of Studies has revised and updated of contents on four occasions. The first stage, from 1999 to 2009, saw one revision, and the second stage from 2009 to present was one of updating and revising the content of subjects on three occasions: December 2010, October 2011, and July 2013 (the Board of Studies NSW, 2013). The table below shows the syllabus changes from 2010 to 2014.

Table 4.1 The main SDD's syllabus update of Preliminary Courses

Software Design and Development Stage 6 Preliminary Course		
2010	**2011**	**2013**
1. Concepts and Issues in the Design and Development of Software		
1.1 Social and ethical issues		
Ergonomics	Evolution of software applications	No change
Intellectual property	Intellectual property	Intellectual Property: Students learn more to use of software covered by a licence agreement
Inclusivity	Social context of software design: 1) Ergonomics; 2) Inclusivity; 3) Privacy; 4) Required skills in software design and development	No change
1.2 Hardware and software		
	Elements of a computer system	No change
Hardware	Hardware	Hardware: describe how data is captured, stored, manipulated or displayed on a variety of hardware devices

Software Design and Development Stage 6 Preliminary Course		
2010	**2011**	**2013**
Software	Software	Software: operating systems and utilities; functions of operating systems
The relationship between hardware and software	The relationship between hardware and software	No change
1.3 Software development approaches		
The structured approach to software solutions	Structured approach	No change
The prototyping approach to software solutions	Agile approach	
The rapid applications software development approach	Prototyping	
End user approach to software development	Rapid applications development approach (RAD)	
	End user approach	
	Selecting an appropriate development approach	
2. Introduction to Software Development		
2.1 Defining the problem and planning software solutions	**2.1 Defining and understanding the problem, and planning and designing software solutions**	No change
Defining the problem	Understanding the problem	
Abstraction/Refinement	Abstraction/refinement	
Data types	Data types	
Structured algorithms	Structured algorithms	
2.2 Building software solutions	**2.2 Implementing software solutions**	
Coding in an approved programming language	Coding in an approved programming language	
Error correction techniques	Developing source code	
Libraries of code	Error detection and correction techniques	
User interface development	Commonly executed sections of code	Commonly executed sections of code: make use of procedures
Documentation	User interface development	No change
	Documentation	
2.3 Checking software solutions	**2.3 Testing and evaluating software solutions**	
Test data	Testing the solution	
Evaluation of design	Evaluating the solution	
Evaluation of implemented solution		
2.4 Modifying software solutions	**2.4 Maintaining software solutions**	
Reasons for maintenance coding	Reasons for maintenance coding	
Social and ethical implications	Features in source code that improve its maintainability	

Software Design and Development Stage 6 Preliminary Course		
2010	2011	2013
Features in source code that improve its maintainability	Understanding source code	
Interpretation	Inclusion of code from other sources	
Documentation		
3 Developing Software Solutions		
Implementing projects	Project management	
Project management techniques	Documenting software solutions	
Project documentation	Developing software solutions	No change
Social and ethical issues related to project work	Social and ethical issues related to software solutions	

This table shows that the SDD syllabus of Year 11 received major updating in 2010 and 2011. Twelve new concepts appeared in 2011, a change of 40 per cent (12 of 30 concepts) from 2010, and have four name changes to sections. The syllabus did not change in 2012 and in 2013 only small changes took place compared with 2011, including detail changes to three content items (a 10 per cent change).

Table 4.2 The main SDD's syllabus update of HSC Course

Software Design and Development Stage 6 HSC Course		
2010	2011	2013
1. Development and Impact of Software Solutions		
1.1 Social and ethical issues		
Rights and responsibilities of software developers	The impact of software	No change
Software piracy and copyright	Rights and responsibilities of software developers	
The software market	Software piracy and copyright	Software piracy and copyright: current and emerging technologies used to combat software piracy
Significant social and ethical issues	Use of networks	No change
	The software market	
	Legal implications	Legal implication: national and international legal action resulting from software development. Identify issues raised in cases at both national and international level
1.2 Application of software development approaches		
Software development approaches	Software development approaches	Software development approaches: trends in software development
2. Software Development Cycle		
2.1 Defining and understanding the problem		
Defining the problem	Defining the problem	No change
Design specifications	Issues relevant to a proposed solution	

Software Design and Development Stage 6 HSC Course		
2010	**2011**	**2013**
Modelling	Design specifications	
Communication issues	System documentation	
	Communication issues between client and developer	
	Quality assurance	
2.2 Planning and design of software solutions		
Standard algorithms for searching and sorting	Standard algorithms	Standard algorithms : standard logic used in software solutions
Custom-designed logic used in software solutions	Custom-designed logic used in software solutions	use of data structures, including multidimensional arrays, arrays of records, files
Standard modules (library routines) used in software solutions	Standard modules (library routines) used in software solutions	
Customisation of existing software solutions	Documentation of the overall software solution	No change
Documentation of the overall software solution	Interface design in software solutions	the design of individual screens in consultation with the client
Selection of language to be used	Factors to be considered when selecting the programming language to be used	
	Factors to be considered when selecting the technology to be used	No change
2.3 Implementation of software solution		
Interface design in software solutions	Implementation of the design using an appropriate language	
Language syntax required for software solutions	Language syntax required for software solutions	
The role of the CPU in the operation of software	The need for translational to machine code from source code	
Translation methods in software solutions	The role of machine code in the execution of a program	
Program development techniques in software solutions	Techniques used in developing well-written code	No change
Documentation of a software solution	Documentation of a software solution	
Hardware environment to enable implementation of the software solution	Hardware environment to enable implementation of the software solution	
Emerging technologies	Emerging technologies	the effect of emerging hardware and software technologies on the development process
2.4 Testing and evaluation of software solutions		
Testing the software	Testing the software solution	

Software Design and Development Stage 6 HSC Course		
2010	**2011**	**2013**
solution		
Reporting on the testing process	Reporting on the testing process	documentation of the test data and output produced
	Evaluating the software solution	No change
	Post implementation review	
2.5 Maintenance of software solutions		
Modification of code to meet changed requirements	Modification of code to meet changed requirements	No change
Documentation of changes	Documentation of changes	using CASE tools to monitor changes and versions
3. Developing a Solution Package		
Designing and developing a software solution to a complex problem	Designing and developing a software solution to a complex problem	use a logbook to document the progress
Systems implementation	Whole project issues	No change
4. Options		
Option 1 – Evolution of Programming Languages	Option 1 Programming Paradigms	No change

Similar to Year 11, this table shows that the Year 12 syllabus experienced major changes in 2011. However, the course structure did not change. The NSW Board of Studies (2011) shows that the objective in updating the syllabus would provide students with knowledge and understanding about using software solutions and connecting with other computer systems. Changes also concerned greater understanding of legal, social and ethical issues of software design and development. Furthermore, students will receive training in group- and communication-related skills in creating, designing and developing software solutions. In 2013 there were only nine concept changes and updates, only 24 per cent of the number of changes made in 2011.

4.2.2 ICT Years 11-12: Outcomes and Indicators

Hayes (2007) notes that strong arguments have been made for the introduction of advanced ICT applications as a means to create a powerful learning environment. Such applications transform traditional learning and teaching methods so that students deal with knowledge in an active, self-directed and constructive way, to make it more transferable to situations outside school.

The NSW Board of Studies describes syllabus outcomes for the ICT subjects in the following terms.

Software Design and Development (SDD) Outcomes: Year 11 students need to be able to describe hardware and software functions; correctly use data types; understand the interactions between the elements of a computer system; and be aware of developments in the levels of programming languages. They need to be able to identify software problems and use structured approaches to designing and implementing software solutions. In Year 12, the outcomes require higher levels of knowledge: explaining the relationship between hardware and software; describing the main components of computer systems data storage and operation; identifying and evaluating legal, social and ethical issues in a number of contexts; and applying appropriate development methods to solve software problems and implement well-structured software solutions. In addition, students in Year 12 are to create the various types of documentation required for the software development cycle and solutions and justify the need for this documentation (See Table 3, Appendix F).

Information Processes and Technologies (IPT) Outcomes: Year 11 students need to achieve the ability to describe the nature of information processes and information technology. They need to understand IPT functions and operations, and to be able demonstrate the information processes within an information system. Students have to be able to explicate the interdependence between each of the information processes, and to describe social and ethical issues. The syllabus requires students to go further and develop information systems, and relate them to current and emerging technologies in the context of an identified need. They need to explain management and communication techniques used in individual and team-based project work. Year 12 requires the demonstration of ways where information systems will meet emerging needs; justification for resources and tools to successfully develop projects, and evaluation of the ethical implications of using specific resources and tools. Students are to know how to implement methodical approaches to problems, explain effective management techniques and thoroughly document individual and team projects (See Table 4, Appendix F).

Information and Digital Technology (IDT): This VET subject is an option in Stage 6, offered because industry curriculum frameworks provide students with the opportunity to gain industry-recognised national vocational qualifications under the

Australian Qualifications Framework (AQF) as part of their NSW Higher School Certificate (HSC) (Information and Digital Technology Curriculum Framework, 2013). In IDT, there are four mandatory focus areas: a) working in the industry; b) operating system software; c) diagnostic testing, and d) safety. Additionally, there are three directions for further choices of study: a) web and software applications, b) networking and hardware; and c) digital animation. One stream has to be chosen for study.

Information and Digital Technology (IDT) Outcomes includes Focus Areas and Streams:

Focus Areas consists of four main parts: 1) *Working in the industry*: students are to describe the nature of the information and communications technology industry; understand how to deliver quality support for users of ICT services, and explain how to communicate with colleagues and clients and work effectively with them; 2) *Operating system software*: explain the purpose and functions of an operating system, and understand the processes and procedures for installing, configuring, optimising and testing an operating system; 3) *Diagnostic testing*: analyse common symptoms and causes of hardware and operating system problems; explain the purpose of preventive maintenance; remove destructive and malicious software; and 4) *Safety:* be able to explain ICT industry safe work practices and procedures; describe workplace health and safety consultation; discuss participation in the ICT industry, and demonstrate workplace policy and procedures that ensure the safety of clients, colleagues and the ICT worker.

Streams includes: 1) *Web and software applications*: students are to be able to use the features and functions of software applications, and know to use the problem-solving and troubleshooting strategies for solving software related problems; 2) *Networking and hardware:* main outcomes are knowing the principles and processes involved in setting up a secure small office or home office network; and recognise network problems; and 3) *Digital animation:* understand the principles involved in planning and producing digital animation; and demonstrat knowledge of industry-based software.

ICT Strategies for NSW

The NSW Department of Education and Training ICT Strategic Plan 2010-2011 showed the important strategies as well as providing, improving and promoting of the ICT environment and initiatives that facilitate, foster and develop teaching and learning to meet individual student needs and deliver standardized framework. The strategy focuses on ICT outcomes and indicators including: teaching and learning, and learning management.

Student learning outcomes: It is demanded that students need to be able to develop ICT support for the connecting of learning programs and school curricula. As well, teachers need to learn how to teach in online environments and take teacher professional development as well. In addition, teachers need to learn how to manage local learning environments within a standardised framework so that students would improve their learning performances. Furthermore, students will have individualised learning environments using blended learning opportunities. For that, teachers are required to highly engage their students by using ICT environments.

Learning management outcomes: ICT systems support teaching, learning, reporting and community services, improving students engaged with public education, student performance, and resources management. Furthermore, they improve teachers access to information to manage learning outcomes and to develop individualised learning programs. *Indicators of student learning*: available, responsive online learning environments and network applications. Satisfied and engaged students. *Indicators of learning management*: increasing ICT literacy of teachers and learning management systems that allow teachers to engage in connected delivery and professional development.

The strengths of ICT outcomes and indicators

ICT outcomes and indicators constitute a set of performance standards and indicators that can be used with a range of assessment procedures and instruments for a variety of educational purposes. Just as staged outcomes are meant to typify what most students will achieve by the end of the stage, the indicators are used to quantify the development of students' learning and indicate some possible directions. The ICT

outcomes and indicators provide a guide to school-based curriculum planning and assist programs supporting student achievement. Instead of focusing on only the content of learning and teaching, ICT outcomes and indicators focus on the connections between teaching processes and student learning (what students know and can do), which can help teachers scaffold (or map) the learning process.

From a practical point of view, the strengths of ICT outcomes and indicators are in fact that they work with outcomes in terms of stages and strands. They are able to provide detailed descriptions of student achievement, formulated in a way that assists teachers and parents to interpret student outcomes. By clearly referring to outcomes and indicators, teachers can make more consistent judgments about student performance and record student achievement reliably and validly, by using a fair and transparent set of criteria.

4.2.3 Assessment in Years 11-12: ICT support document

The assessment process of identifying, gathering and interpreting information about student achievement is used for the following key purposes: a) to assist student learning; b) to evaluate and improve teaching and learning programs; c) to provide information on student learning and progress in a course, and d) to report on achievement for each student at the end of a course. It provides learning opportunities in the context of everyday class actvities for students, in order to demonstrate their learning. As such, it is considered that the assessment program provides the most effective learning opportunities students when they are involved in setting learning results, in order to know and understand what is expected. Therefore, it is requested that students be familiar with the assignment standards, so that after they obtain the results, they can understand and choose the next steps in their learning.

The detailed standards, referenced in HSC assessments by the NSW Board of Studies (2013) requires schools to ensure that the documented assessment tasks reflect the weightings and specified components. Tasks are designed to focus on objectives and outcomes. Various types of assessment tasks are deployed in order to obtain the appropriate outcomes being assessed, so that students are given the opportunity to

demonstrate their level of achievement in a range of different types of abilities. As such, students should get meaningful feedback about what they can do, and what they need to do, in order to improve their level of performance.

Years 11-12 ICT Subjects, Assessment (Internal and External)

Internal assessment gives a measurement of a student's achievement based on a wider range of syllabus content and results to ensure a common focus for internal assessment in the course across schools, while allowing for flexibility in the design of tasks, as well as to reflect the weightings and components specified in this Board of Studies document, and the types of assessment tasks that are appropriate for the outcomes being assessed. With the external assessment, students' results relate to syllabus standards by supplying clear connections to syllabus outcomes and helping students to evidence the levels of goal outlined in the course performance scale. In this section, overviews of the three subjects' assessment are described.

Software Design and Development (SDD) Assessment: For Year 11 there are four assessment components: a) Knowledge and understanding about hardware and software development approaches; software development processes; social and ethical issues (30 marks); b) Design and development of software solutions (35 marks); c) Project management techniques, including documentation, teamwork and communication (15 marks), and d) A project about hardware or software (20 marks). For Year 12, three components out of four are similar to those for Year 11, with one different component: "knowledge and understanding about the development and impact of software solutions and the software development cycle."

It found that in four contents of assessment, The NSW Board of Studies assessment was designed to focus on software solutions, and worth 35 per cent (35 marks) in which only 15 per cent accounted for teamwork and communication content in Year 11 and 20 per cent in Year 12. However, a comparision of the content showed that the assessment's design ensured the components and weightings for the course.

Information Processes and Technology (IPT) Assessment: In Year 11, the introduction to information skills and systems is weighted with 20 marks, tools for

information processes 50, and developing information systems 30 marks. In Year 12, project management is weighted with 20 marks, information systems and databases 20 marks, communication systems 20 marks, and option strands 40 marks. In this subject, the content of tools for information processes is emphasised and worth 50 marks in Year 11, because the content is very important content and made up of eight lessons. Introduction to information skills and systems is weighted for 20 marks across five lessons. In Year 12, the content of the four sections is evaluated evenly.

Information and Digital Technology (IDT) Assessment: The focus areas and streams have been set out above. The focus areas are mandatory, and students must complete the HSC examination on the one stream they have studied. The examination consists of a written paper worth 80 marks, and each candidate's score will be converted to a 100 band score. The test time allowed is 2 hours plus 5 minutes reading time. There will be three separate written papers, one for each stream. Candidates will be required to complete a paper test based on the stream they have studied. Each paper will consist of four sections:

1) Section 1 (20 marks): Objective questions, with 10 marks based on the mandatory focus areas (the same for all three papers); and 10 specific to the stream focus area.

2) Section 2 (30 marks): About five short-answer questions offer 15 marks for the mandatory focus areas, and 15 marks specific to the stream area. Questions may contain multipleparts; there will be about 12 items in total; at least two items will be worth from 4 to 8 marks.

3) Section 3 (15 marks): One structured extended response question which is based on the stream focus area but can also draw from the mandatory focus areas; the question will have two or three parts, with one part worth at least 8 marks. The question will have an expected length of response of around four pages of an examination writing booklet (approximately 600 words) in total.

4) Section 4 (15 marks): There will be one extended response question based on the mandatory focus areas, and so the same for all three written papers; the question will have an expected response of around four pages of an examination writing booklet (about 600 words).

In summary, in a standards-referenced approach to HSC Assessment, schools are expected to conduct sound assessment programs that allow students to demonstrate the breadth and depth of their knowledge, skills and understanding. Schools should develop quality assessment tasks and well-constructed marking guidelines. They should provide effective feedback to students in relation to their strengths and weaknesses and any areas for improvement.

Each school should encourage students to take responsibility for their own learning. The school should evaluate and refine teaching programs in response to student performance. The school should report student achievement to various audiences including parents, employers and others and know how to approach this task sensitively and responsibly. Finally, it is important that schools will continue the practice of reporting assessments to the Board in ways that meet their needs, and report assessments to the Board as in the past that provide appropriate discrimination between students in terms of their overall achievement (The Board of Studies NSW, 2013).

4.3 Summary

The documents reviewed in this chapter have provided an overview of ICT curricula and assessment in Australia through the analysis and description of key aspects at national and state level.

The rationale for ICT education is that ICT uniquely engages students in technological processes and production as well as design and computation thinking. ICT also engages students in ways of understanding the world in which they live, so that they can identify and explore real-world needs, and develop critiques that indicate aspirations and opportunities. ICT knowledge is constructed by students through observing, representing, investigating and communicating. The importance of ICT is emphasised mainly through the pragmatic aspect of ICT.

The objectives of ICT education, both in the national ICT framework and the NSW syllabus, are built on outcomes-based principles. They have shown considerable consensus on the objectives of ICT education. They see the development of students'

confidence and enjoyment in working in ICT, developing knowledge, skills and understanding of ICT, and the application of ICT, as the main objectives of ICT education. More recently the focus was on literacy and numeracy, which are asserted as one of the goals for schooling in Australia. The practical value of ICT in society is regarded as a top priority.

The content of the ICT curriculum at the secondary level will include the development of two "Technologies" subjects: Design and Technologies, and Digital Technologies. Both ICT subjects will develop active and informed citizens with the capacity to be confident, creative, ethical, enterprising, and environmentally and socially responsible innovators.

In terms of assessment practices, an outcomes-based approach is used in each document. Teachers are encouraged to use a variety of strategies for assessing students' ICT achievement: profiles, benchmarks, outcomes, indicators and portfolios are some key measures for understanding assessment and reporting policies at both national and state level.

Based on the document analysis in this chapter and an analysis of Vietnamese curriculum documents in the following chapter, discussion of the strengths and limitations of the Australian ICT curriculum will be presented in chapter 6, where the intended Australian and Vietnamese ICT curricula and intended ICT policies will be compared and contrasted.

Chapter 5 ICT Policies and Curricula in High Schools in Vietnam: Documentary Analysis

This chapter presents an overview of ICT education in Vietnamese high schools. High school education refers to the three years of upper secondary education, covering Year 10, Year 11 and Year 12. The Ministry of Education and Training (MOET) is distinct from the Department of Education and Training (DOET) in as much as MOET is the policymaking body while DOET has administrative responsibility. This chapter discusses and analyses key Vietnamese ICT teaching and learning policies, ICT curricula, and assessment at high schools by reviewing four sections: a) National ICT Curriculum Standards for Three-year Secondary Education (MOET, 2006); b) ICT Syllabus for Three-year Secondary Education (MOET, 2006, revised 2011); c) Vietnamese ICT Textbooks for Three-year Secondary Education (Educational Publisher Press, 2006), and d) National Planning for ICT in Education (Vietnamese Government, 2009)

The main intent of the first document is to embrace general aspects of education across all learning areas. Key content areas include basic principles of ICT teaching and learning in Vietnam. The second document includes objectives and detailed content of the current high school ICT syllabus. The third document describes requirements and prescriptions that ICT textbooks need to have in order to be mandated for teaching and learning in Vietnamese high schools. The last document describes objectives and challenges on implementations of National Planning for ICT in Education from 2010 to 2015, and estimates further advancements up to 2020.

The analysis of these documents provides an understanding of the current ICT teaching and learning trends in Vietnam public schools. As English translations of these documents are not readily available, this chapter will focus on synthesising key features of these documents translated from Vietnamese into English. Furthermore, some discussions of the key principles underpinning the ICT curriculum will be highlighted in the end of the chapter.

Chapter Two has referred to curriculum in terms of three phases or aspects (Mullis et al., 2009). First, there is the intended curriculum, which is the curriculum as envisaged by the educational authority and expressed in the Vietnamese educational policy documents. Then, there is the implemented curriculum, as it actually takes shape in practice, through the governmental educational school administration. Last, there is the *attained* curriculum, which is the curriculum as evaluated through its actual educational achievements in society and in the minds and levels of knowledge and skills among students who have studied under that curriculum. This relates to the evaluation of educational achievement which has been the subject of substantial comparative education research with regard to Mathematics and Science curricula (Mullis et al., 2009). Here, the ICT policy and the intended curriculum, together with the question of assessment of ICT within the curriculum are discussed with reference to Vietnamese high schools, which are the equivalent of upper secondary education in Australia.

5.1 National ICT Secondary Curriculum Standards, Three Year Upper Secondary Education

This MOET document on upper secondary education, issued in 2006, sets the scene for the 21st century by prescribing standards for teaching and learning requirements as well as assessment and textbook writing. The Standards outline the content and objectives of the ICT curriculum in a structured way. The document begins by introducing key learning areas and setting out the allocation of the school year from 2007.

5.1.1 Key learning areas; allocation of time

There are basic "learning areas" for Vietnamese high schools: Literature, History, Geography, and Foreign Languages; Physical Education and Citizenship Education; Mathematics, Physics, Chemistry, Biology, and ICT. MOET prescribes a mandatory 37 weeks of teaching each year in high schools, with 26 periods of 45 minutes every week. In this picture, the allocation for ICT is two periods per week in Year 10, and then in Years 11 and 12, two periods per week in Semester I and one period in Semester II. However, to implement the schedule in all high schools, beginning from the school year 2007-2008, MOET issues a schedule for each high school

academic year, which covers teaching/ learning time as well as vacations. Figure 5.1 shows the four steps process to explain the issuance of the timetable for a school year in Vietnam.

Figure 5.1 Process for issuing the schedule for the school year
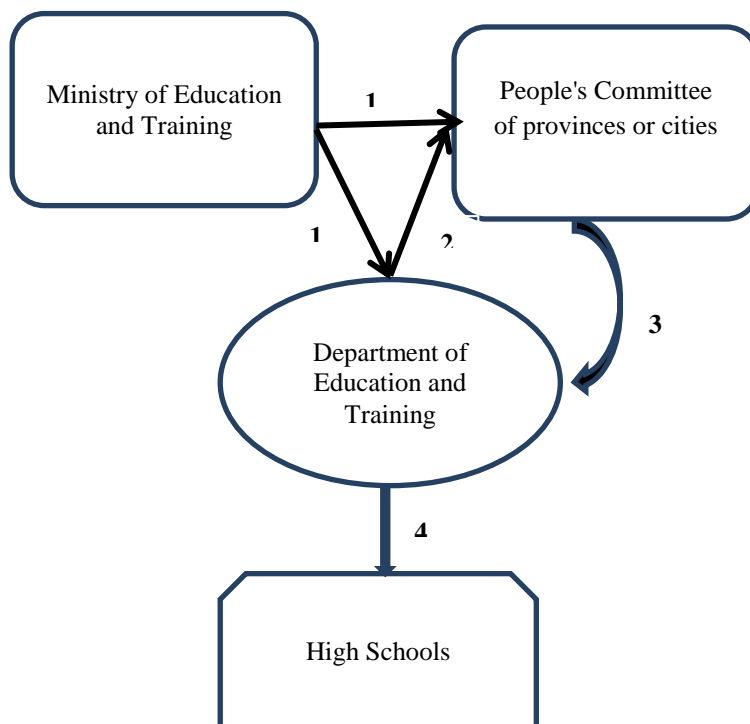
In the first step in Figure 5.1, the Ministry issues a Planning Framework for each high school year to send to the People's Committee of each province or city as well as to the Department of Education and Training. Next, the Department of Education and Training submits a plan for the school year plan to the People's Committee of provinces or cities. In the third step, the People's Committee of each province or city decides on a schedule, which is sent back to the Department of Education and Training. Finally the Department of Education and Training sends the schedule to all schools. For example, the MOET (2014) issues the Planning Framework for the 2014-2015 school year. The Chairman of the People's Committee of the provinces and cities directly under the Central Government must decide: a) The class times for kindergartens, primary schools, and high schools; b) The times off from school and extensions of school times in special cases. The Director of the Department of Education and Training decides when students can stay away from school in cases of

severe weather, natural disasters and for extra study. The director also decides teachers' vacation schedules. For instance, the 2013-2014 school year finished on May 31st, 2014 but the day before (May 30, 2014), the MOET issued its time table and planning for the 2014-2015 school year, and on July 17th, 2014 the People's Committee decided the school year was to begin August 5th, 2014 (in 18 days).

This analysis found that the participants in this research believe that in implementing ICT policies, excessively using iterative and recursive processes creates practical difficulties in schools when it comes to the ICT education. They observed that the process of implementing and updating schedules is very time consuming because it involves complex steps and, in the end, the teachers are negatively affected. They lack detailed information on the reasons behind the various decisions that have been made. As each school year ends and planning for the next year begins, the vacation lasts about one and a half months, and the participants believed that it was difficult for each school and its teachers to participate in all these steps of the scheduling process while, in the limited time available, developing lesson plans and engaging in staff development. The goal of each school is to have a Department of Education and Training schedule for the school year, but the mandatory scheduling process means delays and, in addition, these schedules rapidly become outdated. The result is considerable difficulty in providing the resources that are needed in schools.

5.1.2 Key content areas within ICT

The MOET (2006) sets out the content of the secondary ICT curriculum in terms of fundamental concepts, precise knowledge and acquired skills. The curriculum aims to enable students to understand the principles underlying ICT and its function in society. In terms of hardware, students have basic knowledge of computer architecture and computing systems and operating systems (OS).

In terms of software, processes and applications, students learn about algorithms and data structures to help them to proceed to Principles of Programming and Programming Languages and become familiar with the concepts of Databases and Graphics, and proceed to Computer Networks. ICT has a strong component of skill and practical use, and students learn to be proficient in word processing, the use of

graphics, and the creation and management of data files. They need to carry out efficient information searches on the internet. Moreover, students need to understand the importance of the effective use of computers in different academic disciplines, from a perspective of career-oriented education in the field of ICT.

5.1.3 Principles underpinning the Vietnamese ICT curriculum

The Ministry holds that curriculum writers need to follow two principles (MOET 2006). According to the first principle, they should identify ICT content in order to answer the question, "What is involved in teaching computer science in high school?" These writers should base their work realistically on the conditions in the country for program editors of ICT subjects; and an awareness that ICT should be part of the repertoire of knowledge in every year of every school. Further, students need to have up-to-date knowledge of computer information systems (informatics), but in view of the rapid development of ICT, curriculum writers need to thoughtfully and systematically introduce new information in order to avoid student cognitive overload, while at the same time helping them to catch up with ICT changes.

The second principle curriculum writers must bear in mind is that the teaching and learning topics for ICT are based on a paradigm of seven "How?" questions:

1) How should each program item be taught?
2) How should students be shown how to learn?
3) How should computer laboratories be developed and used?
4) How should computers be used in teaching?
5) How should academically gifted students be identified and nurtured?
6) How should poor performers be assisted to learn?
7) How should extra-curricular forms of education be utilised, if indeed they are used? (MOET, 2006).

These questions serve to focus on the role of ICT across the broad range of development and application of the natural and social sciences. Therefore, the content, ideas and methodologies of ICT play an important role. Apart from the

specific study of ICT subjects, ICT itself filters into other subjects in the school curriculum, and elements of ICT spread into society.

The document shows the emphasis on ICT in education by MOET (2006), articulated in five major points. The first is the need to nurture the creation and development of a mature pedagogy for ICT teaching. The second point is that ICT is described at each level as a subject that demands practical application, as well as the teaching of theoretical knowledge. Third, teachers must begin with the actual situation of Vietnamese education and be flexible in showing students how ICT applies in day-to-day experiences. Fourth, teachers need to perceive the extent to which ICT knowledge is embedded in the activities of organisations, in economic and financial life, as well as in mass media and in information-centred activities in local, national and international contexts. Finally, ICT subjects tend to require a greater investment of funds and effort over time than other subjects. Overall, these aspects confirm that the national education system accepts that equipping teachers and students with the necessary facilities for ICT devices presents challenges that must be faced.

5.1.4 Key principles underlying the ICT curriculum

To understand the ICT curriculum in Vietnam and the direction in which it needs to go, the government ought to clearly recognise that ICT is a new set of complex subjects. It is an integrated area with specific subject divisions in terms of information content and the emphasis given to varying specific skills. This means that the syllabus needs to be scientifically devised, but with the caveat that the system cannot afford waste or overlap. Similarly, the nation does not have endless reserves of time at its disposal for development. Vietnam needs to deploy synchronous activities. The construction program for each year level presents a number of decisions to be made, and all of them are mandatory: policy work; staffing work that understands teacher morale as well as logistics; computer laboratories; construction of an education network and internet connection. In addition, there is an undeniable need to study teaching methodologies and to keep training new teachers.

As if these issues were not enough, hardware and software are developing rapidly. Hardware needs to be replaced regularly, and software needs to be upgraded every

few years. Therefore, students need to be able to achieve a level of computer expertise that will enable them to keep up with these rapid changes. This is a major challenge in maintaining an adequate quality of the academic instruction. However, the fact that ICT has permeated all corners of society means that academics may criticise the dilution of academic content in the curriculum. As well, extra-curricular outlets for the creative, inventive ideas of talented ICT thinkers need to be created in order to provide them with adequate opportunities for academic learning and sociocultural development. The spirit of what MOET is saying might be expressed as a message to a teacher: If you accept the genius of Silicon Valley then you should not deny the possibility that your students may have similar abilities that can project Vietnam toward a meaningful future. As well, the message from the 1990s to present is that technology changes things, and isolating students from current creative trends is likely to be counter-productive. Thus, MOET sees ICT subjects with an "open mind and knowledge", in the sense that teachers and students might have elective elements that can be readily updated with new ICT content (MOET, 2006).

5.1.5 Standards related to organisation and assessment of the ICT curriculum

The MOET (2006) sees assessment from the major aspects of time and content. The time dedicated to the study of the ICT curriculum is very short and so the time for assessment is necessarily short as well. In Year 10, ICT teaching takes place twice per week in 45 minute periods and averages one and a half periods per week in Years 11 and 12, over a school year of 37 weeks.

The total exposure time for each is as follows. Year 10: a total of 70 periods, comprising 36 periods of theory, 19 periods of exercise/practice, 7 periods of exercises, 2 periods of review, and 6 periods of tests (see Table 1, Appendix G). Year 11: a total of 52 periods, comprising theory, 23 periods; exercises/practice, 15 periods; exercises, 7 periods; review, 3 periods, and tests, 4 periods (see Table 2, Appendix G). Year 12: a total of 52 periods, comprising theory, 22 periods; exercises/practice 20 periods; exercises, 4 periods; review, 2 periods, and tests, 4 periods (see Table 3, Appendix G).

Thus, the total number of 175 periods is devoted to ICT study over the whole three years of the high school course, where theory accounts for approximately 46 per cent, and practice/exercises about 43 per cent. Over the three year period from Year 10 to Year 12, teaching time for the ICT subject amounts to only one third of the time devoted to subjects such as Mathematics or Literature. This is a serious issue which will be discussed in depth in Chapter Eight.

Moreover, ICT policies require that from Year 10 to Year 12, it is necessary to ensure the presence of practices and exercises in all periods for each chapter across the school year. It is necessary that teachers consider and balance the amount of time required for exercises, practice and review. However, for periods of exercise and review where no specific content is set out, decisions regarding information content related to exercises should be based on the local situation, to ensure adequate opportunity to provide sufficient knowledge and skills. To help decide, the MOET policies require more content for exercises. Review periods emphasise and aim to strengthen knowledge and skills training in forms that can be learned in the classrooms and computer labs. Therefore, matters regarding theories, practice and exercise should be taught in the order presented in the recommended textbook. Yet, the authors show that some content areas would be more effectively learned using computer technologies and adequate software containing pictures, photos, diagrams and videos introducing more intuitive ideas.

Also, when practicing on computers, activities should be created to accommodate individual practice, and not group practice. In addition, some chapters are severely lacking in detail, for instance, the theoretical content Chapters 2 and 3 in Year 10. Textbooks need to provide sufficient ICT content detail in order to be more effective. At the same time, it is suggested that this creates opportunities where ICT teachers could take more risks and target more activities outside of prescribed ICT textbooks.

The frequency of testing is another significant issue. The MOET recommends frequent testing for student practice and assessment in both theoretical and practical skills. In Year 10, six periods are to be spent on testing: one period on each semester examination; one period on each of two other examinations; and two periods on practical computing. In Year 11, four periods are to be spent on testing (two periods

in each semester). In Year 12 four periods of testing are required, two in each semester. While the MOET recommends frequent testing, it can be seen that the time dedicated for testing is limited, and more testing opportunities should be created.

In summary, this section has provided an overview of the ICT curriculum standards and has outlined basic principles of ICT teaching and learning, as well as ways of performing assessments. Essentially, the ministry is asserting that the content of ICT subjects in high schools should be able to reach the goals that it has set out in its policies related to ICT teaching, learning and assessment. It can be seen that there are some major disparities between policies and their outcomes. As well, comparisons with the ICT senior secondary curriculum in NSW display a striking difference in terms of expectations, feasibility and possibilities of record tracking. This issue will be discussed in Chapter Six.

5.2 The ICT Syllabus for High Schools

The ICT Syllabus is one of three MOET documents issued in 2006. This section discusses the objectives and main content of the syllabus, and the scope and sequence of the content, as well as syllabus revision (a syllabus, which is a descriptive outline of the content of a course, is different from a curriculum, which prescribes what should be taught and achieved in a course) (Goodson, 2013).

5.2.1 The content scope and sequence

The organisation of syllabus content from Year 10 to Year 12, is summarised below, based on objectives.

Table 5.1 ICT content for Year 10

Some basic concepts of Information Technology	(1) Introducing computer science knowledge; (2) Information and data; (3) Introduction to computers; (4) Problems and algorithms; (5) Programming language; (6) Solving problem on computers; (7) Computer software; (8) The application of ICT; (9) ICT and society
Operating System	(1) The concept of operating systems; (2) File and file management; (3) Communicating with the operating system and file processing; (4) Some popular operating systems
Text editor	(1) Some basic concepts; (2) Familiarisation with Microsoft Word; (3) Some functional text editor; (4) Using drafting tools; (5) Working with tables
Computer Network and Internet	(1) Computer networks; (2) The global information network: Internet; (3) A number of popular internet services

Table 5.2 ICT content for Year 11

Some concepts of programming and programming languages	(1) Classification of programming language; (2) Translation Programs; (3) The components of programming language; (4) The base components of Turbo Pascal (TP)
The simple program	(1) Program structure; (2) The data types standards; (3) Statement variables; (4) Operation, expression, assignment statement; (5) Organised input/ output simple; (6) Translation, performance and calibration programs
Structure of branch and loop	(1) Branch organisation; (2) Organisation repeat
Types of data structure	(1) Array and variable indexes; (2) String data types; (3) Record types
File and file processing	(1) Classification and file statements; (2) File Processing
The subprogram and the programming structure	(1) Subprograms and classifications; (2) Procedures; (3) Functions; (4) Exploiting the available subprogram of programming language

Table 5.3 ICT content for Year 12

The concept of database	(1) The concept of database; (2) Management system database
Management system database Microsoft Access	(1) Introduction MSACCESS; (2) Table structure; (3) The operations base; (4) Access data; (5) Reports
System database relations	(1) The type of database model; (2) System database relations
Architecture and security of database systems	(1) The architecture of database systems; (2) Information security in database systems

5.2.2 Objectives of ICT teaching

The aims and the specific objectives of the ICT curriculum can be seen in the textbooks that have been analysed for this study. ICT is viewed as a science with its own characteristics. As such, students need to acquire a systematic understanding of basic ICT concepts as well as algorithms, programming language and databases. The author's opinion that students need to be trained to think, to co-operate with others, and to be supported in order to have innovative learning outcomes.

5.2.3 Important factors influencing the ICT Syllabus

The pace of acquiring information is speeding up. Intel President Gordon Moore observed that the number of transistors incorporated in an integrated circuit doubles every two years. This is known as "Moore's Law" (Moore, 2013). It has held true up to the present, though it may not continue. Given the rapidity of change in ICT, textbook writers have indicated that ICT curriculum content needs to be updated regularly. Also, the quality of images used in textbooks needs to be sound. Researcher has observed that textbooks regularly contain only black and white

pictures and lack clarity. Books ideally need to be printed with coloured photographs of adequate quality. The level of teacher training and issues of teacher availability in many parts of Vietnam mean that these textbooks are very important. Therefore, the nature of rapid change in ICT, lack of adequate resources and the lack of adequate numbers of well-prepared ICT teachers, adds to the difficulties in supporting the subject area, meaning that satisfying standards tend to be more difficult to attain than with other subjects.

5.2.4 The ICT syllabus; additions and revision

The ministry's adjustment of the implementation of ICT in high schools has been directed to maintaining educational targets that are realistically achievable by schools and teachers. This can mean concentrating on some aspects of the syllabus more than others, depending on local conditions. In-service training is a valuable approach here. Attention is being given to duplicated content in textbooks. Changes may also be made where content, exercises and questions in textbooks are outside the requirements of the curriculum or are cognitively beyond student capacity to understand. Furthermore, existing textbook content may not have been expressed in sufficiently rational terms (MOET, 2011).

From 2006 to 2014, the MOET revised the syllabus content only once, in 2011. This revision was focused only on content on some chapters and made no additions in updating the curriculum, despite rapid changes in the ICT world. Similar to the 2006 edition of the syllabus, the revised 2011 version is prescriptive but very brief, and with no detailed explanations for the changes. The most obvious change in the content of the syllabus is related to practical problems and practical activities.

In summary, this section has described the objectives of ICT teaching and learning, the guidelines for teaching and assessment, and the content of ICT, as included in the syllabus. It has outlined the need for major changes occasioned by the revision of the syllabus, and the provision of reasons for those changes. This has been flawed by the slow pace of updating the content. The syllabus is the basis for the compilation of textbooks, and thus this section has provided some details to discuss the following section on ICT textbooks.

5.3 ICT High School Textbooks

To align the use of high school educational materials from the 2008-2009 school year in accordance with the 2005 Law on Education, the MOET issued textbooks for both teachers and students. The textbooks are basic instructional and learning instruments, identified by their authors, editors and general editors under the authority of the ministry, with appropriate titles. Teachers are to prepare lessons in accordance with the specified standards of knowledge and skill, consistent with student absorptive capacity. Any conflicting interpretations of a topic in textbooks and school education programs should be resolved by reference to those programs. With examinations and evaluation, questions should relate to information in the teaching materials but should stress independent thinking and the creative application of knowledge to solve problems, minimising the practice of rote textbook learning. Schools should purchase textbooks for the use of teachers, and teachers have the responsibility to update MOET textbooks and advise students accordingly.

5.3.1 Some features of ICT textbooks

High school ICT textbooks published in Vietnam are different from their Australian counterparts. Vietnamese textbooks are relatively slim volumes, usually of A5 size, and for Years 10, 11 and 12 they are 172, 143 and 132 pages in length, respectively. A typical textbook, dated 2006, has an illustrated full-colour cover with global symbols in pink, green or violet for each of the respective years. The typographical work is well executed. The illustrations focus on the major points of each lesson and although the textbooks present concepts, definitions and procedures, in general, provide very little detail, leaving elaboration and explanation as well as diagrams and examples to the teacher. The textbooks do provide a short history of ICT as well as reference sources to hardware and software. There are seven, four and two reference lessons respectively, for Years 10-12.

5.3.2 Content of ICT textbooks

The Year 10-12 textbooks contain the following six bodies of content:

- Some basic concepts of ICT, networks and the internet;
- Operating systems;

- Text editing;
- Some programming concepts, Pascal, basic programming languages;
- System databases, the management system database Microsoft Access;
- Architecture and database system security.

5.3.3 The structure of ICT textbooks

The syllabus determines the content of the ICT textbooks; the main task for the authors is to choose an appropriate structure for the content. Ho et al. (2006) note that in organising ICT information, the authors should comprehensively and appropriately present the full MOET program to students. The student reader needs to see ICT in terms of skills as well as knowledge, in a family, social and national context, and he or she needs to see how ICT information can be internalised through independent learning in a self-assessment situation. For the teacher, the textbook needs to prescribe the scope and level of required knowledge, and to define the skills that must be acquired by students. The textbook needs to be a support mechanism for the compilation of lesson plans, for teaching in class, classroom organisation and student assessment. Finally, the textbook needs to refer to further books and materials that will reinforce and enhance the basic structure of the syllabus. The structure of the textbook should facilitate understanding and encourage further explore of ICT.

The order of content

Content should be presented in stages from the easy to the more difficult concepts, keeping firmly in mind that a student will take time to build up comprehensive knowledge of ICT. For example, Chapter One of the Year 10 ICT textbook begins with presenting basic ICT concepts in nine sections, one practice exercise and three further readings. Chapter Two introduces the operating system in four sections, with two practice exercises and one further reading. The text editor, Chapter Three, is treated in three sections, four practice sessions and one further reading. Chapter Four uses three sections, one practice exercise and one further reading to introduce computer networks and the internet.

These sections, practice exercises and illustrations are numbered uniformly throughout the textbook; for example, Year 10 has 1-19 sections and 1-8 practice exercises. Some pictures are used flexibly and the remaining images are numbered, while further readings are not numbered but inserted at appropriate places in the text. Rather than adhering to the curriculum's rigid, ordered approach, the authors flexibly altered positions and layouts as well as the ordering of information.

The relationship between different ICT content areas

Organising content can enhance basic concepts, basic principles, and the interrelation between different aspects of ICT. For example, when the database Microsoft Access is introduced in Chapter Two of the Year 12 textbook, students are taught through creating and exploring a specific relational database management issue. However, Chapter Three progresses to generalised theoretical concepts of database systems, and so consolidating student learning through two different but complementary teaching and learning approaches.

5.3.4 The organisation of ICT content

As mentioned in 5.3.2, the Year 10-12 textbooks contain seven bodies of content. Each chapter begins and ends with a content outline, and key terms are noted. Core content text is italicised and framed, not only to aid student memory and semester-end examination preparation but to facilitate teacher lesson plans and content reviews. Giving students the opportunity to see the content of a lesson before the teacher's class presentation is intentional. It works on the principle of student curiosity, so that the student may be thinking about the lesson before the class. The aim of the questions at the end of each chapter or section is to have students practise responding to what has been learnt in class and to stimulate home study, self-assessment and peer group discussion. Comment on the seven fold paradigm (Ho, et al, 2006) follows:

Basic concepts of ICT, networks and the internet: These provide students with a basic knowledge of ICT and the potential of informatics to develop resources in the service of society through the computer as a working tool. Students need to be aware of the place of ICT in the world of knowledge, along with ethical issues. As well,

students understand some basics of networks and the internet such as IP, domain names and the profits of networks and the internet, to know how to access a computer with the internet. Contents include a total of 32 periods (18 per cent of the three years curricula), but networks and the internet account for only 6.8 per cent.

Operating systems: The aim here is to distinguish hardware and software and to understand the power of the computer through support programs. Apart from the concept of the operating system, which may sound simple but needs careful thought and precise language, as it is applied to major problems, students study file management, communication with the operating system, and the specifics of a number of popular operating systems. This content accounts for 6.8 per cent of all curricula.

Text editing: the aim is that students should understand how to create and store documents, repair and format text, work with tables, and work with software applications through the menu. Specifically, the aim is to know how to use the Vietnamese text editor to produce clear, elegant text. This implies practice with tables and in the practice exercises for each final chapter of the year's curriculum there is a model for the minimum requirements of the program's efficient use of Microsoft Word. Thus, teachers need to teach students how to learn text editing on computer so that the text drafted follows the general convention (such as typing letters, () {} [] "", and the other characters, not down the line by Enter if not the end).

Programming Languages: This body of ICT content is made up of relevant terminologies and concepts of different programming languages. This has the largest textbook, from which Year 11 students study programming languages in 52.5 periods (30 per cent of the entire three years) across nineteen lessons. The content includes programming concepts, Pascal language, and several basic programming languages (C++, JAVA, and Visual Basic). The main programming content is data conversion, algorithmic manipulation of the data structures and commands used in programming languages. The MOET (2006) requirement is that upon students' completion of the textbook, they be able to solve simple problems with a computer, based on their knowledge of algorism, and data structure using Pascal or C^{++} programming language.

System database, the management system database Microsoft Access: Here there are simple programs and fundamental algorithms for programming branching structures and loops, structured data types, file and file manipulation, and subprogram and structured programming.

Architecture and database system security: This includes learning Microsoft Access, the database management system; how to create and modify table structures, how to create links between tables, table commands and basic operations, how to create a form and use it to update data; and architecture and database system security.

5.3.5 Teaching and learning units

The textbook units state the logic and relevance of programming languages. The textbook also aims to assist teachers in compiling lesson plans, conducting classes, assessing students and organising the classroom. It also aims to encourage active student learning, self-testing and self-assessment of knowledge and skills.

Each of the four to six chapters in a textbook, as already explained, contains a summary of content and prominently displayed key terms. This is particularly convenient for teachers. For example, Chapter One of the Year 10 ICT textbook describes some basic ICT concepts at the front of the chapter (p. 3) and the end of the chapter (p. 57) features key terms in science and technology problems, management problems, communications, artificial intelligence, entertainment software, and online training.

Each chapter is divided into anywhere from two to seven units of instruction, and each unit is subdivided into blocks of narratives, activities, work examples and sets of questions/exercises. A typical unit of instruction will start by introducing new ICT concepts and giving examples of related problems involving these concepts. It will end with exercises, for both computer and blackboard exercises. The following is an example of an abridged translation of Instruction Unit Three from Chapter Two of the Year 11 textbook.

1. The general structure

There are 2 parts:

[<Declaring part>]

<Body part>

Note:

•The interpretations by natural language are placed in brackets <and>.

•The components of the program may or may not have been enclosed in square brackets [and]

The components of the program

a. The report

Declare the program name

Declare the program name: possible or not.

Program<program name>;

For example, in Pascal

Program Example 1;

Program Quadratic equation;

Declare library

when to use library, the library must declare before.

+In Pascal:
Use <library name> ;

+In C++:
include<stdio.h>

Declare constant

const constant name= value;

For example:

In Pascal:

const Max=1000;

pi=3:14;

Result=20;

+In C++:

const int Max=1000;

const float pi=3:14;

  Declare constant often used for values appear multiple times in the program.

Declare variable

Var <variable name>:<data type>;

All variables replaced in the program must have names and declare for the compiler program knows and declares.

b. The program body

In Pascal:

begin

[<command sequence>];

End.

2. Simple example program

Example 1: The program shall provide display the message "Hello everyone"

In Pascal	In C^{++}
Program Example;	#include <stdio.h>
Begin	void main()
Write ln ('Hello everyone');	{ printf ("Hello everyone");
End.	}

A major concern is that, although the textbooks are regarded as the only way of teaching, they are not regularly updated. An example of this appears in the Year 10 textbook, which was issued in 2007. It included four chapters, and a total of 22 lessons. The 2011 edition saw changes in only six lessons (less than 25 per cent of the total content), and with no new added sections. For example, the file management system (Section 2, p. 66) is omitted, nor is the network model on p. 139 (see Table 1, Appendix H for detailed content). Also, there is very little content on copyright and licensing.

The other two textbooks have similar stories. The Year 11 ICT textbook included six chapters with 19 lessons, of which nine (a proportion of 47 per cent) were adjusted directly. However, lesson 13 (p.74) and lesson 19 (p.110) contain no text at all, with no explanation (see Table 2 at Appendix H for detailed content). The Year 12 ICT textbook has 13 lessons in four chapters; five lessons (38 per cent) have been revised, but lesson 1 (database concepts) and lesson 2 (p.17) do not contain teaching material (see table 3, Appendix H).

5.4 National Planning for ICT in Education

The Government of Vietnam decided in 2009 to approve overall development of human resources in ICT for the ten years period 2010-2020, with three main objectives. The first states that in 2010, 100% of high school students will be learning ICT. The second objective recommends strengthened training, to foster and to improve ICT teacher staffs for school education, and to promote the application of ICT in teaching and management at all levels. 65% of the teachers will have the ability to use ICT to support teaching and fostering by 2015. The third objective, is that by 2020, all school students not only those in high school will study applications of ICT.

To implement the above objectives, the Vietnamese Government gives five solutions: 1) Innovation of curricula, contents, methods, and process training, to enhance the quality of ICT human resources training; 2) To develop ICT curricula to include modular knowledge, update new technology, and to deploy training for learners. This program applies to all levels of education and continuing education; 3) Encourage manufacturers to develop programs that provide computer and Internet

connections at a discount for teachers, students and pupils. Also, by the end of 2015, 90% of high school teachers will have the use of their own computer, and a policy to offer research support to teachers, and helping students borrow money to buy a computer; 4) Developing and promulgating standards of knowledge and skills of ICT application for teachers; and 5) To implement the Government of Vietnam's Decision.

The MOET has annually required the Department of Education and Training to perform the tasks of ICT education in the school year. For example, in the 2013-2014 school years, the MOET has decided to perform the three tasks of ICT in education including: 1) Directing teachers and students to use open-source software inside and outside of ICT lessons; 2) Updating the programs and content of teaching towards modular knowledge's modern, practical and flexible, rather than using a textbook only; and 3) Ensuring all students are proficient in using office software, open-source software, E-mail and Internet services for learning.

With the major goals of ICT in education promulgated by the Vietnamese Government and the MOET, a full report on ICT teaching and learning assessment in high schools has yet to be produced. The government needs to show consistency in the evaluation of these criteria across regions and in all schools in the country.

5.5 Summary

It was found that the four documents reviewed in this chapter are closely interrelated. The first document sets out the general aims of high school ICT education and describes the content of the ICT curriculum. However, it is argued that the intention of this document is to demonstrate the relationship between Vietnam's national education policies and standards of high school teaching and learning. In particular, this review shows that the subject of ICT is a highly valued part of the Vietnamese curriculum.

The other three documents focus on the ICT curriculum itself. They share common aspects such as ICT content, ICT syllabuses, and ICT textbooks. Currently, the

Ministry of Education and Training has made a number of changes in the ICT content of textbooks to accommodate the reality and needs of teaching and learning.

The third document, the Syllabus, which is based on the Scheme (from 2007, before new school's year the MOET will be issued the Plaming of School's year for each year) and its revision, also adopts some ideas from Standards. This document is currently the most important ICT curriculum document in Vietnam. It includes all the themes of the intended curricula such as the objectives, content, and requirements for teaching and assessment. By reviewing this document, a Vietnamese curriculum framework can be formed. However, ICT textbooks will be replaced by the syllabus and standards after 2016.

This thesis addresses the need to compare the similarities and differences between intended ICT curricula and assessment in Australia and Vietnam. Further discussion of the strengths and limitations of the Vietnamese ICT curriculum will be presented in Chapter Eight, which will contrast and compare intended ICT curricula and assessment in Australia and Vietnam.

Chapter 6 Comparing Secondary ICT Curriculum, Policies and Assessment, in Australia and Vietnam

This chapter compares and contrasts the ICT curriculum in Australia and Vietnam, focusing on the rationale for each system to explain the key differences and similarities: a) ICT teaching and learning policies; b) Common reforming trends in the ICT curriculum; c) ICT curriculum rationales; d) ICT curricular objectives; e) Key ICT curriculum features; and f) Assessment methods.

6.1 Policies of ICT Teaching and Learning

It is fair to say that the 21st century has ushered in a time of universal acceptance of the essential role of ICT in economic, social, and educational change. For example, the leaders of the eight major industrial democracies of the world (G8 Heads of State, 2000) have noted that ICT has become a growth engine for the global economy. Moreover, ICT is likely to contribute significantly to sustainable development, enhanced public welfare, strengthened democracy, increased transparency in management, and the fostering of cultural diversity. Thus, ICT can promote peace and international stability. The OECD (2006) also emphasises the economic importance and impact of ICT in developed countries and points out the need of these countries to develop a workforce with skills to use ICT to increase productivity, as well as the need for young people to develop ICT skills to prepare for adult life. ICT education policies can play a significant role in reform and innovation (Means et al., 2004). This chapter shows how ICT works in different ways in Australia and Vietnam to contribute to positive change in the educational system.

6.1.1 Government policy

The two countries' ICT education policies have similar underlying goals, but there are a number of important differences. Australia's policy is embodied in the Digital Education Revolution Project (Government of Australia, 2008) and its Vietnamese counterpart is entitled National Planning for ICT in Education (Government of

Vietnam, 2009). This section will include comparisons, analysis and worthwhile goals and results of the implementation of ICT education policy.

The education systems in Australia and Vietnam

In both countries, pre-university education is divided into primary school, junior secondary school and senior secondary school education (refer to Table 6.1). There is also a distinction between public school (government-funded) education and private school (independently funded) education. In should be noted however that in Australia's Federal system, there are specific rules for the organisation of school education for each State. Here, the State of NSW is taken to represent Australian education. In contrast, in Vietnam, the educational system has uniquely synchronised between each local. This table describes the systems of education between two countries.

Table 6.1 The school education systems, New South Wales versus Vietnam

School Education	NSW	Vietnam
Primary School	Kindergarten + Year 1 to Year 6	Year 1 to Year 5
Junior Secondary School	Year 7 to Year 10	Year 6 to Year 9
Senior Secondary School (in Vietnam: "High School")	Year 11 to Year 12	Year 10 to Year 12

In NSW, "Kindergarten" is the first year of primary school, while in Vietnam primary education starts from "Year 1". Secondary school education in NSW is divided into four years of junior secondary followed by two years of senior secondary, while in Vietnam, there are three years of junior secondary and three years of senior secondary.

Scheduling

In Australia, students attend school for 200 days a year. The school year begins in late January or the beginning of February, and ends in mid-December. The long holiday runs from mid-December to late January, during the southern hemisphere summer. The school year is divided into four terms, each from nine to 11 weeks, with term breaks of two weeks. The typical school day is from 9:00 am to 3:30 pm. Students eat lunch at school.

Australian State or Territory websites conveniently provide school schedules, as shown in the following table for NSW. Teachers, students and parents are able to access the school timetable for each school year on the relevant State or Territory website.

Table 6.2 The NSW school schedule, 2013 and 2014

Term	2013	2014
1	Wednesday 30 January - Friday 12 April (Eastern division) Wednesday 6 February - Friday 12 April (Western division)	Tuesday 28 January - Friday 11 April
2	Wednesday 1 May - Friday 28 June	Monday 28 April - Friday 27 June
3	Tuesday 16 July - Friday 20 September	Monday 14 July - Friday 19 September
4	Tuesday 8 October - Wednesday 18 December	Tuesday 7 October - Friday 19 December

By contrast, accessing the current school schedule in Vietnam is not as timely. Teachers, parents and students are unable to access schedule details until two to three weeks before a term begins. It would be advisable for the MOET to make a similar arrangement to that of Australia, to make it less difficult for interested parties to prepare for the new school year (see section of 5.1.1). Access in Australia to information on schools, curriculum and related details is far easier for parents and students than in Vietnam.

National planning for ICT in education

According to Kozma (2011), there are four key elements to the framework of ICT policies: infrastructure development, leadership, teacher training, and technical support and curriculum development. This framework will be used to compare the operations of ICT policy in Australia and Vietnam.

The 2008 nation-wide DER initiated by the MCEETYA and the 2009 Ministerial Council for Education, Early Childhood Development and Youth Affairs (MCEECDYA) took the form of a 2008-2014 program to develop system-wide reforms on the integration of digital technology into school education. Similarly, the Government of Vietnam (2009) approved the overall development of human

resources in ICT by 2010 and up to 2020. However, beneath this surface similarity were major differences in implementing and evaluating ICT educational policies.

In Australia, the DER (2008) documentation evidences the following elements of Kozma's framework nationally. *Infrastructure access* is in place for digital teaching and learning resources, tools for processing information and a foundation for knowledge, communication and collaboration. *Leadership* ensures a coordinated plan to provide schools with infrastructure, learning resources and teacher capacity to address 21st century educational challenges. *Teacher training* ensures teachers have the skills and tools to design and deliver programs that meet student needs and mobilise the benefits and resources of the Digital Revolution. Further, *learning resources* are mandated to stimulate and assist student learning outcomes, including collaborative and interactive activity guides, and instructional and reference materials.

By contrast, the Government of Vietnam (2009) does not articulate specific educational objectives for ICT in education, and does not have a procedure for evaluating content delivery. For example, the Government requires that by 2010, 100 per cent of high school students are to be studying ICT, and by 2020 all school students are to be doing so. Further, by 2020, all students at every level are to be studying the application of ICT. The differences and similarities between *students learning ICT* and *students studying the application of ICT* were not clarified. More seriously, there is a delay of this report by the government. The National Plan for ICT in Education was issued in 2009, when the government recommended measures such as innovative curricula and methodologies for modular knowledge, updated new technology, and the deployment of teacher training. Nevertheless, five years later, the Government has not reported on its progress in implementing ICT education in schools. The objectives for ICT education in Vietnam may be well-intended, but are lacking clear definition in important ways.

Returning to the Australian situation, the Department of Environmental Resources regularly updates progress (DER Mid-Program Review, 2014). A 1:1 student to computer access ratio was achieved for Year 9–12 students across the country in 2011 through the provision of free laptop computers to students. Network

infrastructure, especially wireless access, is now more robust. Teacher focus on digital teaching and learning has sparked innovation in the use of digital technology in a marked way (DER, 2014).

As with other countries, national policy on ICT in Australia and Vietnam sees ICT teaching and learning as very important issues because it directly affects national development. Yet in many significant ways there are differences in the implementation of ICT education between the two countries. In Australia, what the government actually achieves is transparently recorded in public Annual Reports. In Vietnam, there are many gaps in the record of the implementation of ICT education policy. So far no national report has surfaced to demonstrate progress, and there are still no specific standards for evaluating ICT teaching and learning. Though the economic, social and political circumstances of the two countries differ, certain Australian educational procedures in relation to ICT could serve as useful models for the Vietnamese Government.

6.1.2 Regional policy on ICT education

There is a limitation when it comes to comparing the Australian situation with that of Vietnam in that education is fundamentally a State responsibility under the Australian Constitution. Furthermore, in NSW, public education is divided into the Eastern and Western Divisions. The school selected as a representative case of NSW education is located in the urbanised Eastern Division, and its comparative Vietnamese counterpart is in Yen Bai Province. However, this thesis argues that the comparison between this NSW school and the Yenbai school is fairly made, and that it validly represents the differences between the respective national systems of ICT education.

The Digital Education Revolution (DER-NSW 2011) policy of the NSW Department of Education and Training provided that every student in Year 9-12 student was to have, by June 2012, a wireless-enabled laptop computer that may be taken home every day. The computer is connected through a managed wireless infrastructure within the school or through an alternative private network outside. The aim is to engage every student in a sustainable program of learning that is personally

identified through the ownership and daily use of a personal computer. The laptop is for the sole use of the student and the student is responsible for it. Ownership will be transferred to the student on completion of Year 12. Schools will govern the use of the laptops in line with principles of responsible learning, and are to provide access to a loan laptop to a student whose own laptop is lost, stolen or collected for repair, replacement or investigation.

The DER-NSW program is a measure clearly designed to maximise the pedagogical impact of practical learning supported by ICT equipment at a 21st century level. Knowledge merges with skills and experience to achieve a level of student awareness and confidence. Further, there is a process of joint participation by teacher and students in a process of shared access to global information resources and powerful tools for information processing, communication and collaboration. The teacher is responsible for ICT-informed pedagogy in a classroom where students are responsible for the care of their laptops, using them in enhancing their learning, and securely saving their work (DER -NSW Policy Website, 2014; Howard et al. 2010).

As for Yenbai, Resolution 10 of Yenbai Provincial Committee (YPC, 2009) noted improvement in the quality of ICT teaching and learning in schools, and predicted that by 2015, all secondary schools would be equipped with school computers and with internet connection, and 50 per cent of the schools would have a website to facilitate ICT service management and teaching. These predictions have not yet transpired.

It will be useful to refer to the Department of Education and Training 2012-2013 Annual Report evaluating ICT teaching and learning at the schools and recommending measures to improve the quality of ICT education. The report notes that each teacher needs to have a laptop to use projectors for lectures, and the school has at least one computer room for teaching practice. It notes that all schools need to actively acquire and use software and support tools such as Microsoft Powerpoint, Violet, Lecture Maker, Adobe Presenter, electronic learning system e-Learning, MathType, Sketchpad, Editor lesson, Auto GRAPH, McMIX, Flashget, 5.4 Quizzes, 6:05 Crocodile Physics (Physics), 6:05 Crocodile Chemistry (Chemistry), Flash Player, Macromedia Flash, and software mixing examination tools like TestPro.

However, the Provincial Department in Yen Bai provides only an annual evaluation plan. It does not carry out any long term evaluation plan.

To compare the implementation of ICT policy in NSW and Yenbai from 2008, NSW has reported definite progress (DER-NSW, 2014), while Yenbai has not achieved many significant changes in the provision of ICT teaching. Teachers are still mostly relying on outdated textbooks to teach ICT subjects. To add to the problem, facilities in Yenbai have not been updated because of constraints on investment (YDET, 2013).

6.2 Trends in ICT Curriculum Reform and Impact on Quality

Since the late 1990s there have been considerable reforms in ICT curricula and pedagogy internationally. In this section, three common trends in ICT curriculum reform in Australia and Vietnam are discussed.

6.2.1 Outcomes-based education

As discussed in Chapter Five, outcomes-based education has been a major trend in education throughout the Western world since the late 1990s. In Australia, ICT literacy has been defined across the nation in terms of outcomes/standards-based education. At the state level, the NSW Government now expects ICT teaching and learning at secondary schools to focus and organise entire programs around clearly defined outcomes, and schools expect all students to demonstrate achievement of specified outcomes through each stage of learning.

In Vietnam, there have been calls for significant reforms in traditional teaching, learning and assessment practices. The revised Syllabus and Standards both advocate reform of the ICT curriculum in Vietnam. The Standards state that the essentially content-based ICT curriculum should be transformed into an outcomes-based education practice. The proposed reforms in Vietnam demonstrate a common rationale with Australian practice: there is the assumption that enhancing achievement in ICT is a significant key to developing the knowledge and skills necessary to compete in the global economy. Australia's educational goals include

ICT knowledge and skills, because the country's socio-economic prosperity has to rely on high levels of ICT skills among its citizens in the workforce (ACARA, 2012). Similarly, Vietnam regards economic development as closely linked with the development of science and technology and so considers ICT education as a priority (MOET, 2011). Thus, ICT educational outcomes are of key learning importance. The achievement of ICT educational outcomes is regarded as a key goal for educational reform in both countries.

6.2.2 Constructivist ICT education

Another major trend in contemporary ICT education is based on the concept that students are actively involved in the construction of ICT. Constructivist theory in ICT learning suggests that learners personally negotiate meaning by creating different mental representations of ICT knowledge.

Australian ICT documents such as Statements of Learning for ICT emphasise the knowledge, skills, understandings and capacities that students in Australia should learn and develop in the ICT domain. By comparison, in Vietnam, The Vietnam Education Law (2005) requires that methods of teaching promote the activeness, consciousness, initiative and creativeness of students. The constructivist approached to learning and teaching, in fact the infrastructure conducive to rule-based learning, emphasises specific lessons in very prescriptive ways. This may be because the approach to constructivism is new and the national infrastructure supporting it has not been updated with the new requirements.

6.2.3 Alternative assessment

Recognising the limitations of pen-and-paper tests in assessing student learning, educators are turning to alternative, performance-based assessment supported by criterion-referenced standards. For example, assessment is based on authentic tasks that indicate students' ability to achieve communication goals; teachers and students focus on communication, not on right and wrong answers; and students help to set the criteria for successful completion of communication tasks. Therefore, assessment helps educators gain a deeper understanding of student learning and enables them to communicate evidence of this to parents, employers, and the community at large.

Both Vietnamese and Australian assessment policy makers recommend the integration of assessment with teaching and learning as well as the use of a variety of strategies in assessing students' ICT learning.

6.3 An ICT Curriculum Rationale

ICT is now widely acknowledged globally. While ICT education is a highly valued subject in secondary schools in both Australia and Vietnam, there are distinct differences between the two countries in the way ICT is seen as a key learning area. In order to describe in detail the differences between ICT teaching in the two countries, the following fundamental issues arise: a) What is the ICT curriculum? b) Why is it important to study ICT in secondary school? c) How should ICT be taught and how should it be studied? The answers to these questions need to be multidimensional, to enable comparison and contrast between ICT senior secondary curricula in Australia and Vietnam.

6.3.1 The nature of ICT curricula

According to Australian documentation (ACARA, 2012), ICT has the potential to extend student learning capabilities, engaging them in understanding concepts and processes in areas of learning and facilitating changes in learning, thinking and teaching. Its keynote is exploration, manipulation, and discovery. ICT enables powerful, precise and concise communication.

Australian curriculum developers have essentially adopted a constructivist view of ICT in education that recognises its capacity to handle various aspects of reality as learners construct their own knowledge. The Australian documents emphasise the practical value of ICT in social science, medicine, economics, commerce, engineering, and art. Apart from the information technology aspect, there is clear emphasis on ICT as a means of communication. It is a fair interpretation of the rationale here to say that the Australian ICT curriculum is based on a philosophy of pragmatism and constructivism.

In contrast, Vietnamese ICT curriculum developers (Ho, et al., 2010) define ICT teaching and learning at school as a science; ICT consists of concepts and rules

characterised by practicality and rigor. In a traditional textbook-oriented pedagogy of ICT teaching and learning, ICT is seen as essentially a body of ICT teaching and learning. The nature of ICT is essentially that of a distinctly structured body of knowledge with its own laws. The ICT curriculum in Vietnam emphasises the importance of ICT in economic, social and cultural development, and there is definite advocation of ICT as a valuable tool to train students' logical capacities.

These two contrasting views of the ICT curriculum for schools reflect different social and cultural traditions. As Chapter Two shows, the traditional Vietnamese education system focuses on the college entrance examination, and accordingly the ICT curriculum, designed for college entry, stresses theoretical rather than the practical knowledge. Thus, in secondary schools in Vietnam there are a total of 57 practical periods as opposed to 157 periods of theory (Ho et al. 2010). There is a definite contrast here with the outcomes-based education that has recently influenced Australian ICT curriculum developers, which has strongly emphasised the teaching of practical knowledge and problem-solving skills (Stage 6 Syllabus, 2010).

Current thinking suggests that there are distinctive features in ICT curricula between Southeast Asian and Western countries in terms of the nature of ICT. In Southeast Asian countries (take Vietnam as an example), ICT knowledge is viewed more like a "product", despite curriculum reform aimed at changing this perception (Peeraer & Van Petegem, 2012). In contrast, in Western countries (take Australia as an example), ICT is perceived more as a *"process"* (Al-Debei & Al-Lozi, 2012). However, Terwel (1999) shows that constructivism in education can be seen as a recent branch of the cognitive science, there is a direct link between constructivism and pragmatism, both of which emphasise the active role students play in acquiring knowledge and the process of constructing knowledge.

6.3.2 Key principles of teaching and learning

Curriculum documents in both countries cover key principles and requirements for ICT education. A current NSW ICT secondary syllabus document (NSW Department of Education, 2013) envisages student learning in terms of five principles, three of

which are motivation, interaction, and investigation. The other precepts are that students learn ICT through language, and that they learn ICT as individuals, very much in the context of the intellectual, physical and social growth that they are experiencing at their particular age.

For its part, the Vietnamese syllabus sets out three main precepts: teaching is to enhance students' basic knowledge; it is required to develop students' intelligence and ability; it is required to integrate ICT with education in ideology and morality.

Besides these general principles, Vietnamese curriculum documents also include the compulsory use of textbooks, which provide detailed suggestions for teaching and learning. As discussed in Chapter Five, the textbooks incorporate two principles: ICT teaching should stress the interrelation and integration of ICT knowledge; and ICT teaching should be appropriate to the students' level of cognitive ability.

There are distinctive features about ICT teaching between Southeast Asian and Western countries in terms of the teachers' role. In Southeast Asian countries, with Vietnam as an example, ICT teachers are required to play a central role in the teaching process. The teacher is assumed to be an expert in ICT, and ICT knowledge is transferred from teacher to students. In essence, this is a transmission model. In Western countries like Australia, the role of the teacher is more of a facilitator of teaching, helping students to learn. However, the transmission role of the teacher is still apparent in many Australian classrooms.

6.3.3 Common features

Despite the conceptual differences noted above, both national systems of ICT education do share common characteristics about the nature of ICT and the purpose of ICT learning. Both define ICT education as "a science of relationship", and both accept that ICT education is pursued for a variety of practical purposes as well as for its intrinsic interest. Both agree that ICT education is the study and mastery of basic knowledge and skills; a foundation for the learning of other subjects; and a study that is important in achieving an ability to think in an ICT perspective.

As far as indicators are concerned, "ICT understanding", that is, the development of students' basic ICT knowledge and skills is one of the most important goals of education in both Australian and Vietnamese secondary schools. Furthermore, in Vietnam, ICT and Vietnamese language are the only two subjects requiring formal post-secondary school assessment. In NSW, ICT understanding and competency are the only two areas that are required to be standardised. It remains true however that the respective rationales underlying the Vietnamese and Australian ICT curricula appear to be built on different philosophical, social and culture bases. In the following sections, ICT educational rationale and its relation to other ICT curricular issues are further problematised.

6.4 ICT Curriculum Objectives

The Organisation of Economic Co-operation and Development (OECD) has pointed out that the nature and extent of ICT objectives are essential for policy makers and curriculum specialists in all countries. A particular concern of international studies is to examine curricular objectives of education systems and the way they are organised to achieve specific outcomes which may vary considerably in quality, depth and order (OECD, 2002). As just shown, common objectives do exist across the Australian and Vietnamese systems, but it is necessary to direct attention to actual outcomes.

As discussed in Chapter Five, Vietnamese syllabus documents describe the objectives of ICT teaching in secondary schools in some ways:

These objectives, ordered according to their importance, indicate that cognitive aspects of learning are a priority in the current Vietnamese ICT curriculum, which focuses not only on fundamental knowledge and skills but on students' logical thinking. The objective also recognises the social domain of ICT as critical: ICT is a vehicle for developing ideological and moral education.

The objectives of ICT education in Australian documents are different. They reflect a concern to develop positive attitudes towards ICT as well as the development of knowledge and skills and information technology processes, expressed in terms of three major objectives: to appreciate ICT as an essential and relevant part of life; to

develop students' ability to work with ICT; and to advance students' knowledge, skills and understanding.

The Australian priority is the process of learning and application, with no evident moral or ideological political objectives. Incidentally, the ICT Stage 6 mention of "developing students' appropriate language for the effective communication of ICT education" is not mentioned in the current Vietnamese ICT curriculum.

From the aforesaid discussion, the different emphases in ICT curricula may be attributed to differing views on the nature of ICT education. As Section 6.2 noted, Vietnamese curriculum developers adopt a purist view of ICT education that sees acquisition of ICT knowledge content as the main objective in the ICT curriculum. By contrast, Australian curriculum developers adopt a constructivist view of ICT. They assert that the experience of ICT is a process, and education in ICT through practical activities is the most important objective in the ICT curriculum.

The general goals of education as well as the social, culture, economic and political situation come into play. As Prise (1992) notes, moral-political objectives included in the ICT curriculum in Vietnam are determined largely by the social and political situation where moral-political objectives are set as a general educational goal and conveyed through all subjects of school curricula and out-of-class activities,

Education authorities in Vietnam base this practice on the simplistic belief that the student can be "forced" to conform to teaching, and that student behaviour will then conform to such learning. The intended curriculum then acts as a powerful influence on student values and beliefs.

Yet the two systems do share common characteristics. Analysis shows that both systems divide curriculum objectives into cognitive and non-cognitive domains. Cognitively, both systems accept that ICT education should aim to develop student capacities of comprehension, application of formulas and principles, analysis of problems and synthesis of conclusions, and thoughtful evaluation. Both systems aim to develop students' basic ICT competence, though there are differences in the

relative emphasis placed on knowledge and skills respectively. Certainly both systems recognise the importance of problem solving in ICT learning.

By including ICT processes in the curriculum objectives, the newly published version in Vietnam adopts, to some extent, a constructivist view of ICT teaching and learning addressing the link between and interests in ICT education activities.

For students of ICT, both countries recognise the importance of personal motivation in a broad affective domain. Both urge that positive attitudes towards technology in general should be promoted to students. There is a common view that ICT education should relate to students' daily lives.

Specific topics within the ICT curriculum should relate well to each other, and ICT as a subject should relate well to other areas in the curriculum. The following section shows how this is envisaged in relation to a number of specific ICT content areas.

6.5 Key Aspects within the ICT Curriculum

The ICT curricula in Australia and Vietnam are similar, as they are with the curricula of many other countries. Both countries stress fundamental ICT knowledge and skills. However, deeper analysis of the scope and sequence of content for both teaching and learning reveal distinct differences in curricular expectations.

6.5.1 Social and ethical issues

To bring together details of "social and ethical" or "informatics and social" issues referred to earlier, Table 6.3 shows major differences between the NSW and Vietnamese secondary school ICT curricula.

Table 6.3 Major differences in social and ethical issues content

Content	NSW	Vietnam
Legal issues	• Copyright and/or licensing • Piracy • Intellectual property • Security and protection	• Cultural and social legislation on computerisation.

Content	NSW	Vietnam
	(including viruses)	
Ethical issues	• Code of practice and conduct • Privacy and Security • Inappropriate use including hacking • Data accuracy, validity and bias	(Not included in Vietnamese curriculum)
Social issues	• Changing nature of work and enterprise • Equity, access and control for all users with respect to gender, disability, and culture • Industrial issues	• Impact of Informatics on the development of society • Social Computerisation • Entertainment • Education
Industrial issues	• Rights and responsibilities of users of Information and Software Technologies • Ergonomic principles and industry standards	• Solving problems of science and technology • Automation and Control • Artificial Intelligence

Table 6.3 shows that the Vietnamese curriculum includes less content regarding social and ethical issues than the NSW curriculum.

Social and ethical issues (or informatics and social issues) are important for students in learning ICT procedures and actually using ICT applications. UNESCO (2002) asserts that teaching social and ethical issues helps students understand the social, economic and ethical issues related to the use of information technology. It explains the past and present states of computing development and projects trends. The NSW Board of Studies (2010) requires students to be introduced to software widely used in society, to consider how the software originated, and to reflect on issues arising from the course of development of the technology. Social and ethical content accounts for 10 per cent in Year 11 and is still maintained at 7 per cent in HSC examination Year 12.

By contrast, social and ethical content is not emphasised in Vietnamese ICT education. As Table 6.3 shows, ethical issues are not a specific part of the curriculum. Social and ethical issues is taught only in Year 10, in a small section amounting to 20 lines (Informatics Year 10, 2010). This observation may be related to the use of pirated software in Vietnam. According to the Business Software

Alliance (BSA) Global Software Survey (2013), 81 per cent of software used in Vietnam was unlicensed compared to the Australian rate of 21 per cent. This issue will be taken up in some detail in the Conclusions and Implications Chapter.

6.5.2 Hardware

Table 6.4 Hardware content in the ICT curriculum

Content	NSW	Vietnam
Hardware components and functions	1) motherboard 2) central processing unit (CPU) 3) coprocessor chips 4) memory: random access memory (RAM), read-only memory (ROM) 5) hard disk 6) controller cards 7) graphics adapter cards 8) power supply 9) expansion slots 10) bus lines 11) input/output ports 12) display 13) cameras 14) digital watches 15) monitoring devices	1) Central processing unit (CPU) 2) Main memory: ROM (read-only memory); RAM (random access memory) 3) Secondary Memory: Hard disk, Floppy disk, CD disk, and USB 4) Input devices: Keyboard; Mouse; Scanner; Webcam 5) Output Devices: Monitor, Printer, Projector, Speaker and Headphone, and Modem
Hardware solutions	Developing hardware solutions	Not included in Vietnamese curriculum

Table 6.4 above shows essential similarities in hardware education. The Australian lesson content however is more sophisticated: The Australian Curriculum (2010) includes training content that covers hardware system and function components; the way in which a variety of input devices, output devices, storage devices and CPU components achieve their purpose; and current developments in computer hardware and trends. The Vietnamese Informatics textbook (Year 10) on the other hand provides only brief, sketchy descriptions of major hardware concepts, so that when students' study relates to hardware, they experience difficulty in understanding.

6.5.3 Software

Table 6.5 Major differences in software content

Content	NSW	Vietnam
Concepts and Issues	1) Evolution of software	1) The concept of software

Content	NSW	Vietnam
	applications 2) Intellectual property 3) Social context of software design	2) Distinguishing between software and system software; 3) Operating system; 4) File and file management; 5) Communicating with the operating system; file processing;
Introduction to Software Development	1) Defining and understanding the problem; planning and designing software solutions; 2) Implementing software solutions; 3) Testing and evaluating software solutions; 4) Maintaining software solutions	1) Text editor; 2) Some concepts of programming and programming languages; 3) Simple program; 4) Branching and loop structure; 5) Structured data types; Files and file operations; 6) Subprograms and structured programming
Developing Software Solutions	1) Project management 2) Documenting software solutions 3) Developing software solutions 4) Social and ethical issues related to software solutions	1) The concept of a database system; 2) System Administrator database MICROSOFT ACCESS; 3) System database relations
Development & Impact of Software Solutions	1) Social and ethical issues 2) Application of software development approaches	Not included in the Vietnamese curriculum
Software Development Cycle	1) Defining and understanding the problem 2) Planning and designing software solutions 3) Implementation of software solution 4) Testing and evaluating of software solutions 5) Maintaining software solutions	Knowledge and security database systems

Table 6.5 illustrates major differences in curriculum software content between the two educational systems. NSW software provides much more detailed information on Software Development, Software Solutions and the Software Development Cycle. The Vietnamese curriculum aims to help students solve simple problems by computer in several programming languages, and like the Australian curriculum teaches basic algorithms with a choice of teaching one of the programming languages: Pascal, C / C ++, Java, Visual Basic, or Python (Ho et al. 2010), but the

Vietnamese curriculum does not provide knowledge and understanding of legal, social and ethical issues and their effect on software design and development, and it does not focus on skills in teamwork and communication associated with the design and development of software solutions, as in NSW.

6.5.4 Network and internet

In Australia, Network and Internet content is taught in Years 7-10 as two student options out of a total of eight. In Vietnam, students study only some basic concepts of network and Internet from one chapter of Year 10's textbook over a total of 12 periods: six periods of theory; four exercises/practical periods; and two exercises (Knowledge and Skills Standards Textbook for Year 10, 2010).

Table 6.6 Network and Internet content in the ICT curriculum

Content	NSW	Vietnam
Internet	1) Historical perspective of the internet 2) Uses of the Internet 3) Internet software 4) Types of protocols 5) World Wide Web (www) 6) Control of access to web information 7) Website development 8) Features of a website	1) What is the Internet? 2) Types of Protocols 3) Organizing and accessing information 4) Finding Information on the Internet 5) E-mail 6) The issue of information security 7) Uses of Internet 8) Explorer
Networking Systems	6) A communications network 7) Data transmission modes 8) Data transmission rates 9) Data transmission media 10) Types of networks 11) Client server and peer-peer networks 12) Components of networks 13) Security of information 14) Network topologies 15) Network operating systems 16) Factors influencing media transmission 17) Project development	1) The concept of computer network 2) Communication protocols of computer networks 3) Classification of computer networks 4) Global Information Network 5) The network model

6.5.5 Other content

In addition, the four major strands – social and ethical issues, hardware, software, and internet and network – are contained in both curricula. There are quite a number of differences in content that are described here.

Developing a solution package

The NSW curriculum focuses on designing and developing a software solution to a complex problem. It is suggested that students learn to use a logbook to document the progress of their project as well as email messages, spreadsheets, blogs and handwritten dated entries. With each entry, the ICT curriculum requires students to describe: time and date, tasks achieved, difficulties and solutions, ideas and thoughts, reflection on progress, and reference to resources used. In contrast, the curriculum in Vietnam cannot accommodate all this in its secondary schools due to the limited time for ICT teaching and learning (See at 5.1.5), and the ICT curriculum is not updated frequently (from 2007 to present, MOET has only revised one time, in 2011).

6.5.6 Summary

Australian curriculum developers have achieved a definite balance of content across the four strands identified in the curriculum: social and ethical issues; hardware; software; and network and Internet. Vietnamese curriculum developers place more emphasis on the software strand.

As a general statement, the Australian curriculum focuses on developing processes and practical utilisation of ICT knowledge, skills and creativity, while the Vietnamese curriculum focuses on solving simple problems through some programming languages. The Australian curriculum adopts a constructivist approach to ICT learning, but the Vietnamese curriculum takes a traditional approach to ICT education based on presentation of a fixed body of knowledge.

6.6 Method of Assessment

Curriculum documents for both national systems contain suggested assessment arrangements.

6.6.1 The nature and purpose of assessment

The Australian curriculum framework embodies assessment as an integral part of the learning process, aimed at optimising the learning process (Chapter Four). The major purpose of assessment is for the improvement of learning. ICT Stage 6 describes

assessment as "the process of gathering evidence of and making judgment about students' needs, strengths, abilities and achievement." In understanding a rationale for assessment, assessment ICT Stage 6 asserts that assessment should lead to improve in student learning because information gained through assessment provides feedback to students and teachers, leading to more effective learner-centred programs and ultimately improvement in student learning. Assessment Stage 6 is about gathering information on student development and achievement, helps to plan further learning experiences, and gives teachers a starting point to evaluate the teaching program and also target particular learner groups.

In Vietnam, curriculum documents base ICT education assessment on teaching objectives and basic syllabus requirements. It requires not only assessment of students' understanding and mastery of basic ICT knowledge and ability are assessed. It is also recommend that the teacher should also improve assessment methods in order to enhance student learning. The standards see the purpose of assessment being to enhance students' all-round moral, intellectual and physical education development. The syllabus also envisages improved methods of assessment as a means of encouraging students to study harder.

In both countries, assessment is closely linked with teaching and learning, and the major purpose of assessment is to enhance student learning outcomes. Yet the rationale for assessment that is presented in each case is quite different. The Australian documents focus on positive feedback to teachers that comes out of assessment in relation to their teaching methods, while the Vietnamese documents focus on using assessment feedback to promote student self-motivation for improvement in their studies.

6.6.2 Principles of assessment

The Australian National Statement (discussed in Chapter Four) stipulated that assessments should reflect all of the goals of the school ICT curriculum and be demonstrably fair, valid and reliable. In comparison, the Vietnamese syllabus approach is broadly similar: ICT assessment should be based on the teaching objectives and basic requirements of the syllabus; not only should students' mastery

of basic ICT knowledge be assessed, but also their practical ICT ability. Analysing the above principles, it is clear that the operative policy principle of both education systems is to align assessment with stated syllabus/curriculum outcomes.

6.6.3 Strategies for assessment

There are set strategies in both countries for the development of assessment. The Australian National Statement urges continued emphasis on "useful, practical and fair assessment strategies". NSW ICT stage 6 recognises the need for students to demonstrate their learning through speaking, writing, drawing and engaging in other activities, and so encourages handwritten tests; practical investigation and recording of observations accompanied by student explanation and work samples, and structured interviews along with student-teacher discussions.

The Vietnamese plan prescribes the form of assessment as open or closed book examinations, oral tests or a practical test using practical manipulation. Reporting uses percentages or grades, with teacher comments as necessary. The Syllabus encourages oral examinations and practical tasks in addition to written examinations, and also emphasises the role of daily classroom teaching and regular homework as well as the end of year examination. The standards suggest that the methods of assessment should have a variety of approaches such as paper-pen examination, thematic activities and essays; group activities; and self-assessment and daily observations be used by the teacher to make balanced assessments.

Documentary analysis of proposed assessment procedures shows a variety of strategies for ICT assessment. However, the Vietnamese system tends primarily to emphasise written examinations while NSW as a representative of the Australian system as a whole emphasises a broader range of assessment strategies.

6.6.4 Other assessment issues

The Vietnamese curriculum guidelines document the use of both summative and formative assessment. With summative assessment, which is reckoned at the end of the course of study, student achievement is measured against the specified learning objectives of the syllabus. Thus, end of semester and school year end examinations

as well as the final secondary school examination assesses achievement. The ongoing process of formative assessment on the other hand, which enables feedback and guidance, is strongly oriented towards assisting students to improve their understanding and their performance (Wallace et al., 2009). Another way of viewing the process is as a one-off formal semester assessment as opposed to informal assessments that will occur during teaching and learning activities.

Unlike Vietnamese documents, in Australia, at both national and state level, several official documents such as secondary ICT outcomes and indicators provide common guidelines and examples to assist teachers, schools and systems with the complex process of assessment. The overall intention is to take models of appropriate assessment and make their requirements and methodologies explicit for the teachers who need to use them in practice.

6.7 Summary

Australia and Vietnam both follow a global educational reform agenda. In many ways, their objectives, content and suggestions for teaching, learning and assessment of the subject of ICT are commonly held. Both systems advocate an outcomes/standards-based rationale, both adopt a constructivist approach to teaching and learning, and both encourage the alignment of assessment practices with teaching and learning. It should be said however that there are underlying differences between the rationales of each respective educational system, in particular in the Vietnamese tendency to assess a body of ICT knowledge as opposed to the Australian tendency to assess a growing capacity to apply ICT skills, though it must be accepted that there are differing systemic educational resources involved.

The case studies in Chapters Seven and Eight track ICT curriculum and assessment in a representative school in Australia and Vietnam respectively.

Chapter 7 Case study of Yenbai High School, Vietnam

The public senior secondary school in Yenbai, Vietnam has been coded as "Yenbai School". This chapter is a case study investigating the teaching and learning of ICT in Yenbai School. In 2013, data were collected through reference to documents, through interviews with Principal Khoa and other teachers on their views of ICT teaching and learning, and through observation of classroom practice.

The content of this chapter is presented in six sections: 1) Background information on Yenbai School; 2) Beliefs about the quality of ICT teaching and learning; 3) Opinions about the content of ICT teaching and learning at high schools; 4) Views about ICT assessment; 5) Suggestions about factors influencing the quality of ICT teaching and learning; and 6) Summary.

Ultimately this case study will serve as a platform for a comparative examination of the major research question: What are the key characteristics of the quality of the teaching and learning of ICT education in NSW and Yenbai Province?

7.1 Background Information on Yenbai School

After discussing the rationale underpinning education in Yenbai School, specifically including ICT education. This section will describe the key policies and curriculum of the school as well as its strategies for quality teaching and learning.

7.1.1 Rationale: Yenbai School

Yenbai School, established in 1957, is one of the largest public high schools in Yenbai Province. The school has a total of 83 staff, including 71 teachers, among whom 11 have a Master's degree and 60 have a Bachelor's degrree. The school library has over 5,000 books (not including e-books). There are two computer laboratories, containing 97 computers with internet access, and there are seven classrooms, each equipped with a projector. School Principal Khoa has said that "the teachers' knowledge and conduct play an important role in the school's quality of teaching and learning and the reputation of the school" (Principal, interview, Apr. 14, 2013).

In the 2013-2014 school year, 93 per cent of the students were recorded as being of good conduct, 71 per cent as advanced students, and 8.5 per cent as achieving excellent results. One hundred per cent of the Year 12 students graduated, with 49 achieving the status of excellent students at the Provincial level, and three were excellent students at the national level.

In the 2013-2014 school year, ICT education percentage results for Years 10 to 12 were: 14.6 per cent excellent students; 60.6 per cent good students; 24.7 per cent average students; and 0.1 per cent weak students. However, it is important to note here that ICT learning results are categorised in terms of "true" or "false" (that is through judgements of either "truth" or "untruth"). The accuracy and validity of these assessments is discussed in 7.4 below.

The policy of Yenbai School is based on the educational objectives promulgated by the Vietnamese Ministry of Education. The school aims at the overall development of students. This development should not only be intellectual and vocational, but should include the acquistion of life skills, and be based moral and esthetic values, including physical education and the development of creative personal abilities. Yenbai School's motto is: ***Emulate good teaching and good learning.***

The school's policies focus on teachers in essentially two ways: morality and knowledge. Morally, teachers' personal behaviour and lifestyle should be socially acceptable and teachers should respect their colleagues, especially in the presence of students. Regarding knowledge, examinations and assessments given by the teachers must comply with the content and programs of the Ministry of Education. Teachers should use clear, precise language in the classroom, encourage active student learning and maintain warm relations with students.

The Yenbai School curriculum contains 13 subjects, one of them being Computer Education. In line with the general practice where high schools decide on the number and content of streams on the basis of student preference and prevailing school circumstances, Principal Khoa explained that Yenbai offered the Basic Strand

with 19 classes, and the Natural Sciences Strand with 12 classes. Yet, with all Vietnamese high schools, students studied only one ICT subject (a major difference from the NSW senior secondary curriculum). As he explained:

> In our school, each teacher has a syllabus and a grade textbook for the ICT subject, and is required to follow these. For all teachers, teaching and assessment must strictly accord with the requirements of the syllabus and textbook content (Khoa, interview, Apr. 14, 2013).

The Principal explained that the 71 Yenbai School teachers were divided into six groups. One of the groups, numbering 15 members, was comprised of ICT and Mathematics teachers.

To make a comparison at this point: the content in the Vietnamese syllabus was much more difficult than that of Sydney School, and what was expected of students at similar age levels in Vietnam was much greater than in the Australian case. It is important to note that at Sydney School teachers were able to implement the syllabus through choices of lesson sequence and through their individual teaching practices. The use of textbooks at Yenbai School was also very different from that at Sydney School: Yenbai teaching followed a fixed prescribed content and sequence, whereas Sydney School teachers planned and taught lessons using a variety of texts, materials, and strategies.

Principal Khoa saw the rationale for upgrading teacher skills in Yenbai School in terms of effective deployment of the education workforce, enhancing management expertise in the educational field, and evaluating principal and teacher professional standards according to MOET (2006). Yet Yenbai School does not as yet have a detailed strategy to improve the quality of teaching and learning that complies with either the Ministry of Education or the Provincial Department of Education and Training another point of difference from Sydney School.

7.1.2 The Yenbai Principal and ICT teachers

This researcher interviewed Principal Khoa. He had spent 20 years teaching mathematics and 10 years in educational management. After eight years as Deputy Principal at two different high schools, he was appointed Principal of Yenbai School in 2011. Principal Khoa commented about ICT education at Yenbai School, saying that ICT teachers must be professtionally competent, dedicated to students, and fair. The ICT teachers were also expected to involve themselves in guiding students to achieve practical results.

Principal Khoa suggested two teachers who agreed to be interviewed. Mr Ha and Ms Nga each had more than 10 years' teaching experience. Ha had graduated from the Ho Chi Minh City Pedagogical University in mathematics (a four year course) in 1992, and from 1995 to 1996 studied ICT at Ho Chi Minh City Polytechnic University. Nga graduated from the University of Natural Sciences in 1999, and received in-service training in ICT. Nga has been teaching ICT at Yenbai School since 2004.

Ha and Nga explained that the high school ICT curriculum was as follows:

Table 7.1 The Planning of ICT teaching (MOET, 2009)

Year	Periods per week	Teaching weeks/ School Year	Periods per year
10	2	35	70
11	1.5	35	52.5
12	1.5	35	52.5
Total		105	175

MOET (2009) allowed a school to choose between 18 periods in semester one and 34 periods in semester two in Years 11-12, or the other way round. Yenbai opted to begin with 18 periods in semester one and 34 in semester two.

Ha taught ICT to one class of Year 11 students and five classes of Year 12, as in Table 7.2.

Table 7.2 Ha's ICT school year teaching periods (Ha, interview, Apr. 24, 2013)

Year	Periods/a week In Semester one (18 weeks)	Periods/a week In Semester two (17 weeks)	Periods/ a year
Year 11	1	2	52
Year 12	5	10	260
Total	6	12	312

Each class was comprised of 35-48 students. In semester one this was for six periods per week; in semester two, 12 periods per week. A period is 45 minutes long.

Nga taught 11 different ICT classes in semester one (three Year 10 classes, three Year 11, and five Year 12). In semester 2 she taught eight different classes (three Year 11 and five Year 12).

Table 7.3 Nga's ICT school year teaching periods (Nga, interview, Apri. 26, 2013)

Year	Periods/week Semester one (18 weeks)	Periods/week Semester two (17 weeks)	Periods/ year
10	6		102
11	3	6	156
12	5	10	260
Total			518

Each class was comprised of 38- 48 students; a class lasted 45 minutes. The MOET specifies that each teacher must teach 18 periods per week, a total of 630 periods a year. Ha fell short by 318 periods per school year and Nga was short by 112 periods per school year. The Principal explained to the researcher that these two teachers also had other duties, which included managing the school website, being in charge of the computers, including computer repair and maintenance, and arranging the school's schedule. However, the two teachers seemed unable to answer my question as to how much time was spent on these duties.

ICT learning theory was carried out in one computer room, and programming in another. On initial impression, the theory classrooms were clean, airy and furnished in traditional style. Apart from the blackboard, slogans a classroom rules were displayed on the walls, but there were no other ICT materials in evidence. In an average class of 45 students, there were three rows of eight tables per row, with two to three students at each table.

The two Yenbai School computer rooms each contained 45 computers, all connected to the LAN. There were four rows, each row with 11 computers. The other computer was for the teacher and was directly connected to the projector and screen.

The researcher observed three Year 11 ICT lessons for each teacher. Appendix H sets out a general picture of ICT teaching and learning at Yenbai School based on analysis of classroom observations and interviews with the teachers.

7.2. Beliefs about the Quality of ICT Education

The Principal of Yenbai gave his view that ICT involves scientific discipline and standard applications, and covers general issues such as information, file structure and folders as well as operating systems. Computer operations relate to industry and to life in general, and informatics generally requires general manipulative skills rather than specialised knowledge.

It follows that ICT teaching and learning require a high degree of flexible thinking from teachers and students. An ICT concept can have various definitions and various interpretations. Teachers need to focus on what student assignments teach about software knowledge and user skills, as well as their application to other school subjects, and ultimately the use of informatics after graduation. In this way, ICT as a subject contributes to a high level intellectual reasoning and accurate, critical and disciplined work habits.

Ha noted that although teachers can refer to various useful sources, when it comes to providing exercises and test formats, they have to create their own student learning environments. Ha said that beginning with ICT in Grade 10 had a definite

attractiveness to the students for its novelty and high social demand, especially with the stimulus of a city environment. ICT is an instrument of learning that can relate to academic understanding and especially internet use in Mathematics, Geography and History. "Computer use" is only a cover-all term for the broad social value of ICT teaching in school.

Ha and Nga both identified self-study and classroom observation as the two main approaches to in-service professional development at Yenbai. Both referred to their individual online self-study work, and Nga emphasised the value of sharing lesson and examination plans with other Vietnamese schools. Regarding observation, the MOET (2008) requires that for high school educational quality, four periods per teacher must be observed each year, two periods under Deputy supervision and two periods at teacher camp; and there must be 18 additional periods of peer observation per school year.

The MOET mandatory week of in-service training formed part of Ha's 2004, 2005 and 2006 MOET Major ICT Teacher Certificates, his 2007-2008 Practical Training Ceriticate, and 2012 Professional High School Certificate. Nga for her part had a 2005 Hanoi National Education University Educational Resesearch Institute Practical Training Certiticate and a 2007-2008 Practical Training Certificate.

Interviews showed that the two teachers were concerned with making ICT accessible. They emphasised the need for careful lesson deisgn with clear objectives and planned activities.

In his lessons, Ha emphasised a flexible, passionate commitment as a model for the students where they could become familiar with programming and so develop a similar positive passion for computer use. In her lessons, Nga showed how theoretical techniques could reveal the nature of a problem. As students understood the lessons, she gave more advanced exercises, and tended to set new exercises beyond the scope of the textbook.

7.3. Opinion on High School ICT Education

Observational data from six Year 11 lessons showed strict adherence to the MOET (2009) agendas based on the 2006 MOET textbooks. Teachers also referred to Teaching of Knowledge Standards, Skill Standards ICT Subject Year 11 (Pedagogical University, 2010); ICT Year 11 Teacher's Textbook (Educational Publisher, 2006); and ICT Year 11 Exercises (Educational Publisher, 2006). Students studied ICT Year 11 textbook and the exercise ICT Year 11 Exercises (Educational publisher, 2006).

Practice on a computer is required and is a constituent of the theory lectures. ICT is a difficult subject to teach when teachers do not fully use the computer to illustrate or practice using sample lessons. Although the design of the program and lessons in ICT textbooks encourage maximum independence with specific tasks on a computer, the teachers' communication still depends heavily on illustrations and presentations on computer. For this reason, teachers should pay attention to characteristics in the expression of active lessons in the absence of computer performance in the classroom.

Informatics differs from other disciplines related to technology or other vocational training because of its association with such a rapidly changing world. Information technology, namely computers is always changing, and requires teachers to constantly improve their professional skills. This environment and its practices are varied and inconsistent, a unique feature in teaching ICT as a subject. The Windows operating system, for example, has nearly 20 different versions being used in Vietnam, such as Windows 95, 98, 98SE, ME, 2000 Professional, 2000 Server, XP Professional, XP Home, 2003 Server and Vista. The system requirements to configure the programme disk in a computer are very diverse. Teachers therefore need to be proactive in learning the latest teaching theories for providing practical guidance to students. Information in the ICT textbooks is only legal on subject knowledge rather than the process imposes on computer manipulation. With each lesson, teachers must be fully prepared to actively present concepts, and manipulate illustrations on the computer in a way that is easy for students to understand. ICT is a relatively new subject in high schools, and there is still a lack of experience in theoretical as well as practical teaching. Teachers must therefore be aware of the subject's basic characteristics: 1) ICT is a "special" subject in the sense that it must

be taught in a "flexible" manner, and not require the imposition of tight standards on methods of assessment, or teaching schedules as with other subjects in the school; 2) Priority should be given to the provision of the best of facilities to teachers when teaching this subject; 3) ICT teachers need to update their knowledge, and it should regularly be checked. The school needs to create good conditions for teachers to improve their knowledge and experience. Conversely, teachers are not only based on the contents with recording knowledge in textbooks; and 4) Methods of teaching, learning and student assessments need to be innovative and allow special and flexible rules.

Teaching methodology can be distinguised in terms of either active or traditional teaching methods. To illustrate, when Ha taught "Subprogram Exercises," on 23 April 2013 (to Year 11-A1 class with 39 students), he used active teaching. However, when Nga taught "Subprogram Exercises and Practice" on 17 April 2013, it was "chalk-and-talk" lesson in a regular classroom (see Appendix H).

It will be worthwhile to compare the lessons by Ha and Nga. First of all, Ha's active teaching method followed a sequence of five steps.

*Ha's Active Teaching Sequence (*see Appendix I, Ha's Lesson Subprogram Practical Exercises).

The first step in this active teaching lesson was a review of the previous lesson. The review included either the teacher's or students' explanation of the main points. The time spent on this activity was about three minutes. According to the teacher, the purpose of the review was to build a close relationship between the previous lesson and the current lesson. For instance, the class began at 3:25 pm in the computer room. When Ha was came into class, the students stood up, greeting him. Ha greeted the students in return, asked them to sitdown. The students sat in separate seats placed in four rows (one student– one computer). This process took about one minute. After that, Ha began the lesson with a testing of the previous learning.

The second step, the teacher presented the problem for the lesson by using computer and projector, and divided the students into two groups (2 rows – one group), and

then he coded them as group one and group two. Each group solved different problems.

Group 1: Solve the problems:

Write the program

1. Create a procedure entered from the keyboard n examinees include: Name, Zone (Z),

Mathematics (M), Physics (P), Chemistry (C):

 The total marks (TM) for

Z= 1 then: TM:= M+ P+ C +2

Z= 2 then: TM:= M+ P+ C +1

Z= 3 then: TM:= M+ P+ C

Writing out the screen of the list

2. Sort examinees by increasing total marks. (Including two fields: name, total marks)

Writing out the screen of the list

Group 2: Solve the problems:

1. Write the program
$s=1^3+2^{3+\dots+}n^3$.
2. Programming reverses a string S
Example: 'abcd'-> 'dcba'

The teacher used a projector for exercises, and required all students to write in their notebooks. This stage consumed six minutes. The reseacher found that when Ha gave two problems to one group, it was difficult for them to solve and understand. Particularly, when students in each group had different problems lead to they could not know to solve the other problems in different group, this issue will be discussed in Chapter 9.

The third step was students working in groups and Ha offered some suggestions about the problems for about six minutes. When the two groups were doing their tasks, the teacher moved among them, and offered suggestions for exercises for each group. For example, with one group, Ha gave asked questions of students, such as 1) What is the variable name data type? 2) For the variable Z, M, P and C, what are data types? 3) To enter data of n examinees, what do we do?, 4) When we calculate the

total mark of a student of each zone, what statements do use? 5) To sort the examinees according to the total mark increment, what algorithms we use?

For the other group, Ha only provided two main questions: 1) In exercises 1, 2, what is stopping the component? What is a lower level? 2) What is a formula of recursion? It was observed that while the teacher gave students questions, not all had answers or other questions. Ha then went to his table and sat down.

The fourth step was finding a solution and summarising the findings. After 20 minutes students had solved their problems, and Ha used chalk to divide the blackboard into two columns and he asked students in each group to share their solutions. Teacher called one student from different group to go to blackboard was presented the problem and the time spent on this activity was about 25 minutes. The results:

One student in group one wrote the first part on the left board:

```
Program group1;
 var ht:array[1..20] of string;
 kv,t,l,h,td:array[1..20] of integer;
i,n:integer;
procedure nhap;
 var i:integer;
        begin
          for i:=1 to n do
              begin
                      write('ht:');readln(ht[i]);
                      write('kv:');readln(kv[i]);
                      write('t,l,h:');readln(t[i],l[i],h[i]);
                      if kv[i]=1 then td[i]:=t[i]+l[i]+h[i]+2;
                      if kv[i]=2 then td[i]:=t[i]+l[i]+h[i]+1;
                      if kv[i]=3 then td[i]:=t[i]+l[i]+h[i];
                  end;
            for i:=1 to n do
           writeln(i:4, ht[i]:20, kv[i]:3,t[i]:3,l[i]:3,h[i]:3, td[i]:4);
          end;
```

One student in group 2 wrote his group's exercise on the right board:

```
        Program group2;
        var n:integer;
         function mu(n:integer):integer;
            begin
              if  n=1 then mu:=1
              else mu:=n*n*n+mu(n-1);
            end;
              begin
                 write('n=');readln(n);
                 writeln('kq=',mu(n)) ;
                 readln;
              end.
```

While two students wrote the problem on the blackboard, most of the other students only sat and watched. They did not discuss the problem within their group, and Ha looked at the board. He did not remind them to focus on the problem. After two students had returned to their seats, Ha asked if someone could write the next part of the program. No one from either group raised their hand. Ha did not make any comment and moved to the last step, which was the teacher's feedback to the students. He used the projector for part of the two exercises of the two groups and required all students to write in their notebooks.

The problem of group one.

```
 Procedure sx;
                   var i,j,tg:integer;
                   tg1: string;
 begin
 for i:=1 to n-1 do
  for j:=i+1 to n do
           if td[i]>td[j] then
           begin
           tg:=td[i];td[i]:=td[j];td[j]:=tg;
               tg1:=ht[i];ht[i]:=ht[j];ht[j]:=tg1;
           end;
  for i:=1 to n do
 writeln(i:4,ht[i]:20,td[i]:4);
  end; begin
 write('n=');readln(n);
 nhap;
 writeln('danh sach sx:');
 sx;
 readln;
 end.
```

Part two of the problem of group two

```
Program b2;
               var n:integer;
                x: real;
function can(n:integer;x:real):real;
        begin
             if n=1 then can:=sqrt(x)
                 else can:=sqrt(x+can(n-1,x));
        end;
  begin
     write('n,x=');readln(n,x);
     write('kq=',can(n,x):5:2);
      readln;
   end.
```

Ha did not explain the difference between two problems solved by two groups and his solving.

The last step, Ha used five minutes before the lesson finished, he reminded students to complete homework based on the problem they had not finished in class.

In contrast, traditional teaching is very different from active teaching. In these classes, teacher two (Nga) adopted whole-class instruction, with the students sitting in rows facing the teacher and the teacher leading instruction by using the textbook.

Nga's Traditional Lesson (see Appendix I, Nga's Lesson Subprogram Practical Exercises)

Nga greeted her students at the beginning of the lesson, As Ha did, and had them sit down. They took separate seats, placed in four rows. Nga spent one minute checking student attendance. She then spent three minutes on the previous lesson's test and reviewed the students' skills and knowledge. Nga next presented the new topic, explaining procedures for solving routine problems. After that, she wrote an exercise on the blackboard and required her students to write it in their notebook. This section of the lesson lasted two minutes.

Exercise 1: Enter one array of n integers from the keyboard: 1) To print array into screen as horizontal, each element separated by 4 spaces, 2) To find maximum and minimum of the array. Printing of result, 3) To sort array ascending. Printing of result.

The teacher then gave questions about the new exercise, which took six minutes. Then she divided the blackboard into four columns. However, five students were called to work on the problem. Each student solved a part of it. This activity lasted thirteen minutes. Then, checking students' work on the blackboard, Nga remarked and revised the problem.

In the next step, the students were given another exercise, following the same steps as before, and this exercise took twelve minutes. At the end of the lesson, she summarised what had been learned and assigned homework.

Nga taught content in a traditional way. She spent two minutes having students write the exercise. After that she offered two suggestions: 1) Students need to understand the request of the problem. She spent three minutes explaining: numbers n and n integers, output: n integers, the maximum value, the minimum value, n is ascending. 2) According to you, the problem is divided into how many small problems; each problem is what kind of subprogram? She used three minutes to explain: Divide into small problems follows Enter array => procedure, print array => procedure, find max, min => procedure.

The next step, Nga called six students to go to the blackboard, and five were asked to solve the problem:
In two minutes the first student wrote the following statement:

```
Type mang=array[1..100] of integer;
        var a: mang;
         n,i,max, min:integer;
```

The second student went to the blackboard to write the answer to the first question. This took about three minutes:

```
Procedure nhapmang(var a:mang);
begin
                              write(' Nhap so luong phan tu n =');
                         readln(n);
                                For i:=1 to n do
                                begin
                                 write('a[',i,']=');
                                 readln(a[i]);
                                 end;
end;
```

The third student spent three minutes writing the answer to question 2:

```
Procedure inmang( var a:mang);
begin
                            writeln(' Cac phan tu trong mang :');
                                For i:=1 to n do
                                write(a[i]:5);
                                writeln;
                        end;
```

The fourth student wrote another answer, taking about five minutes:

```
                Procedure lonnhat;
begin
                            max:=a[1];    min:=a[1];
                    For i:=2 to n do
                                    Begin
                                    if a[i]>max then max:=a[i];
                                     if a[i]<min then min:=a[i];
                                    end;
                        writeln(' GTLN la ', max:5);
                        writeln(' GTNN la', min:5);
                        end;
```

The next step was an exercise that required the sorting of a unidimensional array ascending, and to print the result. Nga required two students to go to the blackboard and write their responses. The fifth student spent approximatively five minutes:

```
Procedure sapxeptang( var a:mang);
var tg,j:integer;
begin
                            For i:=1 to n-1 do
                            For j:=i+1 to n do
                                if a[i]>a[j] then
                                        begin
                                        tg:=a[i];
                                        a[i]:=a[j];
                                        a[j]:=tg;
                                        end;
                            end;
```

The sixth student used five minutes to write the answer:

```
begin
nhapmang(a);
                            inmang(a);
                            lonnhat;
                            nhonhat;
                            sapxeptang(a);
                            inmang(a);
                            readln
                    end.
```

When the sixth student had finished, Nga used three minutes to comment.

The two teachers used different methods of teaching. Ha used active teaching, and Nga used traditional teaching. The two teachers were observed by the researcher to have similarly organised their lessons in a typical manner that included three main steps. The first step was at the beginning of the lesson, when two teachers spent two or three minutes reviewing the previous lesson content. Next, they used thirty-five to forty minutes to present the content of the new lesson. At the end of each lesson, they spent three or five minutes for consolidation exercises. From the above description, it is clear that this type of lesson was well structured. They believed that the content of the lessons ensured the right structure to suit the Year 11 curriculum.

However, during the observations, it was observed that neither teacher promoted enough student autonomy. In Ha's lesson, for instance, he was working in group of at least 23 students that were doing the same exercise. In the end, they did not share the ways in which they attempted to solve the problems. Nga's lessons were similar. Five students were selected to present their solutions on the blackboard, and she did not explain them at all, nor did she ask the students any questions. Instead, she sat in the teacher's area.

The content of the ICT curriculum seemed to be difficult for most of the students. For instance, during the researcher's observation of one of Ha's classes, it was found that only two students understood the program. As well, of from the three exercises Ha gave, one group finished only one of them, and Ha commented that the Year 11 curriculum lacks the content-specific regulations of the *Exercises* and *Reviews*. In Nga's class, almost none of the students understood her lesson, because it needed to be taught in the computer room, but she used a classroom instead, for the reason that the students would not otherwise concentrate on the lesson. Nga said the school needs to have more computers and that they need to be regularly serviced and upgraded in order to respond to teaching and learning needs. As well, she acknowledged the need for ICT teachers to regularly update with new knowledge and training programs.

7.4 Views about ICT Assessment

The MOET's curriculum regulated that in ICT subjects for Years 10, 11, and 12, schools dedicate four periods to assessment and one period (45 minutes in length) to examinations in each of the semesters. All tests ensure proper implementation of the school's time, to include practice tests and end-of-semester examinations, as well as assessments of knowledge and skills (theoretical and practical), according to the content requirements specified in the textbook of knowledge and skills standards for the subject program.

In Yenbai School, Ha and Nga have identified and implemented the content for testing and evaluation. First, the purpose of assessment was to help ensure students understand the basic concepts of ICT, know how to be a text editor, how to exploit the Internet, know Pascal programming language, and understand the Access database, because ICT learning is the knowledge base necessary to continue on to higher education courses and to use ICT in their daily work. Second, the standards of assessment consist of the following criteria: positive and proactive student interest in lessons, their training and practice, and evaluation of the results in implementing lesson objectives through testing. Third, the methods of assessment include an oral exam, written exam, and practice exam.

These statements suggest that, two teachers recognised the importance of assessment in relation to their teaching, they believed that the major purpose of assessment was to determine students' ICT achievement and to stimulate students' motivation to improve their achievement level.

From Ha's experience of ICT tests, he realised teachers needed more experience in effectively imparting knowledge to their students. This includes the knowledge needed to deepen student understanding, common errors to be avoided, and how to make lessons easier to understand. In classroom observations with Ha, students were getting marks in two ways. First, by oral testing. Ha began lessons with testing of the previous learning, with an exercise requesting that students write the general structure of a subprogram, procedure and function in Pascal.

Ha: "Who can tell me?"

Only three students raised their hands. Ha called one student to the board to attempt an answer. The student stood silently for nearly two minutes, doing nothing. Ha asked him to take his seat. Ha did not give him a mark. Ha then asked who could answer this question. The monitor (usually the best student in a Vietnamese class) raised her hand. She was invited to stand and answer, and then Ha gave her a score of 10 out of 10. During the lesson, Ha called upon his students four times to answer questions, but only other student could provide an answer, for which he received a score of eight.

For Nga's assessment, she wanted to evaluate her students to update their knowledge and thinking ability. This way, students and teachers learn the strengths and weaknesses, and to overcome errors. During one classroom observation with Nga, students were marked according to only one oral test. For instance, she started the lesson with testing from the previous one. She posed one question for her students, asking them to answer what a one-dimensional array was called, and to provide an example. No student was able to answer this question. It seemed they didn't understand the concept of one-dimensional array. Nga tried to remind them and re-explain the concept, directly giving them directly the definition but not specifying its role, how the computer uses arrays, or practical examples of using arrays. All students kept silent. Nga explained in two steps. First, she gave a formal definition from the textbook: Nga said that a one-dimensional array is a finite sequence of elements of the same type of data. Her second step was to provide the formal syntax of an unidimensional array in Pascal. She wrote:

Indirect statement: Type <name-array> = array [<first index> . <Index>] or <element type>; Var <array variable name> <name-array>.

After observing these teachers' lessons, it became clear that the two teachers did not have a comprehensive assessment strategy for their students. The teachers only referred to some of the good students and ignored the others.

7.5. Suggestions about Factors Influencing the Quality of ICT Teaching and Learning

When asked, the principal offered many suggestions about improving the quality of ICT teaching and learning. Khoa suggested that teachers needed to improve their ICT teaching by taking four major steps: 1) understanding the purpose of the ICT subject; 2) identifying the content of ICT subject; 3) improving the organisation of the classroom and computer lab, and 4) improving evaluation and testing skills.

The first step was to empower teachers to deeply understand the purpose of ICT subject. This is key for teachers to be able to equip students with ICT knowledge, and to help prepare them to respond to the requirements of Vietnam's industrialisation and modernisation. The second step was to help them clarify the content of ICT as a subject. In this respect, teachers needed to answer the question: *"what does it mean to teaching ICT at this high school?"* This includes five "how" inquiries: a) How to teach each item in the program; b) How to teach students self-learning; c) How to help students in developing and using the computer classroom; d) How to help underachieving students, and e) How teachers could use extra-curricular activities. The third step was to organise teaching practices on three levels. On the first level, teachers should have all students practice under direct supervision, in order to check the basic skills and understanding of lessons. On the second level, students should do their exercises in the textbook and the teacher should verify the results on the student's computer. As for the third level, the teacher should give exercises (small or large) for students to design programs and execute them on computers. Students can be instructed individually or in groups after the teachers check the programs on the students' computers.

The final step was the recommendation that teachers needed to conduct regular evaluation and testing of their students' skills. For the ICT subject program, Principal Khoa asserted that both theoretical knowledge and practical skills are equally important. Thus, student assessment should be carried out on these two parts, each worth 50% of the total score. The assessment should be conducted similar to other subjects, regularly review in oral examinations, fifteen-minute examinations or

assessment practices at levels 1 and 2. For the first test, a one-period examination of theory would be changed to become a practical assessment at level three.

Ha said that teachers select readings in the textbook, and build through exercises and practice, to strengthen the knowledge and skills the students require. During exercises and practice, teachers should involve themselves in sorting, grouping, and seating students so they can help each other and work together, improving the efficiency of the periods.

Nga commented that in some lessons, learning would be more effective when using computers, software, pictures, photos, visual diagrams. Therefore, students need to practice on the computers. However, if the content is not adequately conveyed to the student during practice, teachers should arrange a maximum of two students per computer.

From the above content requirements, the researcher found that Ha and Nga gave their thoughts regarding the subject of ICT, learning and working with educational facilities, appropriate use of common software, exploitation of information using the Internet, understanding how to program, and knowing basic Pascal programming language.

7.6 Summary

This chapter provided a descriptive analysis of case study data from Yenbai School, and the following points summarise the major findings:

- Improving the quality of ICT teaching and learning by providing teachers with opportunities for innovation, improving class management, and facilitating innovation in both teaching and learning.
- Teachers are an important factor in changing ICT teaching and learning. Being enthusiastic and creative in teaching is essential, especially with new textbooks appearing at a rapid pace.
- The school needs to continue helping students "feeling", then "thinking" at high levels. As well, the school should reward teachers and diligent students

for achievement on their examinations.Interviews with teachers indicated major reasons for the gap were the teachers' lack of training in new methods and upgrades of ICT knowledge. The curriculum seemed to be heavily loaded and diffcult for students.

- Classroom observations made it clear that teaching and assessment practices at Yenbai School were highly influenced by the textbook content. Assessments and lessons were found to be highly structured and followed a rigid sequence.

- The two teachers interviewed indicated that they were required to follow the requirements of the syllabus and that teaching and assessing were based on the content of textbooks reflecting the syllabus.The following chapter provides further discussion on the findings of the case study of Sydney School.

Chapter 8 Case Study of Sydney School, NSW, Australia

This chapter will describe the teaching and learning of ICT in a private high school (coded as Sydney School). This chapter, arrangement similar to the Yenbai case study in Chapter 7, proceeds as follows: 1) Background information on Sydney School; 2) Beliefs about the quality of ICT teaching and learning; 3) Opinions about the content of ICT teaching and learning at high schools; 4) Views about ICT assessment; 5) Suggestions about factors influencing the quality of ICT teaching and learning, and 6) Summary.

8.1 Background Information on Sydney School

8.1.1 The academic achievement of the school

The major reason for selecting Sydney School was related to its background and educational setting. In 2009, the school introduced the Senior College Program, extending from Year 10 to Year 12. This program is comparatively similar to secondary schools in the Vietnam system, with Sydney School's focus on a High Study Certificate (HSC) Program for Years 11-12. The second reason for choosing this school in this study was its policy of emphasising ICT in its curriculum.

Sydney School was founded in 1885, and in 2008 became fully coeducational from Kindergarten to Year 12. In 2013, of the 162 HSC students graduating from Year 12, four were among the top one per cent of achievers in NSW, nine were among the top two per cent, and 78 students (43 per cent of Year 12) were among the top 20 per cent performers in the State. A school survey of 539 parent respondents asked about their five most important reasons for choosing Sydney School. First in importance was its focus on student welfare and a safe and caring environment (94 per cent), then quality of teaching (93 per cent), followed by balanced education (91 per cent), school values (88 per cent) and the school's reputation (83 percent). Sydney School has also introduced the International Baccalaureate (IB) Program, which provides an alternative path to internationally accepted qualifications. The parents and community acknowledge the school's high standards of education.

8.1.2 The emphasis of ICT in the school

The Sydney School report (2012) stressed the role of ICT in learning. In 2014, the school's principal said "Using ICT will develop each student's feeling of self-worth, the importance of good communication, fostering a love of learning, an appreciation of cultural diversity and a desire to respect and help others" (Principal, interview, Apr. 20, 2014).

Sydney School follows the New South Wales Board of Studies curriculum for the HSC Program. Rather than placing a strong emphasis on learning through textbooks, the School requires teachers to follow the various syllabuses using an outcomes-based approach. There is a school commitment to an inclusive and accessible curriculum, and teachers are dedicated to continually developing the school's capacity to accommodate the full range of individual differences among its students. The school strives to maximise the potential of individuals spanning the academic, social and emotional realms.

Teachers at Sydney School understand when and how to use technology for quality learning. The principal intends that learning and teaching with technology could happen anytime, anywhere. This statement suggests that outcomes-based education plays a key role in teaching and learning practices at Sydney School.

The principal also indicated that the school policy aims to develop students as outstanding citizens through its commitment to excellence in a safe and caring environment. Sydney School shows that technology is an important part of the school's learning experience. From Kindergarten to Year 12, teachers are continuously finding new ways to integrate the latest and most age-appropriate technologies into their classrooms, in a way that complements and builds upon the school curriculum.

The school has a Technology Strategic Plan (2013-2015), developed for these reasons:

> Improvement in the area of learning with technology was seen to be vital as the current state of technology within the school was impacting on student learning, student and staff retention and there were early signs that it could be affecting student and staff attraction (p.1).

The plan for integrating ICT into all curricular areas aimed to enable the school to continue to remain competitive in preparing students for their future in the world.

The school's core curriculum targets the development of talent and exploration of individual areas of interest through developmentally appropriate projects and experiences. Teachers are to use diverse and effective teaching strategies in order to help students to develop high learning and thinking skills, and students are encouraged to be "critical, enquiring and creative thinkers" and "creative, innovative and responsible risk takers". In such a case, the role of the ICT is prominent. The Director of Teaching and Learning at Sydney School stated that ICT can be used to transform learning and enable engagement in significant ways for learning and teaching. These goals have very practical and accountable outcomes. For example, the use of ICT required the mastering of the iPad, in order to facilitate student research and enhance communication skills so they are comfortable in using this tool at home and at school.

According to a regulation of the NSW Board of Studies (2012), in Stage 6 (Years 11 -12) three ICT subjects are offered: Software Design and Development, Information Processes and Technology, and Information Technology for VET programs. Students may choose to undertake one, two or all three ICT subjects and can undertake Stage 6 subjects without having completed the Stage 5 elective.

In summary, Sydney School is a successful private school with a record of high academic achievement, and a heavy emphasis in using ICT in teaching and learning through its Technology Strategic Plan. How ICT is taught and how ICT education is assessed at Sydney School are analysed in the following section.

8.1.3 Short description of the principal and the ICT teacher

George (the pseudonym of the Sydney School principal) has a record of over 10 years experience as a teacher and has a Master of Education degree. He notes the importance of ICT teaching and learning in an increasingly connected world where students will move into technology-rich workplaces. George introduced an ICT teacher to this researcher; in this study he will be named John. John has taught at the

School for more than 10 years. He explained that his ICT teaching experience corresponded with the period of his general teaching experience because in Australia classroom teachers must teach all key learning areas.

In terms of teaching background, John explained that he had studied for a four year Bachelor of Education degree in secondary mathematics, followed by a Master of Science in mathematics. His ICT secondary school teaching preparation was obtained through in-service training.

John had to learn a great deal of ICT during his in-service courses. Apart from the main element of computer programming, he studied database design; curriculum assessment, graphics, and information systems. With changes to the curriculum, he took further training at university or at school. When interviewed by the researcher, John indicated that he taught ICT to classes to Years 9, 10, 11 and 12, with class sizes between 16 and 30 students.

In accordance with the NSW Board of Studies requirements, the teaching of ICT subjects in Sydney School is as follows: Year 10, Information Software and Technologies; Years 11 and 12, Software Design and Development. ICT teaching and learning at Sydney School are presented first as general classroom teaching and learning practices, summarised from observational data records of two ICT lessons. These observations were followed by a detailed interview regarding the two ICT lessons, to represent the general approach adopted at Sydney School. Different from other subjects, ICT was taught in a computer room. The computer room/classroom was a learning space decorated with colourful pictures on the walls, along with timetables and classroom rules. There were 27 computers arranged in two rows.

8.2 Principal's Views of the Quality of ICT Teaching and Learning

The Principal believed that good ICT education required teachers to have a vision for the future of learning with technology. Specifically, when students studied using the internet, Sydney School wanted them to be able to access online information and evaluate its relevance. As far as social and ethical issues in handling technology were concerned, the School aimed to have students conduct themselves with integrity and

respect in dealing with other learners and indeed with experts in the field that they might encounter.

Asked about his views of evaluation strategies and practices used in the school, the principal indicated that "a range of assessment and observational data" were used. Asked about assessment of the quality of ICT teaching and learning at the school, he said, "The difficulty we encounter is that there are so many variables in a school that contribute to the quality of ICT learning that it is hard to isolate particular elements." A particularly significant learning strategy relates to the use of the iPad, mentioned above. On a daily basis, all students from Year 5 to Year 12 are required to bring a 32 Gb iPad to school. These iPads are by no means simply symbolic. Students must be able to manage their own learning, using their personal device and online tools and resources. They are to be able to safely publish and present their ideas and learning online in a way that highlights their skills and abilities, while respecting copyright and acknowledging sources. Students are taught how to present and publish their ideas in a variety of formats. Moreover, the principal indicated that the school had introduced schoology, a cloud-based learning management system and configurable social network software for education, social bookmarking software called Diigo, and several google applications for education that students can implement at school.

The principal pointed out his strong emphasis on providing teachers with access to quality ICT resources, in order to improve their professional pedagogical and technological knowledge, so they would be skilled in using ICT for quality learning and teaching, and for efficiency in administrative tasks. To perform well, George suggested an arrangement where teachers could access just-in-time, one-to-one, job-based, hands-on learning ICT from a full-time technology integrator. He suggested that teachers were encouraged to participate in school-based innovation days, where they could work in pairs for two days in order to develop new approaches to teaching and new units that might subsequently be used by all teachers. As well, the principal said the teachers are encouraged to share innovative technology practices.

The principal emphasised the need for scool investment in building a sound ICT infrastructure, linking hardware, networking, software maintenance, upgrading, and

documentation. The school has engaged a technology team in order to maintain an adequate ICT infrastructure. The school has surveyed teachers and students every semester in order to obtain feedback about ICT issues. Moreover, Sydney School has established policies and procedures that are developed continuously and used consistently. In addition, teachers and students are surveyed every semester about infrastructure at the school.

John confirmed the continuing effort to improve ICT in teaching and learning. He discussed aspects of collecting feedback from teachers and staff, in order to improve the use of ICT in teaching and learning:

> I'm always trying to improve the way I do things. I gather feedback from students at the end of a unit. I assess my own teaching and I assess the work students have completed and the level of expertise they have developed. (John, interview, Apr. 5, 2014).

The principal believed that the school should make use of the new technology-enabled avenues for learning. For this purpose, he set four objectives for student learning: 1) Extended emphasis on Internet use to a K-12 Digital Literacy Scope and Sequence, as a vast learning resource that would map skill development throughout the period of pre-university schooling; 2) Students need to remain permanently engaged in an increasingly connected technology-rich world, as ICT will play an important part for obtaining employment in the future; 3) Students need to know how to present their skills and abilities, through the school's digital-citizenship programs and policies, in order to become employable, and 4) Students need to develop digital competency, including the use of personal devices and online tools and resources, as a crucial element of higher education and the work situation that will follow.

8.3 Practicality of ICT Teaching and Learning at Sydney School

An examination of ICT teaching and learning at Sydney School was carried out in the form of classroom observations, which includes analysis of classroom observation records and transcripts of teacher interviews.

Classroom organisation

Teaching the subject of ICT at Sydney School was conducted in a computer room specially designed on this purpose. The researcher's impression of the classroom environment was one of a motivating and eye-catching learning space. On the walls were colourful and fancy pictures of trendy technologies. The timetable or rules and regulations of the classroom were posted on the walls. In the classroom were 27 computers, arranged in two rows. During the class, students could sit individually, in pairs, or in small groups. During most of the class time, the teacher remained at the front of the classroom. He used a computer connected to a projector and a SMART Board. This environment gave teacher considerable flexibility in presenting his lessons.

ICT teaching content and methods

A synthesis of observations of four ICT lessons shows that the ICT teaching content was based essentially on units of the NSW Stage 6 syllabus. Data from John's interviews also showed that ICT teaching programs adhered to the objectives and content of the 2012 syllabus. Textbooks were not used in the ICT classes, as decided by the ICT teacher, to allow greater flexibility in designing lessons.

Two software lessons and two hardware lessons given to Year 11 students were observed by the researcher. In the software lessons, John gave a lecture using PowerPoint software and used a SMART Board to explain specific details of concepts, commands and algorithms. With each lecture and each set of practical exercises, students logged on to their computers to write programs directly. While students were completing exercises on the computer, their teacher walked around the classroom, checking students' answers and offering assistance. He checked student answers individually, but when he returned to his desk, they were able to approach him and ask questions.

To present an authentic picture of ICT teaching and learning at Sydney School, two lessons will be analysed in detail below. Lesson One, *Write Four Programs in Python*, was given to a 16-student Year 11 class, observed on 17 March 2014, and Lesson Two, *Hardware and Software*, delivered to a 16-student Year 11 class, and observed on 26 March 2014 (see Appendix I, John's lessons).

First, John's focus on basic concepts and programs can be set out as follows:

Lesson one: Before teaching the new lesson, John spent five minutes refreshing the students' memory of theory exercises from the previous lesson. He then asked students to practise writing four programs, each testing the user regarding addition, subtraction, multiplication and division respectively. After the students had started their computers, John briefly introduced the topic of the lesson. He explained that the four exercises in the current lesson covered basic content from the previous lesson. All the exercises in the current lesson were linked with the ICT syllabus outcomes of the NSW Stage 6 Curriculum. Next, John began writing a software program in the Python language to test the users on five basic facts of addition.

```
# a program that tests users on their addition facts
            Import random
            i = 0
            score = 0
            while i < 5:
                    add1 = int(random.random()*13)
                    add2 = int(random.random()*13)
                    print "what is" + str (add1) + "+" +   str     (add2)
                    ans = input ()
                    if ans == add1 + add2:
                            print "correct"
                            score = score + 1
                    else:
                            print "incorrect"
                    i=i+1

        print "you scored" + str (score)+ "out of 5."
```

The program was already on the teacher's computer and on the school website. John projected the program onto the SMART board. He only briefly explained the algorithms and the syntax of the five basic addition facts, since the students could download the program from the school website. The reseacher observed that more than half the students were apparently not listening to John's explanation. As they were not engaged with doing the programming in Python, it is likely that these students may not have made a genuine effort to understand and adequately practise the Python program. Furthermore, one might assume that they were not particularly interested in understanding programming unless in the unlikely event that some might be planning to go over the program themselves later. In any case, this stage of

the lesson took only about five minutes. After presenting one of the four programs, John required all students to design a similar program.

He gave the following instruction: "One program should test the user on five basic multiplication facts." The figure below shows the program of the five basic facts of mutilplication.

```
# a program that tests users on their mutilplication facts
        import random
        i = 0
        score = 0
        while i< 5:
                fact1 = int(random.random()*13)
                fact2 = int(random.random()*13)
                print "what is" + str (fact1)  + "x" +    str (fact2)
                ans = input ()
                if ans == fact1 * fact2:
                        print "correct"
                        score = score + 1
                else:
                         print "incorrect"
                        i=i+1
        print "you scored" + str (score) + "out of 5."
```

John spent approximately twenty minutes introducing the main steps of the program, explaining the syntax and answering to all students' questions. He did this by demonstrating and explaining how each step was done. For example, one student asked, "What is *rand in* again? Random integer. Do you just do *rand in* 13?"

> John: " I've got fact one and fact two, so two factors. When I multiply two numbers together, the two numbers that I multiply are called factors. I've got a factor one and a factor two. I make factors, factor one, I generate a random number between zero and one, than I multiply by 13, that gives me a random number between zero and 13 but it doesn't go up to 13." (Classroom observation, Mar. 17, 2014)

The teacher took twenty minutes explaining the program although it could have been done much faster, within ten minutes. Even considering that the students had the benefit of the teacher's explanation, it seemed that the exercise was too simple for the Year 11 students to do in class. This might explain why some students had not been paying attention earlier in the class. It might be that the task set by the teacher

might not match the students' abilities, as it lacked a challenging element and failed to engage some of them.

When the students were doing the exercises, John walked around the classroom and checked individaul students' work. He explained to the researcher that he was checking where the students might be encountering difficulties, so that he could offer additional support to help them understand the new concepts.

Lesson Two. John launched a new lesson about computer systems, explaining that any computer system is made up of input, output, process, storage and control subsystems. At the centre, he said, is the Central Processing Unit (CPU), the "brain" of the computer. John displayed a picture of a computer system, and the students appeared to understand the concept. After five minutes, he placed a CPU on the desk in front of the SMART board and explained:

> The CPU is a very sophisticated system. It is made up of many components. All these components have been engineered so they fit onto one silicon chip. This chip is called a microprocessor. Thus, we can subdivide the CPU into two logical sub-systems. Dividing the CPU into logical subsystems means that if you looked at a CPU under a microscope you wouldn't really see two parts because they don't physically exist. Rather, *thinking* of the CPU as having two parts makes it easier to understand. And these two sub-systems are the control unit and the arithmetic logic unit (ALU) (Classroom observation, Mar. 26, 2014).

John used another ten minutes to explain the concept of CPU in detail to his students. When he finished, the students could understand it clearly. Next, John explained the concepts of the Control Unit and the Arithmetic Logic Unit (ALU) for seven minutes, asking his students to focus on the SMART Board and listen to his explanation:

> The Control Unit controls the flow of data within a computer. It also controls the sequence in which instructions are executed: this means that some programs have priority over CPU time. Besides this, the Control Unit decodes instructions for the ALU; that is, it takes instructions and determines which circuits to open and which to close. It locates and retrieves data from RAM that is to be processed. In short, the Control Unit signals the ALU to execute instructions (Classroom observation, Mar. 26, 2014).

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John proceeded to demonstrate how the Arithmetic Logic Unit or ALU carries out all the calculations with regard to data and all the logical processing of data. The number of bits that a Central Processing Unit could process in one brief period of time was called the CPU's word length. The students appeared to pay close attention to John's explanation of the concepts, and appeared to clearly understand.

Second, John's integration of Internet into teaching through school's website and YouTube

Lesson One: After John had finished two programs, he changed to another, a PowerPoint presentation which was on Schooligie (Sydney School's website, where students can download programs).

The program tests the user on five basic subtraction facts below:

```
# a program that tests users on their subtraction facts
        import random
        i = 0
        score = 0
        while i < 5:
                minuend = int(random.random()*13)
                subtrahend = int(random.random()*13)
                if subtrahend  > minuend:
        #swap the two a round
                temp = subtrahend
                subtrahend = minuend
                minuend = temp
        print "what is" + str (minuend)  +  "-"  +    str (subtrahend)
        ans = input ()
         if ans == minuend - subtrahend:
        print "correct"
                score = score + 1
         else:
                print "incorrect"
                 i = i+1
        print "you scored" + str (score) + "out of 5."
```

While John was using the school website to teach the program, it was observed that most students did not focus on solving the program, and only used the result of the program on the website. In the opinion of the researcher, most of the students did not have a clear idea about the programming rules involved in this case.

Lesson Two: After presenting some computer system concepts, John played the YouTube link *But How Do It Know*, an interesting 15 minute clip on computer

hardware with engaging images and sounds. It appeared to the researcher that all students enjoyed the program and were interested in the content of this lesson.

Continuing on to teach the concepts of Random Access Memory (RAM) and BIOS/ROM (Basic Input Output System/Read Only Memory), John used the projector but he also staged a practical demonstration of the tole of the RAM in computer desktop, by opening a computer case on the desktop for students, so they could observe what was inside, in particular to see what the RAM component looked like. It was clear that the students were engaged in understanding the concepts they had just heard and seen in the class.

Third, John's check on how well students understood the lesson material.

In lesson one, when John finished writing the program, and while students were doing their work individually, he checked their students' testing and answered their questions. The following is a dialogue between the teacher and students:

> John: Subtraction is harder. Come up here and have a look at this. The two numbers that subtract from each other, I didn't know what they were called. One's called the minuend and one's called the subtrahend.
> S1: Which one is which?
> John: The minuend should be larger than the subtrahend.
> S2: Can't you just say subtrahend equals minuend; minuend equals subtrahend – would that not work?
> John: No it won't work
> S3: So that's what temp means? Sir is temp a placeholder?
> John: It's a variable, isn't it? Temp as a temporary variable.
> <div align="right">(Classroom observation, Mar. 26, 2014).</div>

Before John finished lesson one, he wrote the program of user on five basic division facts. He required students to write this program and said that it was similar to the previous three programs. After five minutes, he used the teacher's computer to test program.

To summarise, after observing two lessons, it was found that they were carefully structured and dominated by whole-class instruction. For instance, in lesson one, the teacher paid considerable attention to the relationship between the four problems such as similar algorithms, in order to help students understand the way the program

was written. The focus of the lesson was on practising some basic programming procedures in Python.

In the two lessons on hardware, John used PowerPoint, but also used specific computer equipment for the students to observe. For example, when teaching about the chip, he used two steps: 1) In the first step, he placed a computer on the desk and extracted the chip out of the computer. He showed the chip to the whole class, so that each student could make an observation. 2) In the second step, he defined, explained and described the importance of the chip. In order to discuss the structure and principles of using computer hardware, he downloaded a lesson from YouTube for the students, to help them understand the lesson by listening and watching.

The lessons discussed both ICT software and hardware, with reflections on important syllabus outcomes. The researcher found that John's teaching methodology had three components: first, he focused on basic concepts and programs; second, he integrated the lesson with the Internet through YouTube, to create student interest; and third, he checked whether students understood the lesson material.

8.4 Views about ICT Assessments

One of the most important units taught was Software Design and Development, carried out by implementing teaching of the ICT subject for years 11-12, with the contents of teaching and learning mandated in detail by the Board of Studies NSW in 2012. The contents of assessment include:

Preliminary course

The suggested components and weightings for the Preliminary course are set out below.

Table 8.1 component and weighting for the Preliminary course

Component	Weighting (100)
Knowledge and understanding about hardware and software, software development approaches, software development processes, social and ethical issues	30

Component	Weighting (100)
Design and development of software solutions	35
Project management techniques, including documentation, teamwork and communication	15
Project(s)	20

HSC course

The mandatory components and weightings for the HSC course are set out below. The internal assessment mark submitted to the Board of Studies is to be based on the HSC course only.

Table 8.2 Component and weighting for the HSC course

Component	Weighting (100)
Knowledge and understanding about the development and impact of software solutions and the software development cycle	20
Design and development of software solutions	35
Project management techniques, including documentation, teamwork and communication	20
Project(s)	25

Assessment in stage 6 has been set by the New South Wales Board of Studies. The goal of the assessment is to provide evidence of satisfactory achievement and completion in the Preliminary course and to justify the achievement of Higher School Certificates. The assessment of learning provides a useful approach for the delivery of the Software Design and Development Preliminary in Year 11 and HSC courses for Year 12. It provides opportunities in the context of everyday classroom activities for students to demonstrate their learning. The approach is most effective when students are involved in setting learning goals and they know what is expected and the standards of work. Thus, when students receive feedback, it helps them understand the next steps in their learning and plan how to approach them.

In John's words, objectives and evaluation methods are "to allow students to see how they have progressed, to enable teachers and parents to see how students are progressing. Then to use the information gathered from assessment to make decisions about how to progress from there" (John, interview, Apr. 5, 2014). In response to the question of how he evaluates his ICT teaching methods, John said "Consistently, I try to gauge the response my students have to my teaching. I try to determine and measure how they are learning and if there is anything that can be done to improve the matter." Regarding assessment of his students, he said: "Formally, I assess my students four times per year, and informally, pretty consistently, informal methods I use include discussion, observation and reviewing written work." (John, interview, Apr. 5, 2014).

He said that the methods of assessment he used included written examinations, research projects, design projects and online discussions. Finally, John confirmed that: "I think the assessment I have in place is good as it is an area that requires less attention than many other areas" (John, interview, Apr. 5, 2014).

8.5 Suggestions about Factors Influencing the Quality of ICT Teaching and Learning

The Principal of Sydney School wanted teachers to improve in their ability to know when and how to use technology for quality, learning, teaching and efficient administration. He believed that every teacher was at a different place in their ability to know when and how to use ICT. For success to occur, the school would need to provide adequate support for each teacher, in order to help her or him learn and grow. In addition to this, the principal considered that the amount of time devoted to technology focused on professional learning needed to be substantially increased. He wanted effective and innovative practices to be shared within the school among all teachers. Furthermore, he wanted these ideas to be shared widely and freely with colleagues in other schools as well. In response to the question of suggestions about factors influencing the quality of ICT teaching and learning, George indicated that the new curriculum needs to be deeply understood, as it encourages the development of ICT skills and also allows teachers the freedom to design learning and teaching in a way that is best suited to the students they have in their class. In response to the

question about the influence of ICT on teaching and learning, John indicated that improving the level of teacher expertise was very important, adding that a lack of qualified ICT teachers was a major problem.

8.6 Summary

The chapter presented a case study of Sydney School performed through classroom observation and semi-structured interviews. It was found that the quality of ICT teaching and learning played an important role in shaping teachers' programs and students' learning. The following points summarise the major themes:

- ICT teaching and learning at Sydney School are built on an outcome-based approach.
- Teaching and learning of the Year 11 students at Sydney School followed BOSTES requirements and aims to promote students' understanding and development strategies.
- Classes observed were focused on building students' knowledge and skills for achieving outcomes as tested by written examinations, research projects, design projects and online discussion.
- The teacher recognised that the intended State level curriculum suggested using a variety of methods to assess students' ICT learning. As such, the teacher used informal methods including discussion, observation and review of written work.
- An Interview with the principal indicated that students will have the opportunity "to become competent, discriminating and creative users of ICT" and that they will be "better able to achieve syllabus outcomes through effective use of ICT for enhanced learning." This is congruent with the findings from the teacher interview and classroom observations.

The following chapters will continue to explore these themes by contrasting Sydney School with Yenbai School, Vietnam. A full discussion is presented in Chapter Nine.

Chapter 9 Conclusions and Implications

In this concluding chapter, the main findings and limitations of the study are discussed, followed by implications for curriculum, teaching and assessment policy and practice. The major purpose of this thesis has been to examine similarities and differences in ICT policy, curriculum and assessment practices between senior secondary education in Vietnam and Australia, and to identify significant factors accounting for these similarities and differences. Several research questions addressed in this study intended to discuss ways that ICT policy, curricula and assessment were implemented in both countries. This study attempted to examine not only how these aspects of policies, teaching, learning and curricula were intended to operate, but also how they have been implemented in practice in the two countries. A case study of each of two representative schools, Sydney School and Yenbai School, has been carried out through observation and interviews, and analysis of policy, and curriculum and assessment documents have been used to provide general background.

In general terms, this study has sought to answer the main research question: What are the key characteristics of the quality teaching and learning of ICT education in NSW and Yenbai Province? The study was guided by the following specific research sub-questions:

1) What standards and criteria are used to evaluate ICT teaching and to assess student learning in NSW and Yenbai secondary schools?
2) What do teachers consider to be factors that contribute to quality ICT teaching and learning in NSW and Yenbai secondary schools?
3) What are the current ICT teaching strategies in NSW and Yenbai secondary schools?

The study has endeavoured to show how findings from document analysis of ICT education in Australia and Vietnam were represented in policy documents and in specific schools - Sydney School in NSW and Yenbai School in Vietnam – and what the differences and similarities are in ICT teaching and learning. At the same time,

the study aims to show how these findings may be extrapolated in a fair and valid way to provide a comparative educational model for studying different schools and educational systems. It is hoped that the results may provide useful ways to improve the teaching of ICT in Australia and Vietnam, and show how they may inform future relations between the educational circles of the two countries.

Clearly, in choosing Sydney School to represent New South Wales ICT education, and then New South Wales ICT education to represent ICT education in Australia, there are substantial issues involving the representativeness and the specificity of current ICT teaching and learning in Australia. There is a similar question of how senior secondary ICT education at Yenbai School is representative of ICT education in Vietnam. Representation in both cases needs to be seen in terms of the validity of a process of generalisation as quantitative analysis is often used to establish comparability. In this case, the question of validity still remains to be answered. Even if detailed quantitative studies are available, this thesis asserts that qualitative methods will still need to be used to study the complex aspects of different national educational systems such as Australia and Vietnam.

This thesis explores policy, curriculum and assessment practices in authentic settings in a program of cross-cultural research (Paige et al., 2003). A wide range of studies on comparative education has been consulted, but as explained in Chapter Two, to achieve a useful comparison between such different educational systems given the inherent difficulties in valid generalisation requires an imaginative approach that takes into account conceptual construction of representative systems between Australia and Vietnam, as well as features established from practical observation (Gillham, 2008). From the beginning of the research process and right down to this concluding chapter, it has been the firm belief of this researcher that this exercise has value, and that it is a significant step in bilateral relations between the two countries. As such, the results of this exercise in comparative education are not only of use in application to this particular issue of ICT education, but more generally say something about the value of comparative case studies in general. The difficulty of comparison between dissimilar cases may well be more instructive than comparison between cases that are broadly similar.

9.1 First Research Question

The first research question was: What standards and criteria are used to evaluate ICT teaching and to assess student learning in NSW and Yenbai secondary schools?

The methodology in Chapter Three used document analysis to examine the standards and criteria used to evaluate ICT teaching and to assess student learning. As described in Chapter Four, document analysis of Australian intended ICT policies, curricula and assessment was based on the curriculum model handed down and initiated by the federal ACARA and by the NSW State Board of Studies. With Vietnam, the document analysis was based on the MOET documents in Chapter Five. In Chapter Six, intended and implemented ICT policies and actions to improve curriculum and assessment showed common trends between the two systems. However, substantial differences were found in the standards related to objectives and content, both in the enunciated ideal principles and the actual implementations of ICT policies and curricula.

School programs

In Australia, teachers, parents, and students are kept informed of the ongoing program during the school year, while in Vietnam there are four difficult steps that lack transparency. More exactly, there are late directions from MOET to the Committee of Cities or Provinces, then to the Department of Education and Training and finally to all high schools. This means that from the point of view of participants in the process of education, there is a substantial delay in being precisely informed of what is happening in the current school year.

Findings on policy

The outcomes of implementations of educational policies differ greatly in the two countries. In Australia, there have been substantial achievements in the implementation of ICT education through detailed government planning, with investment and development by stages that have required evaluative reports. By contrast, in Vietnam, the Government in its 2009 (Vietnamese Primary Report, 2009) decided to raise the quality of ICT education in ICT education in the 2015-2020 Five Year Plan, but this initiative was general and unspecific. It is difficult to reconcile

this with the 2010 Vietnamese government statement that all students were to study ICT. In 2010, according with Vietnamese government, 100 per cent of students in high schools, that is senior secondary schools, covering Years 10-12, need to study ICT. Yet, though ICT as a subject has been taught since 2007, the Government did not clearly explain the relevant objectives or methods of implementation, and criteria for ICT teaching and learning evaluation and assessment were not provided. Thus, in Vietnam it is fair to say that MOET lacks detailed data reports, feedback and breakdowns for senior secondary ICT education. The comparison with Australia shows that successful senior secondary ICT education requires reserves of data, specific and detailed planning, the implementing of changes, evaluation measures, and methods to implement these measures. Yet, these were not included in the criteria regarding how to implement and evaluate teaching, learning and assessments for ICT education. In order to evaluate and change the current status of ICT teaching and learning in secondary schools in Vietnam, MOET needs to take detailed steps to acquire basic operational data in planning, implementing and evaluating educational reforms in ICT education.

Common standards for ICT curriculum and assessment reform

Documentary analyses, confirmed by interviews with the two school principals, identified three common standards for ICT curriculum and three common standards for ICT curricula and assessment reform in NSW (representative of Australia in this instance) and Vietnam. These were identified through document analyses and were confirmed by interview data from the principals from both countries. These standards, including a) outcomes- based education; b) a constructivist approach to learning and c) alternative assessment, were recognised as key principles directing the reform of ICT teaching and learning in both countries.

The educational systems of Vietnam and Australia share a similar rationale for the place that ICT education has in the upcoming reforms, which are based on the relationship between students' achievement of ICT and the nation's knowledge and economic competitiveness. In both countries, the achievement of ICT outcomes and standards are regarded as key goals. Both systems have recommended and endeavoured to realise a similar constructivist approach to teaching and learning in

order to improve ICT education. Further, in recognition of the achievement, a similar constructivist approach to teaching and learning was recommended (intended), by both systems. Recognising the powerful influence of quality in teaching and learning, education policy-makers in both countries advocated the integration of assessment with the teaching and learning of ICT through the use of various strategies. Overall, the education systems of Vietnam and Australia share a similar rationale for education reform. This was based on the relationship between students' ICT achievement of ICT and the nation's economic competitiveness. However, though the MOET documents mention constructivist approaches to ICT education, the document analysis found that these aspects were not implemented in schools. It seems highly probable that these reforms require renewed effort and more time in order to succeed

ICT curriculum objectives

Through comparing Vietnamese and Australian documents, this study shows that, while common standards exist across the two systems, the specific objectives related to ICT teaching and learning standards and curriculua, or outcomes of ICT curricula, vary considerably in quantity, depth and sequence. As for standards of learning, the Vietnamese ICT curriculum prioritises the cognitive aspects of learning. In terms of the difference in learning standards, the cognitive aspects of learning are a priority for the intended Vietnamese ICT curriculum. They focus on fundamental knowledge and skills and on logical student thinking.

The Vietnamese and Australian approaches clearly contrasts in the content of ICT curricula. This difference is closely linked with different views of the nature of ICT learning. In NSW, curriculum developers generally adopted a practical view of ICT, maintaining that learning the content of ICT in practical contexts is the most important aspect. Curriculum developers in NSW, by adopting a constructivist view of ICT learning, assert the overriding importance of students experiencing the process of understanding ICT through practical activities. In Australia the senior secondary ICT curriculum is often updated in order to include recent innovations and new knowledge. Such frequent updating is not practicable in Vietnam because the curriculum is centrally authorised and issued through prescribed fixed textbooks. In addition, the time for practical applications has been reduced for Vietnamese

secondary schools. As well, the time dedicated to mastering a programming language received different emphasis. While the Australian curriculum entails very few hours of programming, the Vietnamese curriculum requires more than two thirds of the total time for ICT instruction.

In terms of similarities in teaching and learning standards however, there are common teaching and learning objectives. They each divide curriculum objectives into cognitive and skill-based domains. In terms of cognitive domains, each system to a varying degree stresses the importance of basic ICT student knowledge and skills. Both systems stress the importance, in varying degrees, of developing students' basis ICT knowledge and skills in the areas of social and ethical issues, hardware, software, networks and the Internet. In an affective domain, both systems recognise the importance of students' motivation to learn, and both encourage the integration of ICT teaching and learning with students' daily lives.

Intended ICT curriculum standards

It needs to be emphasised here that in Australia, education remains primarily the responsibility of each State. This thesis has taken the curriculum of the State of New South Wales for comparison with the Vietnamese curriculum. The analysis of ICT curriculum documents in Australia and Vietnam found key outcomes and standards such as: a) social and ethical issues, b) hardware concepts and c) software notions; and d) network and Internet concepts are common to both NSW and Vietnamese curricula. However, NSW curriculum developers stress balance of content across the four strands, while Vietnamese curriculum developers tend to emphasise software, specifically learning programming. While the NSW curriculum tends to focus on developing processes for practical utilisation of ICT knowledge and skills, the Vietnamese curriculum focuses more on presenting abstract ideas about notions of ICT in hardware, software and the Intenet. It is particularly worth noting that social and ethical issues are featured throughout Stage Six in NSW, while this area appears to have been virtually ignored in Vietnam, with only 20 lines appearing in the Year 10 ICT textbook. In Vietnam however, the large amount of software content in the ICT curriculum, and sheer number of programming exercises in Pascal or C ++ languages require a substantially higher performance than in NSW, suggesting much

greater expectations in software education for both teachers and students in Vietnam than in Australia.

9.2 Second Research Question

The second research question was: What do teachers consider to be factors that contribute to quality ICT teaching and learning in NSW and Yenbai secondary schools? Semi-structured interviews were held with individual classroom teachers at each school. Analysis of the data showed considerable differences in their views on ICT teaching and learning. John, the teacher at Sydney School, saw the main purpose of his teaching as gathering information about the students' learning and using this to improve his ICT teaching. As noted in Chapter 8, John said that he constantly tried to improve his teaching through student feedback and assessment of their progress. Observing lessons in the classroom, this teacher was able to create definite excitement among the students. For example, when teaching about hardware he not only showed them an image but actually took parts out of a computer to show them. When discussing software he demonstrated how a problem was solved and he gave an opportunity to each student to explain it in his or her own words. Any student still failing to understand the solution could ask the teacher or discuss the problem with other students.

The two teachers interviewed at Yenbai School recognised the importance of ICT teaching and learning based on textbooks and on the 2007 MOET Standards of Knowledge and Skills. This offered some advantages for the ICT teachers in Vietnam, but the dependence on textbooks presented limitations, as follows:

- The textbook was significantly out of date, as ICT itself changes regularly by the year, or even months.
- Dependence on textbooks does little to encourage creative teaching. However, when interviewed on how they could improve ICT teaching and learning, both teachers said that a practical arrangement was to divide the students into small groups and practice exercises ranging from easy to difficult. Observations did not indicate this happening however. The students

merely typed out the teacher's solutions from the textbook. There was no creative thinking among the students and no challenges presented to them.

At Sydney School, John explained his view that the major purpose of assessment was to gather information about students' learning and use this to improve his ICT teaching. He considered assessment as relating mainly to the teacher's sense of professional responsibility in educating students, rather than focusing on the students' efforts or parental factors. The teacher should teach comprehensively and well. At Yenbai School, although both teachers interviewed recognised the importance of assessment in their teaching, they saw the main purpose of assessment as being to check students' ICT learning in order to stimulate student motivation to improve achievement levels. This relates to the Vietnamese tradition where teachers attribute achievement to students' motivation and where parents deeply respect and support teachers. As an extension of this notion, the two Yenbai School teachers mentioned that local Education Department administrators considered student achievement as the most important indicator of teaching accountability. Thus, at Sydney School the focus of assessment was to improve teaching practices; but at Yenbai School it was to push students to achieve better academic results.

As far as methods of assessment were concerned, John explained that he used written examinations, research projects, design projects and online discussion. He also assigned them portfolios to demonstrate their achievement. He also saw the advantage in teachers liaising with parents on their child's learning progress. In relation to upgrading his teaching and assessment processes, John sensed inadequacy in his personal professional training, and that the level of parental support could be improved.

At Yenbai School, Ha and Nga said they used written examination papers and a grading system to record and report student achievement, and a practical examination using computers was very important. Most information available to them on student learning was derived from classroom observation and homework. Major factors hindering them from trying out new methods of ICT assessment recommended by the new syllabus, in their view, were lack of resources and inadequate professional training opportunities.

The interview data suggested that teachers in both Australian and Vietnamese senior secondary schools do not have sufficient professional training in ICT assessment, despite attending in-service training courses. It also became apparent through observation at Yenbai School and through available information on the actual state of teaching across NSW schools that pedagogical knowledge alone does not guarantee that teachers will be able to implement recommended assessment practices in their classroom routine. This lack of opportunities for professional development in the ICT curriculum was reported in Statements of Learning for ICT at Australian Schools (Committee, 2006).

9.3 Third Research Question

The last research question was: What are the current ICT teaching strategies in NSW and Yenbai secondary schools? This question was explored through classroom observations and interviews with the principals of Sydney School and Yenbai School. These two schools were the subject of field research in the form of observation and interviews, and the picture of education in these two schools is presented to represent NSW and thus Australian senior secondary ICT education on the one hand, and Vietnamese senior secondary ICT education on the other. On the basis of data collection and analysis together with the findings from the respective case studies, the following summary emerges:

Finding from classroom observations

This question was explored in classroom observations focused on differences between Sydney School and Yenbai School in classroom organization, class size, teaching practices, and classroom assessment practices.

Classroom organisation:

ICT is a special subject where lessons can be taken in classrooms and in computer rooms. In Sydney School, the students studied both theoretical and practical aspects in the computer room, while in the Yenbai School, teachers taught both practical and theoretical aspects of ICT curriculum in the classroom. The computer room furniture layout at Sydney School was more flexible and accommodating for collaboration

between students, while in the Yenbai School classroom it was strict and formal, leaving limited opportunities for collaboration and peer-to-peer interaction. The observations of Year 11 in the two schools led to a finding that computer room study was more conducive to student understanding than classroom study, as the concepts were explained and offered a practical approach.

Class size: although NSW Education Department standards state a class may contain up to 30 students, the average in Sydney School was 20 students. In Yenbai School, it was 45. From classroom observation of Year 11 teaching at both schools, it appeared that, in contrast to the classes observed at Sydney School, due to the large classrooms at the Yenbai School, teacher chalk-and-talk was dominant, and students had little opportunity to demonstrate their work, answer questions or receive immediate teacher feedback.

Curriculum policy-makers intentions of a constructivist approach to teaching and learning were not generally in evidence at either school, which highlights a disconnect between the intended and implemented curricula. However, Sydney School manifested some aspects of constructivism, while Yenbai School had almost exclusively rule-based learning approaches in place.

Teaching practices: at Yenbai School, it was found that most lessons were dominated by whole-class instruction. The content of the lessons was centred on the syllabus and the textbook and focus of lessons was often on practicing procedures after explicit teaching of concepts. In contrast, at Sydney School, teaching activities were designed to meet the individual needs of students. Apart from formal teaching standards differing from the practice in Vietnam, observation of Year 11 lessons at Sydney School showed a definite difference in approach from Year 11 lessons at Yenbai School. At Sydney School the teacher was asked to follow the syllabus and encouraged to have an outcomes-based approach to teaching and learning. Textbooks were not generally used in ICT classes and the teacher made his own decisions on the specific sequencing of teaching content while maintaining the link to syllabus outcomes. While there were many moments of whole-class instruction, the students engaged in collaborative tasks and could freely move about the classroom.

The Yenbai School Year 11 teachers on the other hand followed a textbook-oriented approach to teaching and learning. Both teachers interviewed stated they were required to follow the national ICT syllabus requirements and base their teaching on the textbooks that were in place. Whole-class instruction was dominant. Lessons were centered on the syllabus and textbook exercises, and often comprised of explicit teaching of concepts followed by practicing procedures without any practical examples.

ICT assessment: significant differences were found between Sydney School and Yenbai School. In each lesson at Sydney School the teacher assessed student comprehension. In teaching Python through practical exercises, the teacher introduced an algorithm and then asked students to practice this, and saved the results on their computer in the form of a student code, where the teacher could check on the computer or directly observe the student doing the exercise. If the student could not understand the exercise or could not complete it, the teacher explained the problem. Basic skills testing at Sydney school was evident but it did not seem to direct largely, teaching and assessment practices. The situation at Yenbai School was different: in Year 11, after two periods of theory in the classroom students were given one practice period in the computer room. But they only retyped the problem, because each one had already been solved by the teacher in the classroom. The result was that the students did not develop a creative problem-solving capacity. As an example, after observing a Year 11 class on the use of Pascal to solve problems, this researcher asked the whole class of students how many of them had understood the lesson. Only three students raised their hand (Classroom observation, Yenbai School, 2013). Yet, according to the 2014 Yenbai School report, only 24.7 per cent of the student bodies were performing as low as "average". Thus, it is natural to question whether student assessment at Yenbai School is a real and accurate reflection of student achievement. This is reflected in recent references to "achievement disease"; that is, the honorable titles of teachers and students, standings between classes, schools and departments does not truly reflect the ability and qualifications in education in Vietnam (MOET, 2006). This points to a need for reform in assessment in Vietnamese schools.

Findings from interviews with principals

Both principals showed strong commitment to implementation of ICT policies in their schools. They affirmed the key role of values and aspirations for ICT teaching and learning and the need for knowledgeable, professional teaching, where teachers know how to use technology for quality learning that can take place anytime and anywhere. George, the Principal at the Sydney School, pointed to the Internet as a vast resource for learning, where students should be able to effectively access online information and evaluate its relevance, collaborating with learners and experts locally and internationally while conducting themselves with integrity, honesty and respect. Further, "students are growing up in a world where they will be Googled; our hope is that they will be 'Googleable' for all the right reasons." (Principal, interview, Apr. 20, 2014) Finally, George hoped that as the students moved from school to university and into the world of work they would have a high level of digital competency. Similarly, the Yenbai School Principal, Khoa, believed that the most important contribution of ICT was its supporting role in all areas of school management and in the development of human knowledge through this fastest and most efficient form of communication.

Educational policies relating to ICT varied between the two countries. At Sydney School as in all senior secondary education in NSW, ICT teaching and learning was primarily based on the BOSTES formula, BOSTES-NSW, which was created by the NSW government in 2014 to bring together the curriculum, teaching, assessment, registration and policy functions previously provided by the Board of Studies NSW, and the NSW Institute of Teachers (Principal, interview, Apr. 20, 2014). (The teaching of the Baccalaureate at Sydney School might show that the school possessed another window to ICT learning, but that aspect is outside the sphere of reference of this thesis). At the Yenbai School, the Principal provided seven documents that taken together trace the implementation of ICT education in the school from 2008 to 2013.

The interview data show that with both schools, the principals themselves do not have specific policies that can be identified with the individual school itself to improve the quality of ICT teaching and learning. The relevant government agency

has policies, and individual teachers may have their own policies to improve ICT teaching and learning, but there is no such thing as a school policy for ICT educational quality. Further, the schools themselves did not have any follow-up method or assessment criteria to gauge the level of achievement by ICT students after graduating from school.

9.4 Discussion of the ICT Achievement "Gap"

Comparative studies produced survey data indicating that there may be some system-based reasons for differences in achievement between East Asian countries and Western countries. Various potential factors are described. They include the teacher's knowledge of ICT, classroom teaching practices, "out-of-school curricula," curriculum standards and content, and the form and content of assessment.

9.4.1 Curriculum standards and content

Document analysis showed that Australian curriculum areas were interlinked far more than in Vietnam. For example, in the NSW curriculum, hardware concepts are taught throughout Stage 6, but for only 20 periods in Year 10. In Vietnam, with regard to curriculum performance standards, a disconnection between theory and practice was found in the teaching. However, in terms of the performance standards of the curriculum, it was found that there was a mismatch between intended, implemented and assessed curriculum both in Vietnam and Australia.This implies that setting high standards does not in itself guarantee high achievement by students.

9.4.2 Teachers' ICT knowledge

As discussed in Chapter 2, the teacher's knowledge of ICT is a major determinant of the quality and depth of ICT teaching and learning. Yet, at the Sydney School, despite the open attitude of the teacher and his preparedness to improve his teaching through experience and reflection on his classroom performance, he did not explicitly link any elements in the achievement gap to any deficiency in his own level of ICT knowledge. He acknowledged that a range of external factors influenced achievement, and that these were linked to out-of-school curricula. But he did not imply or admit that there could have been a marked improvement in the quality of ICT education in his classes if his own educational skills in ICT were raised.

From the Yenbai School case study, it was found that classroom teaching strategies were highly procedural and teacher-directed. The interview data suggested that large class sizes, few resources, and teacher dependence on textbooks limited their adoption of constructivist approaches to teaching and learning. This does not necessarily imply lack of teacher creativity or drive; as one teacher at Yenbai School said, with feeling:

> *Teachers ought to be flexible in teaching and not base their teaching so much on the textbook. We need proficiency-creativity-passion in teaching!*

9.4.3 Classroom teaching

In educational circles, there has been increasing emphasis on classroom teaching methodology as the key factor in ICT achievement (Argentin, Comi, Gui, Origo, & Pagani, 2015). However, the present study does not provide strong support for that argument.

The Sydney School case study showed that after each lesson, students understood what had been taught. When the teacher gave a lesson on writing a Python program, he gave students four exercises, and all were able to do them accurately. However, at Yenbai School, when the teacher taught a lesson on a Pascal program and gave the students three exercises, he asked "How many students can do this?" and only three of 45 students raised their hand (Classroom observation, 2013). It seems that 42 students did not understand this lesson or were not confident enough to respond positively. The researcher discussed these aspects with teacher Ha, and he confirmed only a limited number of students understood the programming language lesson. It is showed that teachers used this model of assessment as a tool to diagnose students' learning – a model that focuses on the process of students' thinking, and the strategies used by students, in order to guide their teaching activities.

In the face of this lack of achievement, it is understandable to infer that, in general terms, the classroom teaching is a major factor contributing to the degree of ICT success of Vietnamese and Australian students. However, on critical examination,

the practice of classroom teaching in terms of teaching methodology cannot be evaluated solely in terms of how constructivist it is, nor can pre-constructivist traditional teaching methodologies necessarily be dismissed as ineffective. There are also cogent external factors. Classroom observation data suggest that due to large class sizes at Vietnamese Yenbai School, students simply did not have the opportunity for interaction with the teacher that the Sydney School students had (incidentally, other NSW school students may not have had this either). The Vietnamese teachers acknowledged the detrimental influence of class size on their teaching practices, so that there was a lack of accord between their teaching in practice and the principles recommended by the Standards. As well, it might be said that Vietnamese classrooms are less interactive than Australian ones, which might further infer that the lack of interaction was detrimental to understanding of ICT curriculum content.

9.4.4 Implemented assessment

As discussed in Chapter 2, it is widely acknowledged that the students' achievements is affected by implemented assessment (Earl, 2012), and this study has supported the strong influence of assessment on ICT learning by Vietnamese students. Nearly all the teachers at Yenbai School explicitly agreed with this, and interviewees Ha and Nga in particular saw assessment as being implemented in order to achieve the objectives of the lesson and to sustain student interest in the lesson. They believed that assessment should be positive and proactive, and that it should be related to training and practice. Assessment should also take the form of evaluation of results through testing.

This thinking is supported by traditional Vietnamese teaching practices (Canh, 2011). Attaching great importance to education itself, teachers have high expectations for their students to succeed. In Vietnam, traditionally, academic achievement is considered a way to bring honour to one's family. Such high expectation for students to learn is an important source of motivation for them. Furthermore, the difference in socio-economic status between academically highly qualified and poorly qualified students is much greater than in Australia. This cultural value placed upon education sends a strong message to students about the

importance of academic achievement, and also constitutes a source of extrinsic motivation for student learning.

9.4.5 The out-of-school curriculum and cultural aspects

As discussed in Chapter 2, out-of-school curricula have been suggested by a number of researchers from Vietnam as being the most important factor accounting for the high ICT achievement of some Vietnamese students. In this study, data from the case study of Yenbai School and Sydney School confirmed the view that homework and out-of-school curricula might impact the high achievement for some students, as there was no pattern of success in achievement in programming in both schools. With hardware and the Internet, hands-on activity was working well for Sydney School. In programming, there was limited success for Sydney School and a very low number for the Yenbai School students who understood programming concepts. It might be the case that Sydney School did not understand the meaning of success as including the learning of programming. Therefore, a limited amount of time and energy was allocated for learning programming concepts. Students from Yenbai School had a large number of programming classes. Yet, a very limited number of students grasped basic programming concepts, and the success of some students could not be connected with any particular teacher strategy.

As such, the data should be considered within the context of other extra-curricular factors, national culture being only one of these aspects. To summarise, the discussion suggests that the high level of ICT achievement in programming by few Vietnamese students both at Yenbai School and Sydney School may be explained partly by underlying cultural factors, and not only by higher standards of intended ICT curriculum and assessment, teacher knowledge or classroom teaching practice. These factors appear to relate to Vietnamese cultural beliefs that value subjects such as ICT are seen as related to high-stakes examinations.

During the classroom observations it was observed that there were differences in terms of classroom attitudes and cultural practices in these two schools. In Yenbai School, parents had high expectations of their children's ICT learning and had established high academic standards for their children. To ensure a high score in

formal assessments, teachers and parents spent considerable time preparing students for assessment. Parents assumed responsibility for their children's high achievement in ICT.

9.5 Limitations of the Study

Limitations on the study require clarification regarding the issue of generalisability and the role of the researcher as the primary instrument of data collection and analysis. In terms of generalisability, a qualitative approach such as the present investigation represents the key strengths of the study but at the same time is liable to be affected by substantial limitations. The fact that data collected from documentary analyses and case studies align with factual information from the real world at many and varied points means that positivist conclusions are not feasible, and that the data taken all together may contribute to the drawing of true impressions relating to the research aims, remain raw and holistic. This will always be an issue in the description of a single object of educational research. However, where comparisons of two separate systems are involved, the question of generalisability will occur at two levels. First of all, each system needs to be generalised to the point where it can be described in general terms. Then a much more difficult and complex process of abstraction will need to occur where two quite different systems are compared and contrasted. The real difficulty at this point is in the fact that a range of dissimilar factors belonging to each of the two systems must be focused or calibrated into a set of comparative criteria that the reader will accept as feasible for the purpose of elucidation of fundamentally significant elements in the essential purpose of the thesis, which is to juxtapose two different ways of teaching and learning ICT and to draw lessons from that process of juxtaposition that will be valid in terms of comparative education..

It could be argued that ideally, given the different national identities and backgrounds of ICT education in Australia and Vietnam, the case study objectives ought to be as similar and representative as possible, and that is a reasonable expectation. As it happened, however, this researcher was unable to obtain permission to observe ICT education at a school that typified a NSW approach to ICT teaching. The next option was to apply to a school that nevertheless represented

certain aspects of Western teaching and learning of ICT that might contribute to a useful study, and so we have Chapter 8 to describe the Sydney School.

From the beginning there was no attempt at purely statistical generalisation, and comparison does not simply result in a dead end because the process is a little complicated. Yin (1994) for example argues that multiple cases may be considered as multiple experiments resulting in analytic generalisation. The use of a case study approach for this study has resulted in a rich and comprehensive account of assessment practices in one Vietnamese and one Australian secondary school. It is believed that it will be clear to the reader that the findings of this study offer (however problematic when extrinsic factors are fully taken into account) insights into the teaching and learning of ICT in two different countries with different educational traditions. Australia and Vietnam, after all, have different starting points and views on ICT education, different resource levels, and different structures of teacher education programs. It was noticed that the Sydney School carries out more practical resources of ICT teaching because, due to its affluence and high level of instruction, it can afford to do so. In contrast, the Yenbai School concentrates on theoretical education in software education because of its educational traditions lead it to do so, and because the people believe it is good kind of providing education. These comparisons might be cautiously extended when one considers available resources an Australian and a Vietnamese school and notices the Australia culture emphasises more hands-on and a great number of resources, while the Vietnamese culture emphasizes more a theoretical educational approach with fewer material resources (Leavitt, 2002).

This study has not begun with hypotheses designed to demonstrate or prove particular points of view. It has attempted to draw conclusions from two case studies. New South Wales schools are not all like Sydney School, but there are elements in the teaching of ICT curriculum that are distinct from the teaching of ICT at Yenbai School, and the differences are instructive. The nature of ICT education in NSW differs from teaching in Yenbai. This thesis has put forward a comparison between the two systems, symbolised by Sydney School and Yenbai School, and which this thesis argues are instructive generally within a perspective of ICT education across different ideological, geographical and socio-economic backgrounds. While the

Sydney School emphasises hands-on activities and practical aspects of ICT education, the Yenbai School instruction remains theoretical and oriented towards an emphasis on programming. The fact is that ICT education has these categories of outworking in distinct educational environments, and this might send a need for changing of educators in both countries, who in NSW face multicultural demands and in Yenbai they face demands related to the adaptation of Western values.

In order to support the objectivity of the researcher's observations, triangulation was used to ensure multiple sources of data. Respondents were asked to confirm findings. In the process of data analysis and reporting, two academic supervisors reviewed the interpretation of emergent data. It is suggested that, whatever the extent to which interpretations of the data are generalisable, the findings of this study may offer important implications not only for academic research into the teaching and learning of ICT, but also regarding important issues for assessment and curriculum development, and, ultimately, for policies in ICT education.

Comparative education perspectives

Differences in ideological foundations of each educational system, whether explicit or logically extrapolated, are likely to influence the perception of those within each system and also needed to be kept in mind by the researcher in observing characteristics of each system through reference to State educational documents and observation of practical classes (Year 11 was the targeted grade in both case studies).

The aim then is to achieve a fair comparison of two quite dissimilar systems of ICT education. This needed to be carried out by an analysis that points to common elements and similarities on the one hand, and clear differences on the other. The ultimate objective is a synthesis of all available information, using a theoretical notion of two representative case studies. The question of representativeness is particular important when it comes to the "Sydney School" case study, because education in Australia is controlled primarily by each State within a Federal system. The Yenbai observations were carried out first, and followed by the Sydney School schedule, and this factor may have influenced the impressions derived from the

study. There are limitations to the comparison, but in this chapter a theoretical justification for a fair comparison is outlined in terms of educational comparison.

It is evident that there are objective as well as subjective factors in a comparison of education in two countries as different as Australia and Vietnam. Where the underlying theory of education differs, where the explicit aims of education in each country differ, and the emerging picture requires a process of simplification, otherwise there will be long treatises and detailed footnotes but no communicable mental image. And any simplification process involving a case study will be unacceptable without a recognisable process of generalisation that can be accepted by the reviewer as fair, reasonable, and significant.

Masemann (1982) identifies a strong ethical current in Marxist thinking but takes up the thinking of Habermas on 'miscommunication' and the thinking of Foley on comparative methodologies that can only be justified by specific studies on very specific systemic questions. This study sees questions behind Masemsn (1982) as challenging indicators of comparing Marxist and Postmodern cultures. As such, this thesis sees the questions however debatable as querying the nature and purpose of education to such an extent of detailed investigation that the purpose of carrying out a comparative case study is liable to be obscured. However, this diagnosis is retrospectively very valuable in the present enquiry, since it enables a useful contrast between current Marxist principles and anticipated Postmodern principles. This contrast is evident in policy and practice, where Australian ICT education is focused on open enquiry and on individual perception and personal initiative, while Vietnamese ICT education is focused on defined performance in specific programming skills, in a socially defined context. Below, this discussion section will show how aspects of constructivism common to both systems are founded on two different manifestations.

It is worth noting at this point that the differences between the two systems are differences that co-exist in time, but in terms of geography, political systems and economic realities are distinguished in terms of culture, language and historical circumstances. Communication and interaction between the two systems is not only

possible but this thesis asserts that it is entirely natural and desirable. It is likely that comparative studies such as this can, out of diversity and difference, derive valuable lessons on the direction of ICT and the purpose of education.

This research project has however proceeded on the basis that a general comparison of the two systems is possible, and that moreover this is the kind of comparison that will provide insights into the value of ICT education for Australia and Vietnam.

At the same time the need to identify different cultural perspectives in Australian and Vietnamese education has already been noted in considering the application of "utilitarian and materialistically oriented approaches" to the study of education (Kalenda & Schwartzhoff, 2015). Here there is a difference in performance and outcomes that needs to be examined thoughtfully: the economic and systemic inputs to education in Sydney School, and the potential socio-economic advantages they confer, are very much more positive than those in Yenbai School. Yet, this study has observed that actual student performance in Yenbai School has been marked by a strong determination to succeed and superior programming skill performance. This is not readily explainable by the educational inputs of Yenbai School, yet it appears to be a persistent feature in practice. This then may be a cultural determinant that deserves further research.

Constructivist aspects in ICT teaching and learning

As discussed in Chapter 2, Vygotsky and the social construction of knowledge is compatible with a Marxist education system. Yet, it seems clear that in Vietnam, as in China, for example, scientific formulations and definitions are targeted more precisely than in Australia. Even in ICT as a subject, the Australian curriculum concentrates more on a technology-supported environment than it does on the task of software programming. The outcomes in learning seem to stimulate more imagination in Australia than precisely defined skill, as in Vietnam. At the same time, the economic and social infrastructure in Australia is able to offer a better student to staff ratio than in Vietnam. Teachers seem better qualified in general. Yet it has been shown also that Vietnam has a commitment to ICT education that is closely related to its prospects for economic development; and that its educational

resources are attempted to be consistently applied across the country. It is important to mention equality of access to education because despite the representative nature of Sydney School in some respects, the level of resources it can devote to ICT teaching is far higher than what can be achieved in many senior secondary schools across NSW. Constructivist intents are at the heart of ICT teaching and learning in Vietnam and Australia, but constructivist aims are different in the school curricula in Australia and Vietnam, and the educational outcomes are different. Wertsch (2010) notes Vygotsky's ideas have had great influence on the West in discussions of cognitive development. However, his view is that individual thinking is shaped by social and historical context. Individual agency remains central, but interaction with society is fundamental. Also this model of cognitive development is designed between active agents and cultural tools, where cultural tools may be accessed equally or unequally. Vygotsky also argues that individual thinking has social origins. McDowell (2013) shows how in the design of ICT learning environments, learning activities need to accept difference and diversity in learners' interests, motivations and goals. The social and political context of ICT in education is also important. This is very clear in the Sydney School case, in contrast to the more basic approach taken in Yenbai School.

Syllabus and educational principles

When it comes to cross cultural comparative education, the question arises of how representative two case studies are. If one were to compare fruit for example, in a cross cultural analysis the task is to compare an apple with a mango, but the Australian apple is a special, more expensive variety of apple. Sharp (1998), as outlined in Chapter Two, has argued that there needs to be a theoretical model to interpret case study data to the point where a conceptual projection of the case study can then be represented in a process of generalised analysis. The treatment of Sydney School is of particular importance here, since it is a well-funded private school representative of a privileged socio-economic group. Yet as a model, it is nevertheless useful because the specific observation carried out related to Year 11 ICT teaching, and certain features of teaching methodology are quite distinct from what was observed in Year 11 ICT teaching at Yenbai School. Constructivist teaching at Sydney School is individually constructed and in many ways student

learning is also individually constructed. The knowledge and skills acquired by students are diverse and emerge more out of practice in an open environment than the curriculum in Yenbai School, which tends to be more specific and more closely defined. Stall-Meadows and Hyle (2010), in advocating "a step-by-step methodological procedure for a qualitative meta-analysis", point to a way to overcome the restricted context of the individual case study by extracting conceptual trends in a particular case study and developing a theory based on multiple case studies. In the present comparison between two schools, the reader will see that the researcher has attempted to observe the differences between the two systems.

Socio-economic factors in a comparative perspective

The methodology adopted here is an attempt at meaningful comparison. The comparison mentions differences, noting that some of them are quite significant. It notes similarities, but qualifies the similarities in order not to exaggerate them. The result is the present rationale of two different realisations of constructivism in a similar aim of teaching ICT but where ICT is mostly the environment of learning in Sydney School but the content of learning in Yenbai School. That is Sydney school. At the same time in Yenbai School, specific ICT content in the form of computer programming is studied and mastered through disciplined teaching and learning practices within a national orientation to economic and social progress under Marxist leadership with its scientific framework where knowledge is able to be clearly defined. A factor in the success of ICT teaching in Yenbai School is the requirement for student discipline in learning.

Teacher qualifications in the Sydney School case study are notable, though it was noted that in this area it is important to maintain and improve teacher qualifications. How well this aspect can be applied across NSW schools is a definite limitation in the scope of the research, although as a general statement, senior high school teaching of ICT is likely to be carried out by teachers who are university graduates in science or mathematics. Funding is a variable that is hard to estimate. Class size in NSW schools is limited generally to 30 in a class as opposed to the situation in Vietnam where numbers tend to be over 40 per class.

This study ultimately is restricted by its comparison of a Western developed country to a Southeast Asian developing country, and particularly by the circumstance that this researcher was unable to observe teaching at a school that might have represented senior secondary ICT teaching in NSW more fairly. However, even with Yenbai School, no precise quantitative study has been carried out to determine the qualification of Yenbai School to be a model representative of ICT education generally in Vietnam.

9.6 Implications of the Study

This study is a contribution to international comparative studies on ICT achievement in education, in theory and also in terms of practice. It has provided a tentative explanation for the ICT achievement gap between Vietnam and Australia. As far as practical work is concerned, the following summarises its practical implications.

9.6.1 Implications for future research

While this study has extended our understanding of ICT teaching, learning and assessment practices in Australian and Vietnam high schools and provided valuable insights into factors accounting for Vietnamese students' higher achievement in ICT, two considerations related to methodology for further research are advanced.

Firstly, as far as the research methods are concerned, document analysis and case studies along with classroom observation and semi-structured interviews have been shown to be effective methods of exploring ICT policy, teaching and learning, and assessment practices, together with their influence on student learning for international comparative studies on ICT achievement. Vanderlinde, Dexter, and van Braak (2012) show that the school-based ICT practices reflected the policy intentions of the national ICT in education policy. Although these methods were time-consuming, they provided more in-depth analyses than would have been possible with a large-scale quantitative study. Thus, it is suggested that further international comparative studies should employ case studies giving rich raw background information for understanding achievement differences.

Secondly, at the same time, as discussed in section 9.5, the findings of this study have been presented within a framework of comparative education. To further validate these findings, more research is needed to ascertain how policies and curriculum influence students' ICT achievement across Vietnam and Australia. Such studies might combine a large-scale quantitative study in conjunction with small-scale case studies (Hopkins, 2014).

9.6.2 Implications for policy of ICT teaching

This study has found that both countries have engaged in national planning for ICT in education. However in Australia the government has made a major achievement in implementing ICT teaching and learning at secondary schools. In contrast, in Vietnam it is significant that the government has engaged in planning but has not been able to report at least modest achievements in ICT teaching and learning in high schools. This thesis therefore recommends that the Vietnamese government issue annual reports regarding the progress of ICT teaching and learning in high schools, and launch a comparison between urban and rural areas in Vietnam to enable the government to make suitable investments to ensure quality ICT teaching and learning in each area.

9.6.3 Implications for ICT assessment and teaching

This study has been a practical attempt to link assessment with teaching and learning on the basis of the literature on assessment of school ICT learning. From this, two implications have been generated.

First, in terms of integrating assessment with teaching and learning, classroom observation found that generally there was a mismatch or disconnect between intended and implemented curricula and assessment, in both Australian and Vietnamese secondary schools. However, there was a strong link between intended and implemented curriculum and assessment at Sydney School. It was found that the teacher at Sydney School was developing and molding his teaching according to his understanding of individual students' needs. Therefore, it is recommended that teachers should use this assessment as a tool to diagnose students' learning (focuses

on the process of students' thinking, and the strategies used) and to guide their teaching activities.

Second, in terms of alternative assessment, the case studies found that handwritten tests still dominate assessment practices across Australian and Vietnam secondary schools, although they were not advocated as the intended curricula and assessment in either country. This thesis recommends that students' portfolios should include authentic assessment where ICT becomes factual to students through real-life problems. Moreover, in Vietnamese high schools, hopefully teachers will turn to newer methods of assessment such as research projects, design projects and online discussion.

9.6.4 Implications for teacher professional development

This study found that lack of professional training in ICT practices was one of the key reasons hindering teachers' preparation from using the intended curriculum and assessment strategies recommended at national level. Classroom observation and interview data suggested that both pre-service and in-service professional developments are needed for teachers to learn programming. For example, especially in Vietnam, ICT teachers at high schools are difficult to have a chance to update new ICT knowledge because they only use a ICT's text- book to be published since 2007.

In terms of pre-service training, it is recommended that a course related to ICT teaching be included in teacher education programs. This course should contain specific content related to the ICT program for secondary schools. As for in-service training, this thesis argues that teachers need more time and resources to improve their practical ICT knowledge and skills. They need time to communicate with their colleagues and reflect on their own ICT teaching practices.

9.6.5 Implications for curriculum and assessment policy-makers

The analyses of documents included in this study offer significant implications for curriculum and assessment policy-makers in both countries. For Vietnamese curriculum and assessment policy-makers in particular, it is suggested that the curriculum focus more on the process of students' learning. To guide teachers' in

their practices, curriculum documents should include more specific content on the process of ICT assessment. In terms of bridging the gap between intended and implemented curricula, it is recommended that class sizes in Vietnam be reduced to ensure that teachers and students have more time to interact in the classroom. In terms of educational reform, it is recognised that major restriction in Vietnam are imposed by the traditional culture, and cultural factors must be considered when considering education reform. The success of any reform will ultimately depend on support from the teachers.

To bridge the gap between intended and implemented policy, curricula and assessment, teachers need to be given more time for ICT teaching, and they need to be provided with more resources. Vietnamese cultural beliefs about achievement are based on traditional attitudes and values that play a part in the process of student learning. To improve students' ICT achievement in Vietnamese secondary school, teachers should not wait for administrative and political factors to recommend them appropriate guidance from the Vietnamese government are a prime consideration. In Vietnam, changes need to be designed and implemented with the ever-present caution that where personal values and beliefs are concerned, ideas and practices will not be able to be transplanted from one person to another or one culture to another (Bishop 1996). Clearly, Australian cultural beliefs about achievement were derived from a very different set of attitudes and values.

9.7 Conclusions

In conclusion, this study has focused on ICT policy, curriculum and assessment practices in Australian and Vietnamese senior secondary education. Findings drawn from this research provide insight into the factors accounting for the ICT achievement gap between NSW students and Vietnamese students. It appears that some factors suggested by other studies such as curriculum standards, teachers' ICT knowledge and classroom teaching practices have not entirely explained the differences in achievement between NSW and Vietnamese students. Behind the presentation of the observed features of ICT education in both countries, there are other factors. Such factors may be related to a culture of success, such as motivation to achieve, diligence, attributing success to effort, parental help, and a broad out-of-

school ICT curriculum that can explain the ICT achievement of students both in the Vietnamese and NSW secondary schools. Further research might focus on a more holistic approach to comparative research by integrating a large-scale study with case studies. This may result in a more authentic account of the ICT achievement gap between Vietnam and Australia.

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Appendices

Appendix A Information and Consent Letter for Principal

Add School/Institute Name
University of Western Sydney
Locked Bag 1797
Penrith NSW 2751
Australia
Telephone :
e-mail :

Participant information sheet for Principal
GENERAL INFORMATION SHEET

Research project: Exploring Quality Teaching of Information and Communication Technology in New South Wales and Yenbai High Schools: A Comparative Case Study

You are invited to take part in a study that is being conducted by Manh Thang Tran The research will form the basis for the degree of doctorate at University of Western Sydney under the supervision of Dr Dacheng Zhao, A/Prof. Allan White and Dr Dorian Stoilescu.

In this project, the major purpose of this study is to investigate similarities and differences in quality teaching of ICT both in Yenbai of Vietnam and New South Wales of Australia at high school level. This involves comparing the development of qualities of the high school ICT teachers force in NSW and Yenbai Province.

The information from this study will be used to complete a thesis for the PhD of Education and I will report the results to School of Education -UWS as requested.

Principal's interview will be performed by researcher with using recorder; it will be not more one hour. Interview transcript will be used as data in the study.

Participation is voluntary. If you do decide not take part, it will not affect your relationship with the researchers. If you change your mind about taking part, even after the study has started, just let me know and any information already collected from you will be destroyed.

No- one will be able to identify you from the results of the study. Only I and my supervisors will have access to the original data provided by you.

Interviews will be on recorder. Computer file containing recorder interviews will require a password for access. These raw data will be stored for 5 years, after which it will be destroyed. Only my supervisors and I will have the right to access this information in accordance with ethical guidelines. If you would like to check your

information from you that will be used in the study, you may contact me or my supervisors bellow.

When I have read this information I will be available to answer any questions you may have. If you would like to know more at any stage, please feel free contact:

Manh Thang TRAN by calling 0452466628 or via e-mail
17322603@student.uws.edu.au;

Dr Dacheng ZHAO by calling 041630357 or via e-mail d.zhao@uws.edu.au;

The UWS Ethics committee by calling 0247360883, fax 024730013 or via e-mail
humanethic@uws.edu.auThe ethics approval number for this project is H9900.
You may retain this information sheet.

Appendix B Information and Consent Letter for Teacher

Add School/Institute Name
University of Western Sydney
Locked Bag 1797
Penrith NSW 2751
Australia
Telephone :
e-mail :

Participant information sheet for teachers
GENERAL INFORMATION SHEET

Research project: Exploring Quality Teaching of Information and Communication Technology in New South Wales and Yenbai High Schools: A Comparative Case Study

You are invited to take part in a study that is being conducted by Manh Thang Tran The research will form the basis for the degree of doctorate at University of Western Sydney under the supervision of Dr Dacheng Zhao, A/Prof. Allan White and Dr Dorian Stoilescu.

In this project, the major purpose of this study is to investigate similarities and differences in quality teaching of ICT both in Yenbai of Vietnam and New South Wales of Australia at high school level. This involves comparing the development of qualities of the high school ICT teachers force in NSW and Yenbai Province.

The information from this study will be used to complete a thesis for the PhD of Education and I will report the results to School of Education -UWS as requested.

During the course of ICT lessons, I will observe your teaching two periods per week on three weeks with Year 11. While I am observing I will write your lessons by classroom observation sheets. Beside of observation, I will have interview teachers around one hour. Observation sheets and file- recorders will be used as data in the study.

Participation is voluntary. If you do decide not take part, it will not affect your relationship with the researchers. If you change your mind about taking part, even after the study has started, just let me know and any information already collected from you will be destroyed.

No- one will be able to identify you from the results of the study. Only I and my supervisors will have access to the original data provided by you.

Observation sheets will be on paper and interviews will be on recorder. Paper information will be stored in a locked cabinet; computer file containing recorder interviews will require a password for access. These raw data will be stored for 5 years, after which they will be shredded. Only my supervisors and I will have the right to access this information in accordance with ethical guidelines. If you would

like to check your information from you that will be used in the study, you may contact me or my supervisors bellow.

When I have read this information I will be available to answer any questions you may have. If you would like to know more at any stage, please feel free contact:

Manh Thang TRAN by calling 0452466628 or via e-mail
17322603@student.uws.edu.au;

Dr Dacheng ZHAO by calling 041630357 or via e-mail d.zhao@uws.edu.au;

The UWS Ethics committee by calling 0247360883, fax 024730013 or via e-mail
humanethic@uws.edu.auThe ethics approval number for this project is H9900.
You may retain this information sheet.

Appendix C Interview Schedule for Principal

Interview questionnaire and interview questions for principals

Before we commence the interview would you kindly complete this brief questionnaire.

Section1: Questionnaire

1. Do you have principal responsibilities for more than one school?

☐ Yes   ☐ No

2. What is the highest level of formal education that you have completed?

☐ High school certificate

☐ Bachelor degree

☐ Master degree

☐ Doctoral degree

☐ Other please list:

…………………………………………………………………..

3. How long have you been a principal/deputy at this school?

☐ 1-2 years   ☐ 3-5 years   ☐ 6-10 years   ☐ More than 10

4. How many years did you spend as a subject/class teacher before you became a principal?

☐ None   ☐ Less than 3 years   ☐ 3-5 years   ☐ 6-10 years   ☐ More than 10

Thank you very much for your cooperation!

Section 2: Follow up interview questions

1. What are the key values and aspirations for ICT teaching and students' learning at your school?

2. What do you think are the key contribution and roles of ICT teaching and learning in education?

3. Which policy documents do you or your teachers refer to for ICT curriculum planning?

4. Does it make provision for quality of ICT teaching and learning?

5. What evaluation strategies and practices are used in your school? (eg. PISA)

6. What difficulties, if any, do you encounter in assessing quality of ICT teaching and learning?

7. Do you have policies to encourage teachers and students to improve the quality of ICT teaching and learning?

8. Could you use any method or assessment's criteria for the level of actual ICT students after graduating from your school?

Thank you very much for your cooperation!

Appendix D Interview Schedule for Teacher

Interview questionnaire and interview questions for teachers

Before we commence the interview would you kindly complete this brief
questionnaire.

Section1: Questionnaire

1. What formal qualifications have you completed?

☐ High school certificate

☐ Bachelor degree

☐ Master degree

☐ Doctoral degree

☐ Other please list:

………………………………………………………………………..

2. What other formal ICT training have you completed (eg. Diploma in ICT)? Please
list: ………………………………………………………………….……………

3. What other informal ICT training have you completed (eg. In-service course at
school)? Please list:

………………………………………………………………………….

4. What grade/year are you teaching ICT to now?

☐ Year 9   ☐ Year 10   ☐ Year 11   ☐ Year 12

5. How many ICT classes are you teaching in each grade/year now?

Year 9……   Year 10……   Year 11……   Year 12……

6. How many years of classroom ICT teaching experience (including part-time or
casual years) will you have completed by the end of this year?

☐ 1-2 years   ☐ 3-5 years   ☐ 6-10 years   ☐ More than 10 years

7. What personal communication technologies do you use outside of work such as:

Please tick: ☐ Computer   ☐ Mobile phone   ☐ Iphone   ☐ Ipad

☐ Others please list any others ………………………………………………………

8. Have you used any of these in your teaching of ICT?

Please tick: ☐ Yes ☐ No

9. What online social communication sites do you use such as:

Please tick: ☐ Facebook ☐ Twitter ☐Blogs ☐ Others

10. Have you used these in your teaching of ICT?

Please tick: ☐ Yes ☐ No

11. Have you ever used such as:

Please tick: ☐ Youtube ☐ Google ☐ Wikipedia

☐ Others please list: ………………………………………………………….

12. Please tick: Have you used these in your teaching of ICT?

☐ Yes ☐ No

13. What ICT resources have you received informal training from your non-work friends?

Please tick: ☐ Games online ☐ Share music

☐ Others please list: …………………………………………………………..

14. Have you used these in your teaching of ICT?

☐ Yes ☐ No

15. Do you have children?

☐ Yes ☐ No

16. If yes, have they taught you anything about using ICT?

☐ Yes ☐ No

17. Have you used what your children taught you in your teaching of ICT?

☐ Yes ☐No

Thank you very much for your cooperation!

Section 2: Follow up interview questions

18. Probe the response to Question 3 – get details of the topic, the depth, how long the course went, how practical it was. Get as many as you can – not just one.

19. Probe if has ticked yes to question 8, 10, 12, 14, 16, 17.

20. Subject knowledge

    (a) Could you briefly outline your most recent (last 3 years) learning experiences in relation to the teaching of ICT? (eg. Have you completed any ICT education or ICT courses in your in-service or at university or at postgraduate levelor teaching faculty)

    (b) Could you briefly outline your experiences in relation to improving the quality of ICT teaching and assessment of your students' learning?

21. Standards and criteria are used to evaluate ICT teaching and to assess students' learning:

    (a) What standards do you use?

    (b) Are these standards appropriate?

    (c) Could you suggestadditional standards to improve the quality of ICT teaching?

    (d) What are the purposes of assessing students' ICT learning?

22. How often do you evaluate your ICT teaching methods? (Give specific examples of the lessons teaching)

23. How often do you assess your ICT students (formally or informally)?

24. What methods of assessment do you use?

25. What could be done to improve the quality of ICT teaching

26. What could be done to improve the quality of assessment of students' ICT learning?

27. What are the main problems of ICT teaching in the curriculum of high schools?

Thank you very much for your cooperation!

Appendix E UWS Human Research ETHICS Committee

17 December 2012
Doctor Dacheng Zhao, Centre for Educational Research

Dear Dacheng,

I wish to formally advise you that the Human Research Ethics Committee has approved your research proposal **H9900** *"Exploring Quality Teaching of Information and Communication Technology in New South Wales and Yenbai High Schools: A Comparative Case Study",* until 19 September 2015 with the provision of a progress report annually and a final report on completion.

Please quote the project number and title as indicated above on all correspondence related to this project.

This protocol covers the following researchers:
Dacheng Zhao, Allan White, Manh Tran.

Yours sincerely

Associate Professor Anne Abraham
Chair, UWS Human Research Ethics Committee

d.Zhao@uws.edu.au
17322603@student.uws.edu.au

Appendix F Tables from the Australian and NSW Curriculum Documents

Table 1 Structure of ICT subjects in NSW

Syllabus	Year of Study	No. of Units	External Exam	Tertiary Entry Score
Software Design and Development	11 & 12	2	Yes	A
Information Processes and Technology	11 & 12	2	Yes	A
VET- Information and Digital Technology	11 & 12	2	Optional	B- Exam C- no exam

Table 2 The major contents of curriculum

Subjects	Topic as set out in the syllabus
Software Design and Development	Development & Impact of Software Solutions (including Social/ Ethical Issues) Software Development Cycle Developing a Solution Package (practical programming) Options Topics (Evolution of Programming Languages, Software Developers View of Hardware)
Information Processes and Technology	Communication Systems Social/Ethical Issues System Development Cycle/Project Work Option Topics Transaction Processing Decision Making Systems Automated Manufacturing Systems Multimedia System
Information and Digital Technology- VET	Working in the industry Operating system software Diagnostic testing Safety Option Topics: Select one of Web and software application Networking and hardware Digital animation

Table 3 Software Design and Development outcomes

Syllabus Content Summary	Syllabus Outcomes
Development and Impact of Software Solutions : - Social and Ethical Issues - Application of Software Development Approaches **Software Development Cycle** - Defining and understanding the problem - Planning and design of software solutions. - Implementation of software solution - Testing and evaluation - Maintenance **Developing a Solution Package Options topics:** - Evolution of Programming Languages OR - Software Developers View of Hardware	• Explains interrelationships between hardware and software. • Differentiates between various methods used to construct software solutions. • Describes how major components of a computer system stores and manipulates data. • Describes the historical development of different language types. • Explains the relationship between emerging technologies and software development. • Identifies and evaluates social / ethical issues in a number of contexts. • Constructs software solutions that address legal, social, ethical issues. • Identifies needs to which software solutions are appropriate. • Applies appropriate development methods to solve software problems. • Applies a modular approach to implement well constructed software solutions and evaluates effectiveness. • Applies project management technologies to maximise the productivity of the software development. • Creates and justifies the need for various types of documentation required for a software solution • Selects and applies appropriate software to facilitate the design and development of software solutions. • Assesses the relationship between the roles of people involved in a software development cycle. • Communicates the process involved in a software solution to an experiences user. • Uses a collaborative approach during the software development cycle. • Develops effective user interfaces in consultation with appropriate people

Table 4 Outcomes of Information Processes and Technology

Syllabus Content Summary	Syllabus Outcomes
Project Work: - Use and understanding of the System Development Cycle. **Information Systems and Databases:** - Information Systems - Examples of database information systems - Organisation methods - Storage and Retrieval - Other information processes - Issues related to Information Systems Communication Systems: - Characteristics of communication systems - Examples of communication systems - Transmitting and receiving in communication systems - Other information processes in communication systems - Issues related to communication systems **Option Strands**: Select two of : - Transaction Processing Systems - Decision Support Systems - Automated Manufacturing Systems - Multimedia Systems	• Applies an understanding of the nature and function of information technologies to a specific practical situation. • Explains and justifies the way in which information systems relate to information processes in a specific context. • Analyses and describes a system in terms of the information processes involved. • Develops solutions for an identifies need which addresses all of the information processes. • Evaluates the effect of information systems on the individual, society and the environment. • Demonstrates ethical practice in the use of information systems, technology and processes. • Proposes ways in which information systems will meet emerging needs. • Justifies the selection and use of appropriate resources and tools to effectively develop and manage projects. • Assesses the ethical implications of selecting and using specific resources and tools • Analyses situations, identifies a need and develops solutions. • Selects and applies a methodical approach to planning, designing or implementing a solution. • Implements effective management techniques. • Uses methods to thoroughly document the development of individual and / or group projects.

Appendix G Tables from the Vietnamese Curriculum Documents

Table 1 The contents of ICT Textbook, Year 10

Content	Length
Chapter I: Some basic concepts of Information Technology	20(15,3,2)
Chapter II: Operating System	12(7,4,1)
Chapter III: Text editor	19(8,8,3)
Chapter IV: Computer Network and Internet	11(6,4,1)
Review	2
Testing	6
Total	70

Note: The numbers: 20 (15, 3, 2) means that a total of 20 periods, which includes: 15 periods of theory, 3 periods of exercise and practice, 2 periods of exercise.

Table 2 The contents of ICT Textbook, Year 11

Content	Length
Chapter I: Some concepts of programming and programming languages	3(2,0,1)
Chapter II: The simple program	6(3,2,1)
Chapter III: Structure of branch and loop	7(4,2,1)
Chapter IV: Type of data structure	15(7,6,2)
Chapter V: File and file manipulation	3(2,0,1)
Chapter VI: The subprogram and the programming structure	11(5,5,1)
Review	3
Testing	4
Total	52

Note: The numbers: 3 (2, 0, 1) means that a total of 3 periods, which includes:

2periods of theory, 0period of exercise and practice, and1period of exercise.

Table three: The contents of ICT Textbook, Year 12

Content	Length
Chapter I: The concept of database	8(5,1,2)
Chapter II: Management system database Microsoft Access	24(7,15,2)
Chapter III: System database relation	7(5,2,0)
Chapter IV: Architecture and security of database systems	7(5,2,0)
Review	2
Testing	4
Total	52

Note: The numbers: 8 (5, 1, 2) means that a total of 8 periods, which includes: 5periods of theory, 1period of exercise and practice, and2periods of exercise.

Appendix H Tables from the Vietnamese Curriculum Documents Adjusting

Table 1 Major changes to the ICT syllabus 2006 to 2011 for Year 10

Chapter	Unit	The content of adjustment (2006 edition)	Guiding the implementation (2011 edition)
Chapter I: Some basic concepts of information technology	Unit 2. Information and data	Section 2. Measurement unit information (page 7)	No need to explain the deep, stopping only at the concept of bit, to know multiples of bits, byte to lookup when needed
		Roman counting system (page 11)	No obligate teaching and learning
		Performing integer (page 12)	No depth explanation of the work performances in memory
		Performing real (page 13)	Performing real (page 13)
	Unit 4. Problem and algorithm	The concept of algorithm (page 33)	Present a simple problem algorithm such as sort a sequence of positive integers; -Knowledge: students need to know both how to performance the block diagram algorithm and language list; -Skill: students just use one of two ways (block diagram or language list) to describe the algorithm
		Some examples of the algorithm (page 36)	-No obligate teaching: +Example 1: To examine the elements of a positive integer; +Example 3: the algorithm of binary search
	Unit 6. Solve the problem on computer	Describe algorithm (page 48)	Optional teaching: algorithm for finding the greatest common divisor of two positive integers M and N. It is not necessary to introduce the algorithm described in the block diagram.
Chapter II Operating Systerm	Unit 10. The concept of operating system	Classification operating system (page 63)	No teaching
		MS-DOS operating system (page 65 from the top to the previous note)	No teaching
	Unit 11. File and file management	Section 2: file management system (page 66)	No teaching
Chapter IV: Computer Network and Internet	Unit 20. Computer network	The network model (page 139)	No teaching

Table 2 Major changes to the ICT syllabus 2006 to 2011 for Year 11

Chapter	Unit	The content of adjustment (2006 edition)	Guiding the implementation (2011 edition)
Chapter two: The simple program	Unit 7. The standard procedures of input/output simple	Section 2: print data on the screen (page 31)	The procedure readln, writeln only a brief introduction of procedure without parameters. Avoid explain how
	Unit 10. Loop structure	Section 10 (page 42)	Not necessarily require students to write a complete program as in the textbook, but students must understand the operation of two types of loop structure, option suitable structure for each specific situation repeated, and writing statement iterative described respectively
Chapter four: Type of data structure	Unit 11. Array and variable index	One-dimensional array (page 53)	To focus on the main contents, illustrate the array type statement with positive integer type
		Example 3 (page 58)	No teaching
		Section 2. 2-dimensional array (page 59)	No teaching
	Unit 12. String data type	Section 2: The string manipulations (page 69)	No in-depth presentation about procedure and function, to know the meaning and operation of the operations (which procedure, function enforcements)
	Unit13. Record type	(page 74)	No teaching
Chapter six: The sub-program and the programming structure	Unit 17. Sub-program and classification	Section 1. The concept of the sub-program (page 93)	No teaching last 2 benefits of sub-program
		Section2. Classification and structure of the subprogram (page 94)	The introduced formal parameters and actual parameters without going into passing parameters by value.
	Exercise 7	All contents of the lesson (page 105)	No teaching
	Unit 19. Library and subprogram standard	All contents of the lesson (page 110)	No teaching
	Exercise 8	All contents of the lesson (page 115)	No teaching

Table 3 Major changes to the ICT syllabus 2006 to 2011 for Year 12

Chapter	Unit	The content of adjustment (2006 edition)	Guiding the implementation (2011 edition)
Chapter I: The concept of database	Unit 1. The concepts of database	Section3. database b) The performance of the database (page 9) c) The basic requirements of the database (page 12)	No teaching
	Unit 2. Database management system	Section2. Activity of one database management system (page 17)	No teaching
Chapter II: Management system database Microsoft Access	Unit 4.Table structure	Specifies the key (page 37)	Adjusted "understand" into "knowing".
	Unit 7. Link between tables	Concept (page 57)	Requirements link content between tables adjusted "understand" into "knowing"..
Chapter IV: Architecture and security of database systems	Unit 12. The architectures of database systems	All contents of the lesson (page 95)	No teaching

Appendix I Year 11 ICT Lesson Planning, Vietnam and Australia

Ha's Lesson Subprogram Practical Exercises

1. Aims

1.1 Knowledge
Reviewing basic knowledge

Understanding programming and subprogram procedures

1.2 Skills
Improving sub-programming skills;

Using subprogram structures and functions to solve other problems; solving specific

problems.

1.3 Attitude
To aim at character training, thinking in terms of programming, self-discipline,

positive, proactive and creative attitudes to seeking knowledge.

2. Methodology

Visual and verbal presentation;

Using open questions, to give issues for students to answer

3. Preparation
3.1 Teacher
Lesson plan including exercises and keys of exercises

3.2   Students
Review of previous lessons;

Bring notebooks, pens, textbooks, sketch books.

4. The lesson in progress

4.1 Calm the class (1 minute): student attention and correct seating.
 Class: 11A1
Date: 23-4-2013
Number of students: 39
Absent: 0

4.2 Test on previous lesson (3 minutes)
Teacher: Explain the structure and function of a subprogram and relevant procedures.

4.3 New lesson

Title: Subprogram Exercise

Teacher and students activities	Contents	Times
Activity 1: Teacher: Divides classroom into two groups Group 1: Solve the problems		6 minutes
	Write the program: 1) Create procedure, entering from keyboard, n examinees include: Name, Zone (Z), Mathematics (M), Physics (P), Chemistry (C): Total marks (TM) for: Z= 1 then: TM:= M+ P+ C +2 Z= 2 then: TM:= M+ P+ C +1 Z= 3 then: TM:= M+ P+ C Write out the screen of list 2) Sort examinees by increasing total marks. (Including 2 fields: name, total marks) Write out screen list	
Teacher's questions	1) What is variable name data type? The variable Z, M, P and C. What are data types? How to enter data n examinees? What statements are used to calculate total mark of a student of each zone? 2) What algorithms are used to sort examinees according to the total mark increment?	
Group 2: Solve the problems	1. Write program $s=1^3+2^{3+...+}n^3$. 2. Write program $$s=\sqrt{x+\sqrt{x+\sqrt{x+...\sqrt{x}}}}\quad (\text{n root})$$ 3. Programming reverse a string S Example: 'abcd'-> 'dcba'	
Teacher's questions	In exercises 1, 2, 3. What are: Stopping component? Lower level? Formula of recursion?	

Activity 2: Teacher's suggestions	Program Group1;
	 var ht:array[1..20] of string;
	   kv,t,l,h,td:array[1..20] of integer;
	 i,n:integer;
	procedure nhap;
	 var i:integer;
	begin
	for i:=1 to n do
	   begin
	 write('ht:');readln(ht[i]);
		6 minutes

Teacher and students activities	Contents	Times

	write('kv:');readln(kv[i]);
	write('t,l,h:');readln(t[i],l[i],h[i]);
	 if kv[i]=1 then td[i]:=t[i]+l[i]+h[i]+2;
	 if kv[i]=2 then td[i]:=t[i]+l[i]+h[i]+1;
	 if kv[i]=3 then td[i]:=t[i]+l[i]+h[i];
	  end;
	 for i:=1 to n do
	 writeln(i:4, ht[i]:20, kv[i]:3,t[i]:3,l[i]:3,h[i]:3, td[i]:4);
	 end;	

Activity 3: Teacher called two students in group 1 to go to blackboard
 	
Two students went to blackboard to solve the problems
 	
Student 1 (group 1)
	<pre>procedure sort;
	 var i,j,tg:integer;
	     tg1:string;
	
	begin
	for i:=1 to n-1 do
	 for j:=i+1 to n do
	  if td[i]>td[j] then
	    begin
	 tg:=td[i];td[i]:=td[j];td[j]:=tg;
	  tg1:=ht[i];ht[i]:=ht[j];ht[j]:=tg1;
	    end;
	 for i:=1 to n do
	 writeln(i:4,ht[i]:20,td[i]:4);
	 end;</pre>
		10 minutes

Student 2 (group 1)	<pre>begin
	write('n=');readln(n);
	nhap;
	writeln('danh sach sx:');
	sx;
	readln;
	end.</pre>	

Activity 4: Teacher: Remarks & assessment with two students in group 1		4 minutes
Activity 5: Teacher called two students in group 2 to go to		10 minutes

Teacher and students activities	Contents	Times

blackboard
 	
Student 1 (group 2) solved problem 1
	program Ex1;
	 var n:integer;
	function mu(n:integer):integer;
	 begin
	if n=1 then mu:=1
	 else mu:=n*n*n+mu(n-1);
	 end;
	begin
	write('n=');readln(n);
	 writeln('kq=',mu(n)) ;
	readln;
	end	

Student 2 (group 2) solved problem 2	program Ex2;
	 var n:integer;
	    x:real;
	function can(n:integer;x:real):real;
	 begin
	if n=1 then can:=sqrt(x)
	 else can:=sqrt(x+can(n-1,x));
	 end;
	 begin
	write('n,x=');readln(n,x);
	write('kq=',can(n,x):5:2);
	 readln;
	 end.	

Activity 6: Teacher: Remarks and assessment with two students in group 2		3 minutes

5. Summing up (1 minute): Using a subprogram.
6. Homework (1 minute): Exercise 3: Write program to reverse a string S (Example: 'abcd'-> 'dcba')

Nga's Lesson Subprogram Practical Exercises

1. Aims:

1.1 Knowledge:

Understanding how to use programs written using the subprogram;
Revise structured data types, and the subprogram structured data declaration type.

1.2 Skills

Formation of skills in structured programming;
Knowing how to divide exercises into smaller modules.

1.3 Attitude

To develop a capacity to think in computer terms and a commitment to learning computer use

2. Preparation

2.1 Teacher

Writing lesson plans, referring to textbooks, manuals and test programs, use of computer and projector.

2.2 Students

Review previous lessons;
Bring notebooks, pens, textbooks, sketch books.

3. The lesson in progress
3.1 Calm the class (2 minutes): student attention and correct seating.
Class: 11T1
Date: 16- 4-2013
Number of students: 38
Absent: 0
3.2 Test on previous lesson (3 minutes)
Question: How is a one-dimensional array defined? How to statement one-

dimensional array by indirection?

Answer:

One- dimensional array is a finite sequence of elements of the same type of data;

Indirect statement:

Type <name-array> = array [<first index> .. <Index>] or <element type>;

Var <array variable name> <name-array>;

3.3 New lesson

Title: Subprogram Exercise

Teacher and students activities	Contents	Times

Activity 1: Teacher wrote an exercise on blackboard	Exercise 1: Enter one array of n integers from the keyboard:
	  1) To print array into screen as horizontal, each element separated by 4 spaces.
	  2) To find maximum and minimum of the array. Printing of result
	 3) To sort array ascending. Printing of result.
		2 minutes

Activity 2: Students thought the request of the problem and wrote the title on their notebook	Seeing, writing the assignment, thinking to a solution	2 minutes
Activity 3: Teacher reminded quickly how to work with array and explain.	Input: Numbers n and n integers Output: n integers The maximum value, minimum value n is ascending	3 minutes
Activity 4: Teacher asked students that the problem is divided into how many small problems; each problem is what kind of subprogram?	Divide into small problems follows: - Enter array => procedure - Print array => procedure - Find max, min => procedure	3 minutes
Activity 5: Teacher called six students turn to go up the blackboard to perform problem		13 minutes
Student 1: To make the statement	type mang=array[1..100] of integer; var a: mang; n,i,max, min:integer;	2 minutes

Student 2: To make subprogram and to enter array	procedure nhapmang(var a:mang);
	begin
	   write(' Nhap so luong phan tu n =');
	   readln(n);
	   For i:=1 to n do
	     begin
	        write('a[',i,']=');
		3 minutes

Teacher and students activities	Contents	Times

	readln(a[i]);
	    end;
	end;
	
	procedure inmang(var a:mang);
	begin
	  writeln(' Cac phan tu trong mang :');
	  For i:=1 to n do
	    write(a[i]:5);
	  writeln;
	end;	

Student 3: To make subprogram and to print array		3 minutes
		5 minutes

Student 4: To make subprogram and to find Max, Min	procedure lonnhat;
	begin
	  max:=a[1]; min:=a[1];
	
	  For i:=2 to n do
	    Begin
	     if a[i]>max then max:=a[i];
	     if a[i]<min then min:=a[i];
	     end;
	    writeln(' GTLN la ', max:5);
	    writeln(' GTNN la', min:5);
	end;	

		5 minutes

Student 5: To make subprogram and to sort array	procedure sapxeptang(var a:mang);
	var tg,j:integer;
	begin
	  For i:=1 to n-1 do
	    For j:=i+1 to n do
	     if a[i]>a[j] then
	      begin
	        tg:=a[i];
	        a[i]:=a[j];
	        a[j]:=tg;
	      end;
	end;	

		5 minutes

Student 6: to finish main program	begin
	  nhapmang(a);
	  inmang(a);
	  lonnhat;
	  nhonhat;
	  sapxeptang(a);
	  inmang(a);
	  readln
	end.	

Teacher and students activities	Contents	Times
Activity 6: Teacher observed programs, program implementation. If there are errors, to ask students and to provide solutions		3 minutes

4. Consolidate lesson: (3 minutes): a) The algorithm for one-dimensional array, b) Dividing the problem into smaller problems. Applying subprograms write programs, c) Using subprogram.

5. Homework (2 minutes): a) Using subprogram rewrite the problem with entire array has been making and practice, b) Review of learned knowledge of semester 2.

John's lessons
Lesson 1: Write four programs in Python

1. Aims:

1.1 Knowledge

Review of basic knowledge with four programs in Python;

Students know to write programming and doing similar of exercises

1.2 Skills
Students can improve using skill programming of using multiplication, addition,

subtraction and division in Python;

Students know writing programs should test the user on five basic facts.

2. Methodology
Teacher used presentation and explanation, combined with sample of programs;

Using open questions, to give issues for students to answer.

3. Prepare

3.1 Teacher

Planning lesson, computer and using projector

3.2 Students

Review all learned knowledge, pens, textbooks…

4. Process of lesson
4.1 Stability class (2 minutes): Check absent students, stability of students'

Placement:
Class: 11
Date: 17-03-2014
Number of students: 16
Absent: 0
4.2 New lesson
4.3

Title: Write four programs in Python

Teacher and students activities	Contents	Times
Activity 1: Teacher's revising	Recalling the students do exercises in theory they have learned in the previous lesson. Then ask students to practice writing 4 programs with addition, subtraction, multiplication, division	2 minutes
Activity 2: Teacher wrote 4 programs in Python	1) One program should test the user on 5 basic **multiplication** facts. 2) One program should test the user on 5 basic **addition** facts. 3) One program should test the user on 5 basic **subtraction** facts. 4) One program should test the user on 5 basic **division** facts	2 minutes
Activity 3: Teacher asked student 1 (S1)	What do you want to do?	1 minute
Activity 4: S1 answered	Addition	1 minute

Activity 5: Teacher explained the program of the user on 5 basic addition facts
 	
Teacher: in another program that's very similar, program that tests the user on 5 basic addition facts
	`# a program that tests users on their addition facts`
	`Import random`
	`i = 0`
	`score = 0`
	`while I < 5:`
	`    add1 = int(random.random()*13)`
	`    add2 = int(random.random()*13)`
	`    print "what is" + str (add1) + "+" + str (add2)`
	`    ans = input ()`
	`    if ans == add1 + add2:`
	`      print "correct"`
	`      score = score + 1`
	`    else:`
	`      print "incorrect"`
	`      i=i+1`
	`print "you scored" + str (score)+ "out of 5."`
		5 minutes

Activity 6: One program should test the user on 5 basic multiplication facts	`# a program that tests users on their mutilplication facts`
	`import random`
	`i = 0`
	`score = 0`
	`while I < 5:`
	`    fact1 = int(random.random()*13)`
	`    fact2 = int(random.random()*13)`
	`    print "what is" + str (fact1) + "x" + str (fact2)`
		20 minutes

Teacher and students activities	Contents	Times
| | ```
ans = input ()
if ans == fact1 * fact2:
    print "correct"
    score = score + 1
else:
    print "incorrect"
    i=i+1
print "you scored" + str (score) + "out of 5."
``` | |
Teacher's explaining	That PowerPoint presentation is on schooligie (This school website, students can download programs) so if you finish that and want to see what's next than you go here. What we're doing. So when you finished, what you should have are 4 programs, I've called them sub as in sub programming, or part, part 1 part 2 part 3 part 4. So each programming is going to look a bit like this. A mark at the top that says what we're doing and then that program there?	
Student 2 asked teacher the question.	Why do you times 13 to get the function?	
Teacher explained that	Because that's how, that will give me random number between 0 and 1. This will multiply by 13 so the slightest number I get is 0.999 multiply that by 13, is just under 13 right, 12.999 and then the ID? Function, truncates…the decimal part off. So it gives me a number between 0 and 12, from 0 to 12 inclusive not 13.	
Student 3 asked	What is rand in again? Random integer, Do you just do rand in 13?	
Teacher answered	So what we're doing here, just in case you've forgotten how this works, if you do forget, you need to learn it again and remember it better this time. So I've got fact 1 and fact 2, so factors, when I multiply 2 numbers together, the 2 numbers that I multiply are called factors. I've got a factor 1 and a factor 2. I make factors, factor 1, I generate a random number between 0 and 1, than I multiply by 13, that gives me a random number between 0 and 13 but it doesn't go up to 13, and then I use the ID function here, this makes a random number, a random integer from 0 through to 12. I made 2 of those and then I print the question what is, than don't forget because fact 1 and fact 2 are numbers I need to cast them	

Teacher and students activities	Contents	Times
	to strings, I need to use the string function when I want to use them in a print state with words. I ask the user to input their answer and I say the answer equals, fact 1 multiply by fact 2 than print correct and add 1 to the score, or else print incorrect, than I increment my loop and i go back up and that's all occurring in a loop, so just 5 questions. When that's done, then go on and try and do the addition which is quite similar.	
| Activity 7: Teacher, write one program should test the user on 5 basic subtraction facts | ```
# a program that tests users on their subtraction facts
import random
i = 0
score = 0
while i < 5:
    minuend = int(random.random()*13)
    subtrahend = int(random.random()*13)
  if subtrahend  > minuend:
    #swap the two a round
    temp = subtrahend
    subtrahend = minuend
    minuend = temp
  print "what is" + str (minuend)  + "-" +    str (subtrahend)
  ans = input ()
  if ans == minuend - subtrahend:
      print "correct"
      score = score + 1
   else:
      print "incorrect"
      I = i+1
print "you scored" + str (score) + "out of 5."
``` | 23 minutes |
Teacher explained:	Subtraction is harder, come up here and have a look at this. The 2 numbers that subtract from each other, I didn't know what they were called. So what I want not to find out. One's called the minuend and one's called the subtrahend.	
Student 4 asked:	Which one is which?	
Teacher answered:	The minuend should be larger than the subtrahend.	
Student 5:	So that's what temp means? Sir is temp a placeholder?	

Teacher and students activities	Contents	Times
Teacher:	It's a variable isn't it? temp as in temporary variable	

Activity 8: Teacher, one program should test the user on 5 basic division facts
 	
Teacher:
	# a program that tests users on their division facts
	import random
	i = 0
	score = 0
	while I < 5:
	    divisor = int(random.random()*13)
	    dividend = int(random.random()*13) * divisor
	    print "what is" + str (dividend) + "divided by" + str (divisor)
	    ans = input ()
	    if ans == dividend/divisor:
	      print "correct"
	      score = score + 1
	    else:
	      print "incorrect"
	      i=i+1
	print "you scored" + str (score) + "out of 5."
	This program is the same
		7 minutes

Hardware and Software

Teacher and students activities	Contents	Times
Activity 1: Teacher explained computer systems	1) Any computer system is made up of input, output, process, storage and control subsystems. 2) At the heart of a computer is the CPU. It is the "brain" of a computer	5 minutes
Activity 2: Teacher explained the Central Processing Unit (CPU)	1) The CPU is a very sophisticated system. It is made up of many components. All these components have been engineered so they fit onto one silicon chip. This chip is called a microprocessor. 2) We can subdivide the CPU into two *logical* sub-systems. Dividing the CPU into logical subsystems means that if you looked at a CPU under a microscope you wouldn't really see two parts because they don't physically exist. Rather thinking of the CPU as having two parts makes it easier to understand. 3) These two sub-systems are the control unit and the arithmetic logic unit (ALU).	10 minutes
Activity 3: Teacher explained CPU – The Control Unit	1) The control unit controls the flow of data within a computer. 2) It controls the sequence in which instructions are executed (i.e. some programs have priority	7 minutes

	over CPU time). 3) Decodes instructions (i.e. taking instructions and determining which circuits to open and which to close) that are to be executed by ALU. 4) Locates and retrieves data from RAM that is to be processed. 5) Signals ALU to execute instructions	
Activity 4: Teacher explained CPU – The Arithmetic Logic Unit	1) The ALU does all the calculating and logical processing of data. 2) The number of bits that a CPU can process at one instant is called the CPU's word length	5 minutes
Activity 5: Teacher said students to watch this video	YouTube (how do it know?)	15 minutes
Activity 6: Teacher: Random Access Memory	1) RAM is also known as read/write memory. 2) All data and instructions that a CPU uses must be placed in RAM before and after the CPU uses them. 3) RAM is volatile (i.e. when the computer is turned off data in RAM disappears). 4) The amount of data that RAM can store is measured in megabytes (millions of bytes) and gigabytes (billions of bytes). 5) Data stored in RAM can be accessed very quickly by the CPU. 6) Data in RAM is stored as a series of 0s and 1s. 0s are represented by circuits holding low voltages while 1s hold higher voltages.	7 minutes
Activity 7: Teacher: BIOS/ROM (Basic Input Output System/Read Only Memory)	1) BIOS contains programs that a computer system cannot operate without. For this reason contents of BIOS are READ ONLY (not changeable). 2) Programs in BIOS tell the computer things like how to boot, how to read/write data to RAM and where to find the computer's disk drives. 3) BIOS/ROM chips are generally installed on the mother board at the factory where a computer is made.	5 minutes

5. Consolidate lesson

6. Homework

Lesson 2: Hardware and Software

1. Aims:

1.1 Knowledge

Understanding about specify explanation in terms of hardware, operating system and application software.

1.2 Skills

2. Methodology

Teacher used presentation and explanation, and give specific example by YouTube.

Using open questions, to give issues for students to answer

3. Prepare

3.1 Teacher

Planning lesson (PowerPoint), computer and using projector

3.2 Students

Review all learned knowledge, pens, textbooks…

4. Process of lesson

4.1 Stability class (2 minutes):

Check absent students, stability of students' placement.

Class: 11
Date: 26-03-2014
Number of students: 16
Absent: 0

4.2 New lesson

Title: Hardware and Software

Teacher (T) and students (S) activities	Contents	Times
T: Computer systems	• Any computer system is made up of ***input, output, process, storage and control*** subsystems. • At the heart of a computer is the CPU. It is the "brain" of a computer.	5 minutes

Teacher (T) and students (S) activities	Contents	Times
T: The Central Processing Unit (CPU)	• The <u>CPU</u> is a very sophisticated system. It is made up of many components. All these components have been **engineered so they fit onto one silicon chip**. This chip is called a **microprocessor**. • We can subdivide the CPU into two *logical* sub-systems. Dividing the CPU into logical subsystems means that if you looked at a CPU under a microscope you wouldn't really see two parts because they don't physically exist. Rather thinking of the CPU as having two parts makes it easier to understand. • These two sub-systems are the <u>control unit</u> and the <u>arithmetic logic unit (ALU).</u>	10 minutes
T: CPU – The Control Unit	• The <u>control unit controls the flow of data</u> within a computer. • It <u>controls the sequence in which instructions are executed</u> (i.e. some programs have priority over CPU time). • <u>Decodes instructions</u> (i.e. taking instructions and determining which circuits to open and which to close) that are to be executed by ALU. • <u>Locates and retrieves data from RAM</u> that is to be processed. • <u>Signals ALU to execute instructions</u>. • The ALU does all the <u>calculating and logical processing</u> of data. • The number of bits that a CPU can process at one instant is called the CPU's <u>word length</u>. • YouTube (how do it know?)	7 minutes
T: CPU – The Arithmetic Logic Unit	• RAM is also known as <u>read/write memory</u>. • <u>All data and instructions that a CPU uses must be placed in RAM before and after the CPU uses them.</u> • RAM is volatile (i.e. when the <u>computer is turned off data in RAM disappears</u>). • The amount of data that RAM can store is measured in megabytes (millions of bytes) and gigabytes (billions of bytes). • Data stored in RAM can be accessed very quickly by the CPU. • Data in RAM is stored as a series of 0s and 1s. 0s are represented by circuits holding low voltages while 1s hold higher voltages. • BIOS contains programs that a computer system	5 minutes

Teacher (T) and students (S) activities	Contents	Times
T: Watch this video T: Random Access Memory T: BIOS/ROM (Basic Input Output System/Read Only Memory)	cannot operate without. For this reason contents of BIOS are READ ONLY (not changeable). • Programs in BIOS tell the computer things like how to boot, how to read/write data to RAM and where to find the computer's disk drives. • BIOS/ROM chips are generally installed on the mother board at the factory where a computer is made.	15 minutes 7 minutes 4 minutes

5. Consolidate lesson:

6. Homework: 5 minutes:
Y11 SDD – Homework Assignment #3: Chapter Summary –Hardware and software

Task Description
- Scan through "Chapter 2 – Hardware and Software" of your course text book (i.e. "Software Design and Development – The Preliminary Course).   As you do so, copy the headings and subheadings from the book into a word document.   Use formatting to mark the difference between major and minor headings.
- Go back and thoroughly read through the chapter; using the word document you created type notes under the relevant headings and subheadings.
- When you have finished reading and taking notes, review your notes and format them so as to optimise their readability