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FACULTY OF SOCIAL, HUMAN AND MATHEMATICAL SCIENCES

School of Education

Modelling School Effectiveness and Attainment Equity in Thailand

by

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ABSTRACT

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Thailand has been facing a crisis of education in terms of low and unequal quality of schooling for over a decade, and these problems are still becoming more and more severe. The big challenges Thailand faces when it comes to promoting quality of schooling and reducing inequity of attainment have been become a national priority and a focus of an extensive public debate. Therefore, the major research question addressed in this study is: what makes school effective in terms of both quality and equity? To answer this, the sequential mixed method research design, which begins with quantitative followed by qualitative research, was adopted in the study.

In Phase I, the quantitative research focuses on investigating school effectiveness factors affecting student attainment and quantifying the level of quality and attainment equity at the school level. Data used in the study were derived from the survey from schools operating in the lower secondary level in the Prachin Buri Province and the individual students' national testing scores (O-NET) in eight subjects according to the Thai Basic Education Core Curriculum. This study adopted the most up-to-date school/educational effectiveness model: the dynamic model of educational effectiveness, proposed by Creemers and Kyriakides (2008). Overall, the multilevel analysis revealed that after controlling for student characteristics, classroom and school contextual factors, the significant factors affecting student attainment included school policy and practice related to (i) quality of teaching, (ii) provision of sufficient learning resources, and (iii) value of favour in learning. In addition, the dimension of effectiveness factors used to define and measure these are: frequency, focus, stage, quality, and differentiation. The overall quantitative findings confirmed the robustness of the original version of the dynamic model of education effectiveness, which can be applied in the context of Thai education. To measure the degree of school attainment equity, this study employed Kelly's attainment equity index (Kelly's AE). The multiple regression analysis showed that average SES is a vital predictor to attainment equity in *nearly* all eight subjects, whereas the percentage of girls as well as school size inconsistently affect attainment equity across eight subjects.

To quantify effectiveness status at the school level in each academic strand, the residual extracted from the multilevel model was shown as the quality of schooling and Kelly's AE index quantifies the degree of equity of schooling. As proposed by Kelly (2012), schools were classified into four main types based on similarities in terms of the pattern of quality and equity across eight subjects: (i) schools that showed a high level of equitability across subjects, (ii) schools that were differentially effective across subjects, (iii) schools that showed a low level of equitability across subjects, and (iv) schools that were consistently ineffective across subjects.

In Phase II, the major aim of qualitative research was to investigate why schools perform differently in terms of quality and equity. Multiple-case study research was utilised in this phase. One school from each group was selected as a representative case to illustrate the insightful features. Data were collected from interviewing the headteacher and eight teachers from eight academic strands. The findings based on cross-case analysis comparing the similarities among four types of schools revealed that the key different features of 'effective vs ineffective schools' are due to differences in school process in policy and practice related to (i) rigorous teaching/instruction aligned to the national curriculum, (ii) teaching preparation for the national examinations, (iii) provision of school academic learning resources, (iv) dealing with students' different backgrounds at intake, and (v) providing instruction/teaching according to students' needs and/or abilities.

The quantitative findings of this study extend the theoretical development by modifying the original version of the dynamic model, especially in the educational context of developing countries. The findings also provide a broader analysis of school effectiveness factors that significantly contribute to student attainment in *all* academic strands of the Thai Basic Core Curriculum, in contrast to the original version of the dynamic model was exclusively developed and based on only mathematics, language, and religious education. In addition, the qualitative findings provide a proposed model, namely 'the Thai school effectiveness-equity model' which presents a detailed illustration of how to raise quality and equity through a continuous within-school process/mechanism given the diversity of students' academic backgrounds. Therefore, the findings will be of interest to policy makers and practitioners involved in school/educational effectiveness and improvement, as well as to theoreticians and educationists in developing the model in the field of school/educational effectiveness.

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DECLARATION OF AUTHORSHIP

I, Sorrapong Charoenkittayawut,

declare that the thesis entitled

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and the work presented in the thesis are both my own, and have been generated by me as the result of my own original research. I confirm that:

- this work was done wholly or mainly while in candidature for a research degree at this University;
- where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;
- where I have consulted the published work of others, this is always clearly attributed;
- where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;
- I have acknowledged all main sources of help;
- where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;
- none of this work has been published before submission.

Signed:

Date:

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Sorrapong Charoenkittayawut

1. Chapter 1: Introduction

This chapter presents the background to the research and describes its significance. It introduces the theoretical considerations of school effectiveness research in the Thai education context and addresses why such research in Thailand is crucial for practice there, given the current educational challenges in the Thai schooling system. The research questions and objectives of the study are outlined, as is the structure of the thesis.

1.1 Motivation for academic considerations

School effectiveness research has a long and distinguished history and its knowledge base has been continually developing for almost half of a century since the influential Coleman Report in the Sixties (Coleman et al., 1966), which is widely recognised as the starting point of research in the field. The major overarching question in school effectiveness research is '*what makes schools effective?*', but, more specifically, it focuses on so-called 'effectiveness factors'; namely, factors that explain the variations in student outcomes and promote more desired student outcomes (Creemers & Kyriakides, 2008, 2010c). Furthermore, school effectiveness research attempts to explore comprehensively the generic scientific dimensions of such effectiveness factors: frequency, focus, stage, quality and differentiation (Creemers & Kyriakides, 2008), and consistency, cohesion and constancy (Creemers, 1994). These factors together significantly contribute to improved student outcomes. With the progress of the knowledge base, school effectiveness research has evolved from different perspectives and disciplines: the economic (Hanushek, 1986); the sociological (Jencks et al., 1972); the psychological (Coleman et al., 1966); and the organisational (Cheng, 1996; Harris, Bennet, & Preedy, 1997). In addition, the methodological progress in statistical techniques (e.g. multilevel modelling, structural equation modelling and multilevel structural equation modelling) promoted the development of more complex theoretical models and more robust empirical studies, which has culminated in the most up-to-date modelling of educational effectiveness: the Dynamic Model of Educational Effectiveness (Creemers & Kyriakides, 2008). This model chose to employ longitudinal data rather than cross-sectional data, with mixed methods designs, advanced data analysis (e.g. multilevel modelling, multilevel structural equation modelling, and multilevel latent growth curve modelling), and modern measurement methodology (e.g. Item Response Theory). In addition, researchers

have investigated the various student outcomes considered vital to the quality of schooling and also integral to the notion of equity of schooling (Kyriakides & Creemers, 2011). Overall, the knowledge base of school effectiveness research has provided and underpinned practical applications in the area of school improvement and has had a far-reaching impact on paradigm shifts in the educational policies and practices in many countries at local, national and international levels.

Over the last five decades, the number of empirical studies conducted on school effectiveness research has increased in developed countries, particularly in the UK, the US, the Netherlands and Australia (Reynolds, Teddlie, Creemers, Scheerens, & Townsend, 2000; Scheerens, 2013). This knowledge base of effectiveness factors, built through these theoretical models and empirical investigations, is largely based on research conducted in economically advantageous educational contexts (so called 'developed countries'), and this begs the question as to whether our school effectiveness models, based as they are on empirical findings from *developed* countries, are compatible with (and comparable to) those of a developing country like Thailand. As Scheerens (2001) points out, the nature of school effectiveness research between developed and developing countries is very different in many aspects. Compared to developed countries, developing countries show a larger between-school variation, a higher consistency between effects of resource inputs and less evidence about the effect of teaching. Therefore, it can be argued that, although school effectiveness research in both developed and developing countries focuses on the same education drivers, the factors of effectiveness (and therefore the outcomes) are likely to be different at a system level in developing countries.

The Thai education system has adopted many of the structures of leading Western countries in their educational philosophies, guidelines and practices so there is a strong Western influence, but some characteristics of the Thai system are very different (Fry, 2002). Whilst some Western processes work effectively in the Thai system, some need prior adaptation and others do not fit at all, or are very difficult to implement because of innate differences in economic, social and cultural contexts. As Mounier and Tangchuang (2010, pp. 58-59) point out:

'The elements of both goals are too often inspired by Western ideas and global trends. They are not built on firm philosophical and political foundations coupled with a profound knowledge of realities... major flaws in these two objectives of the reform and the causes of their incompatibility, stem from the lack of a profound and scientific knowledge of the reality of Thai education that is based on relevant, in-depth and conclusive studies.'

Educational policies and practices in Thailand are likely to be underpinned by a shift to the greater use of empirical research for educational reform, as shown in the Eighth National Research Policy and Strategy, 2012-2016 (National Research Council of Thailand, n.d.). However, the shift to evidence-based, research-informed reform is taking a long time in actuality, with education policies tending to reflect the personal preferences of academics and policy makers rather than the findings of observation or a research database. As such, change is unlikely to result in a reliable framework for school effectiveness research and, in contrast to the great attention being given to school effectiveness research in developed countries, the knowledge base in Thailand is still at an early stage and lagging behind by several decades. Recent or current empirical studies on school effectiveness research are very limited in terms of analysing student outcomes and tend to reflect mostly the researcher's interests.

However, it is encouraging that school effectiveness research in Thailand, like many other countries in Asia, is undergoing a paradigm shift today, from the effective and quality/competitive school movement to the global-class school movement (Cheng & Tam, 2007). The emerging movement related to individualisation, localisation and globalisation is now extensively concerned with international comparatives factors, and the challenge of giving future generations of Thai students (and Thai society) sustainable improvement up to challenging international standards. With the help of networks among ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, Thailand, Brunei Darussalam, Vietnam, Laos, Myanmar and Cambodia), the region as a whole can look forward to the development of a knowledge-base for school effectiveness research with the aim of playing a prominent role in educational reform. As Scheerens (2001) states, the knowledge base from developing countries can provide an incremental contribution to school effectiveness research and comparative studies. Cheng and Tam (2007, p. 263) agree:

'Given the complexity of research on such comprehensive reforms of school education in many countries in Asia, there is an urgent need to develop a critical mass of research intelligence through different types of networking in the region. This work is a necessity not only for individual countries but also for the whole Asian region to meet the numerous challenges in education reform in the new millennium.'

Thailand is relatively well connected to the rest of the world, so developing a school effectiveness knowledge base there – in both theoretical models and empirical studies – will be crucial to improving its education system while at the same time school effectiveness research itself becomes situated to a greater extent in developing countries more than in the industrialised/developed part of the world (Scheerens, 2001). For this reason, this research and thesis focuses not only on school effectiveness within the Thai context, but also aims to provide an empirical contribution to more globally applicable issues.

1.2 Motivation for practical considerations

Now that we have established the significance of school effectiveness research, we have to look at recent changes in educational policies and practices in Thailand, which have largely centred on the principles, policies and practices of future development and improvement (Na Pompet, 2010). While more reliable empirical evidence of school effectiveness research in Thailand is needed as a basis for these educational reforms (at both local and national levels), the issue remains, as Harris, Chapman, Muijs, and Reynolds (2011) have argued, that the insightful knowledge base of school effectiveness research is getting lost in translation by practitioners and policy makers in developing countries.

In the case of Thailand, the current guidelines for education reform represent a paradigm shift from a normative to a positivist stance. The twin challenges identified by policy makers of '*low quality of education*' and '*unequal quality of education*' explicitly reflect the failure of the Thai educational system as a whole and have become a national priority and a subject of extensive public debate. As prioritised in the Eighth National Research Policy and Strategy (2012-2016), research to underpin Thailand's '*educational reform and learning creation*' is considered vital for driving the necessary reforms across different strata of society.

1.2.1 Low quality of education

The increase in the quality of skilled workers in Thailand since the introduction of the Eighth National Economic and Social Development Plan (National Economic and Social Development Board, n.d.) is seen as a driving force behind the recent economic and social growth. Developing countries usually face a low literacy rate that leads to poor quality skills and disadvantaged socio-economic status, turning into '*a vicious cycle*' from generation to generation. As a developing country, Thailand is paying substantial attention to increasing the opportunity for all to access good quality education. The first education law, the 1921 National Education Act, stipulated seven years of compulsory education and caused the first significant expansion in enrolment (Michel, 2010). Afterwards, the 1999 National Education Act mandated twelve years of universal secondary education (Grade 12) free of charge, and nine years of compulsory education (Office of the National Education Commission , 2002). Figure 1-1 depicts the enrolment rate at the different levels of Thai schooling for 2012-13. Overall, nearly 100 percent and more than 90 percent enrolled in compulsory (Grade 1-9) and basic education (Grade 1-12), respectively. However, if we look closely at the transition period in each stage of education, the percentage of enrolment declined. The enrolment to lower secondary education fell gradually by less than 10 percent, while approximately 70-80 percent continued from lower to upper secondary education; in other words, around 20-30 percent of students quit after completing their lower secondary education. With regard to higher education, the enrolment rate was lower than 50 percent, reflecting the gap in enrolment rates at a higher level of education in Thailand. Overall, figures show that Thai education performed fairly well in terms of *quantity*, especially in the compulsory education level.

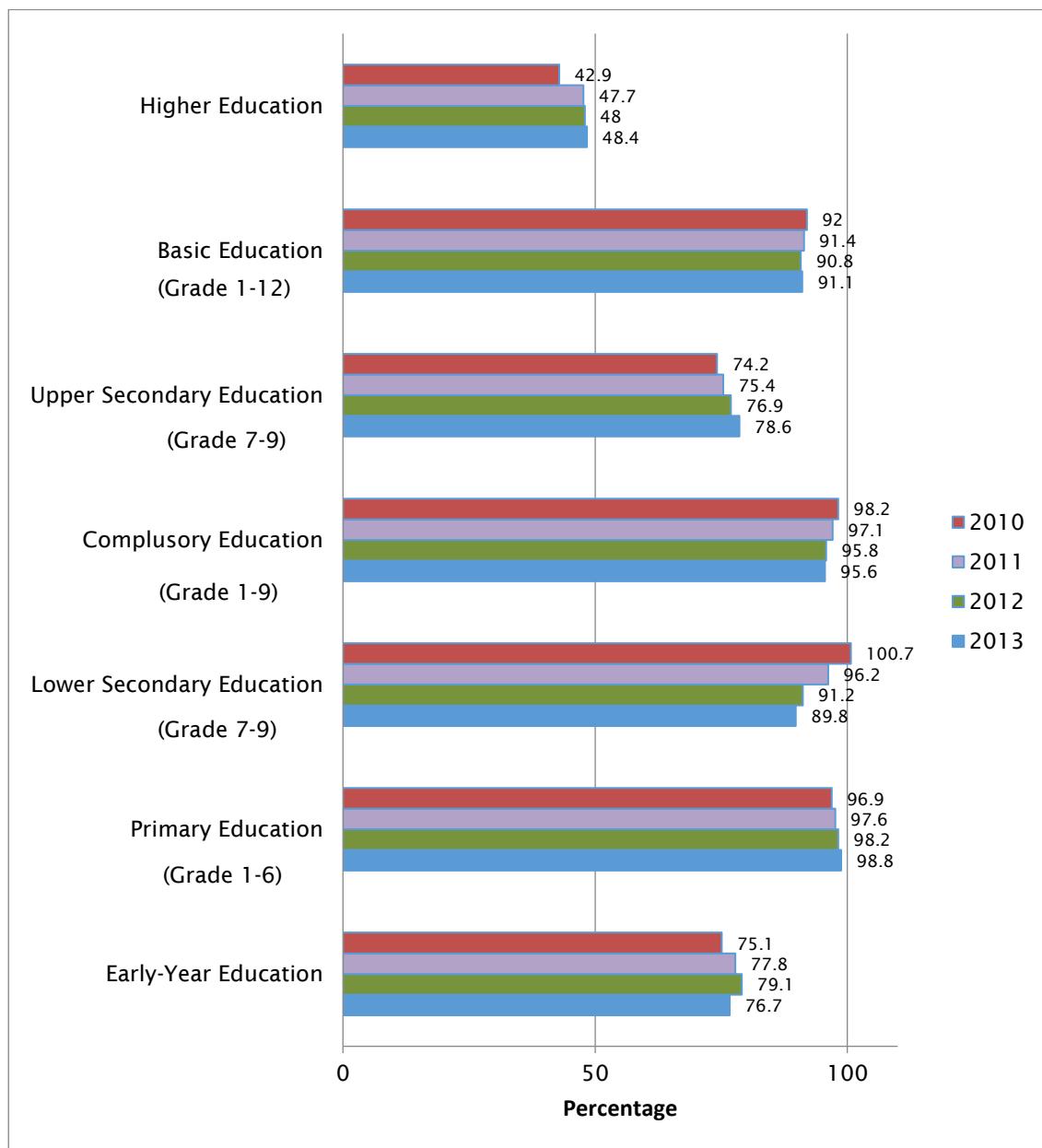


Figure 1-1 Enrolment rates at the different levels of education in Thailand

[Source: Ministry of Education, n.d.-b]

Overall, the Thai education system has demonstrated an impressive quantitative success, but the corresponding quality outcome is less evident (Fry, 2002; Fry & Bi, 2013; Mounier & Tangchuang, 2010) according to both national and international assessments. Comprehensive national testing through the Ordinary National Educational Test (O-NET) of Thailand is carried out in the final year of each educational stage by measuring student performance at Grades 6, 9 and 12. As shown in Figure 1-2, the overall national average scores were lower than 50 percent in almost all subjects (except Health and Physical Education) at all levels of education, particularly in English Language, Mathematics and Science in Grades 9 and 12 which were in crisis. Likewise, international assessments confirmed the same dilemma of the low quality of education in Thailand, as pointed out by Thailand's PISA scores. Figure 1-3 indicates that overall scores in Reading, Mathematics and Sciences have improved over time; for example, scores in Reading and Mathematics in 2012 were higher than those in the previous years. However, Thailand is still lagging behind other countries: Thailand was ranked 50th in Mathematics, 48th in Science and 47th in Reading (among 65 countries) in 2012 (see Figure 1-4, Figure 1-5 and Figure 1-6).

The poor quality of education is also evident in Thailand's labour force. As stated by Phongpaichit and Benyaapikul (2013), the Thai education system fails to provide the quality of graduates to match the needs and expectations of the various labour market/industry sectors, leading to a loss in international competitiveness for the Thai economy (Michel, 2010). Therefore, it can be concluded that the educational reform prescribed by the 1999 National Education Act to raise the quality of schooling and education has failed to achieve its objectives and, as a consequence, more recent educational reforms have shifted the focus *from quantity to quality*. Raising educational standards was explicitly considered the top priority in the 2011-12 stage and again in the 2013-2018 stage in the 'Major Driven Policy for Educational Reforms in the Second Century of Thailand' (Ministry of Education, n.d.-c).

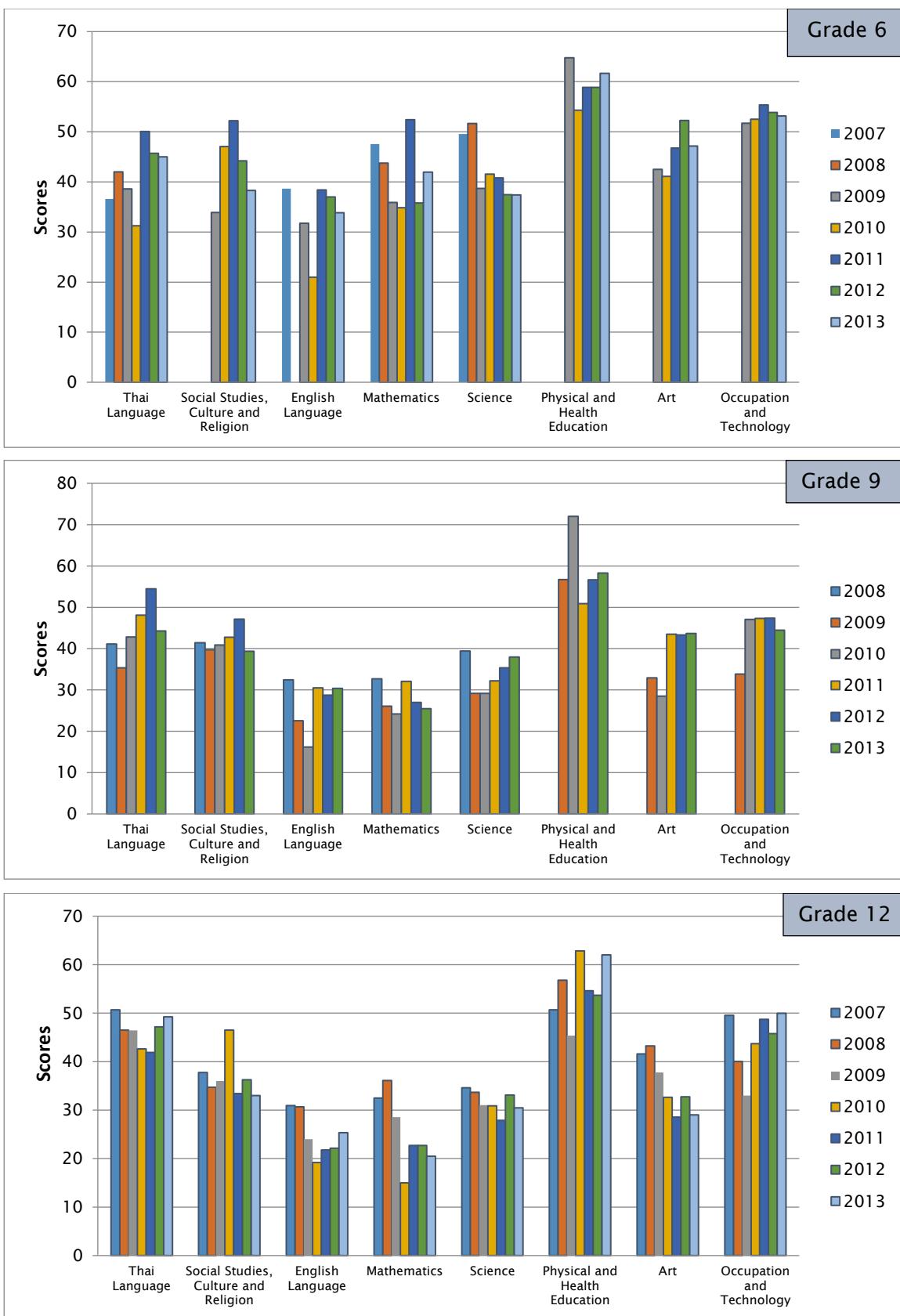


Figure 1-2 O-NET scores for Grades 6, 9 and 12 in the academic years 2007-2013

[Source: NIETS]

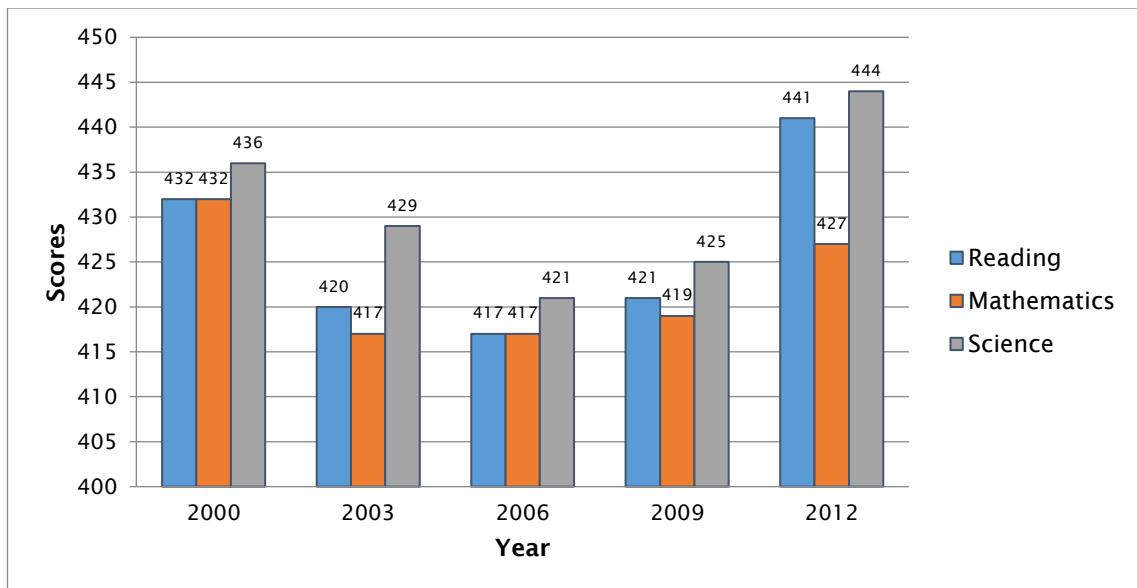


Figure 1-3 PISA scores of Thailand in 2000-2012

[Source: OECD, 2014]

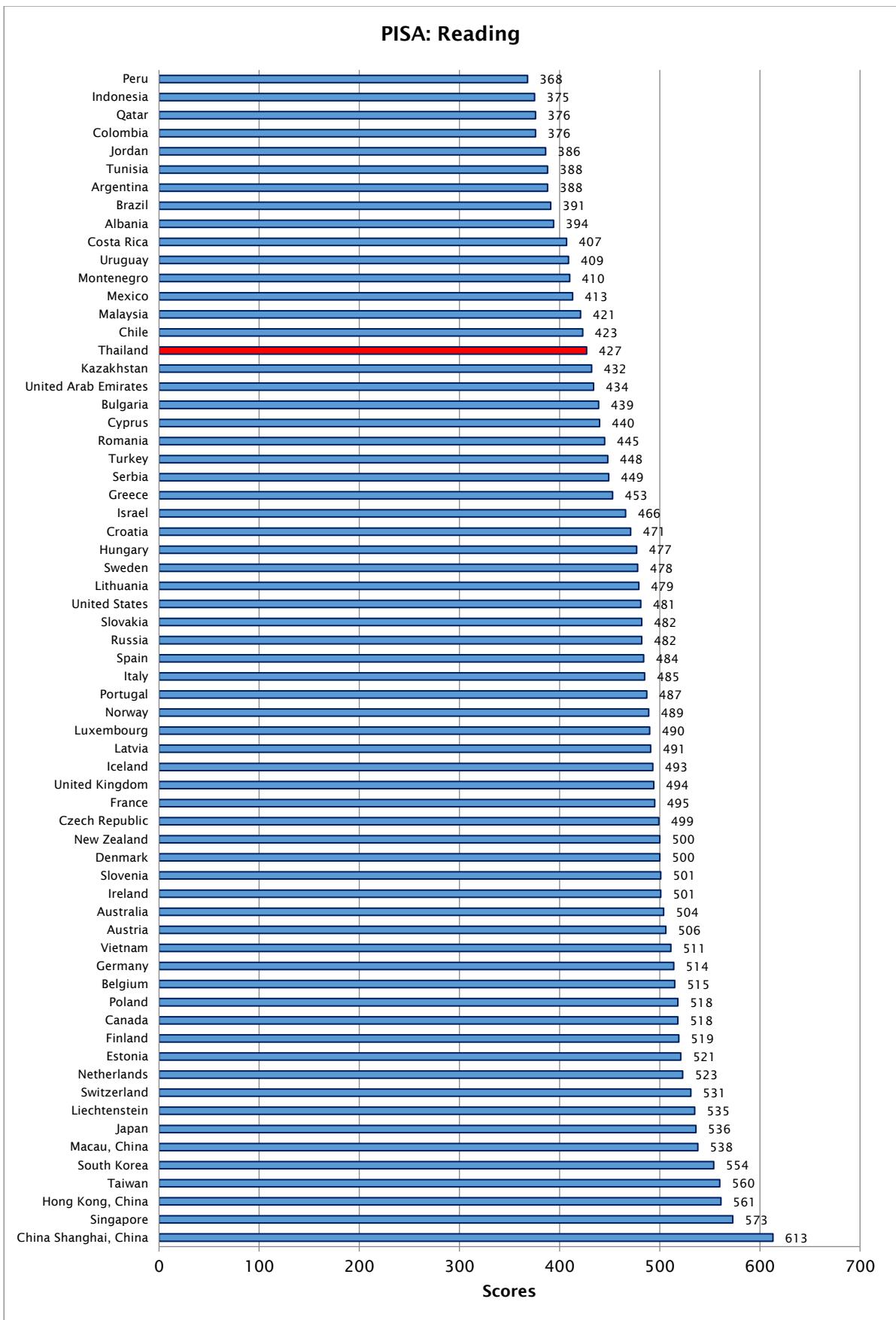


Figure 1-4 PISA scores for Reading in 2012

[Source: OECD, 2014]

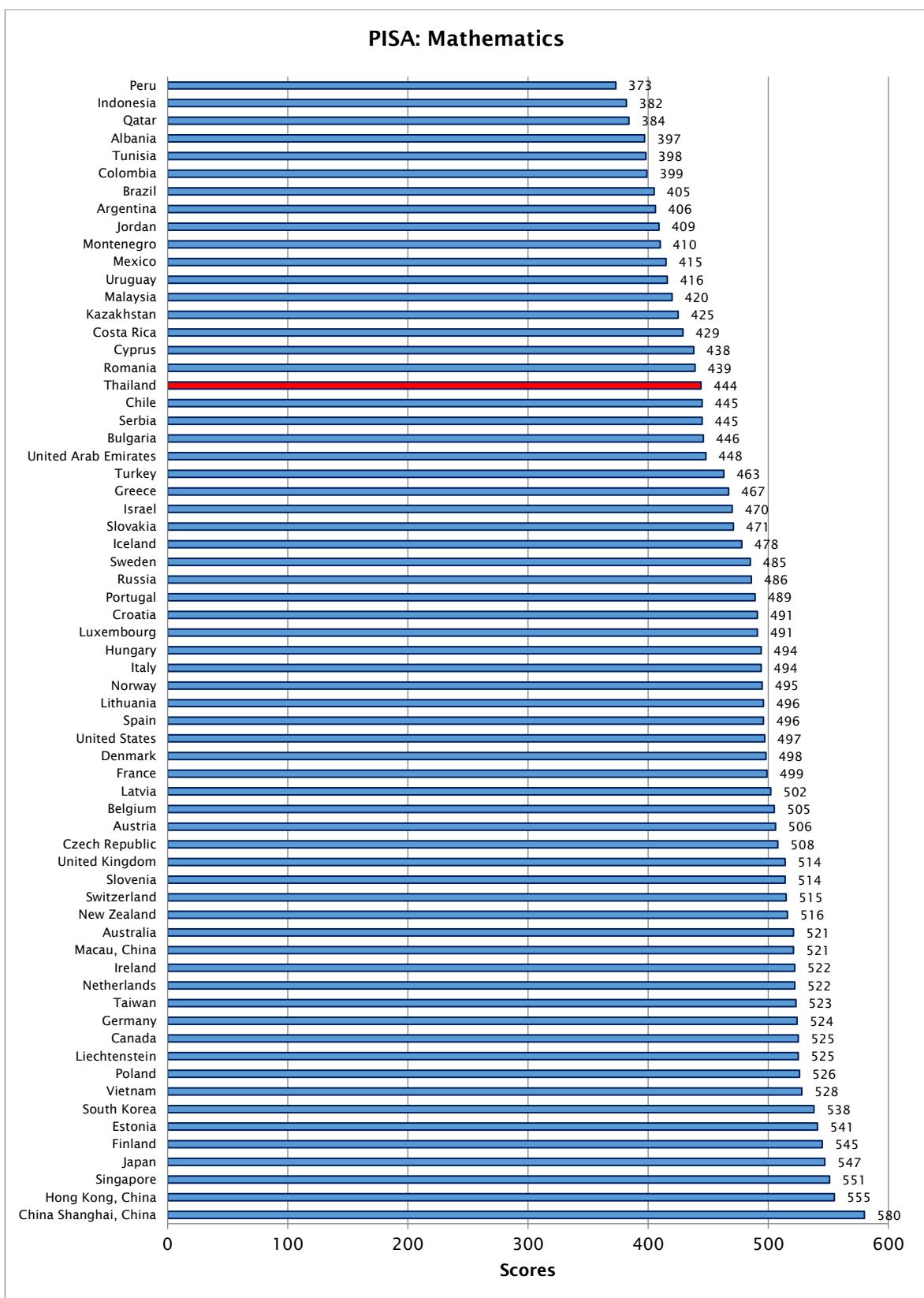


Figure 1-5 PISA scores for Mathematics in 2012

[Source: OECD, 2014]

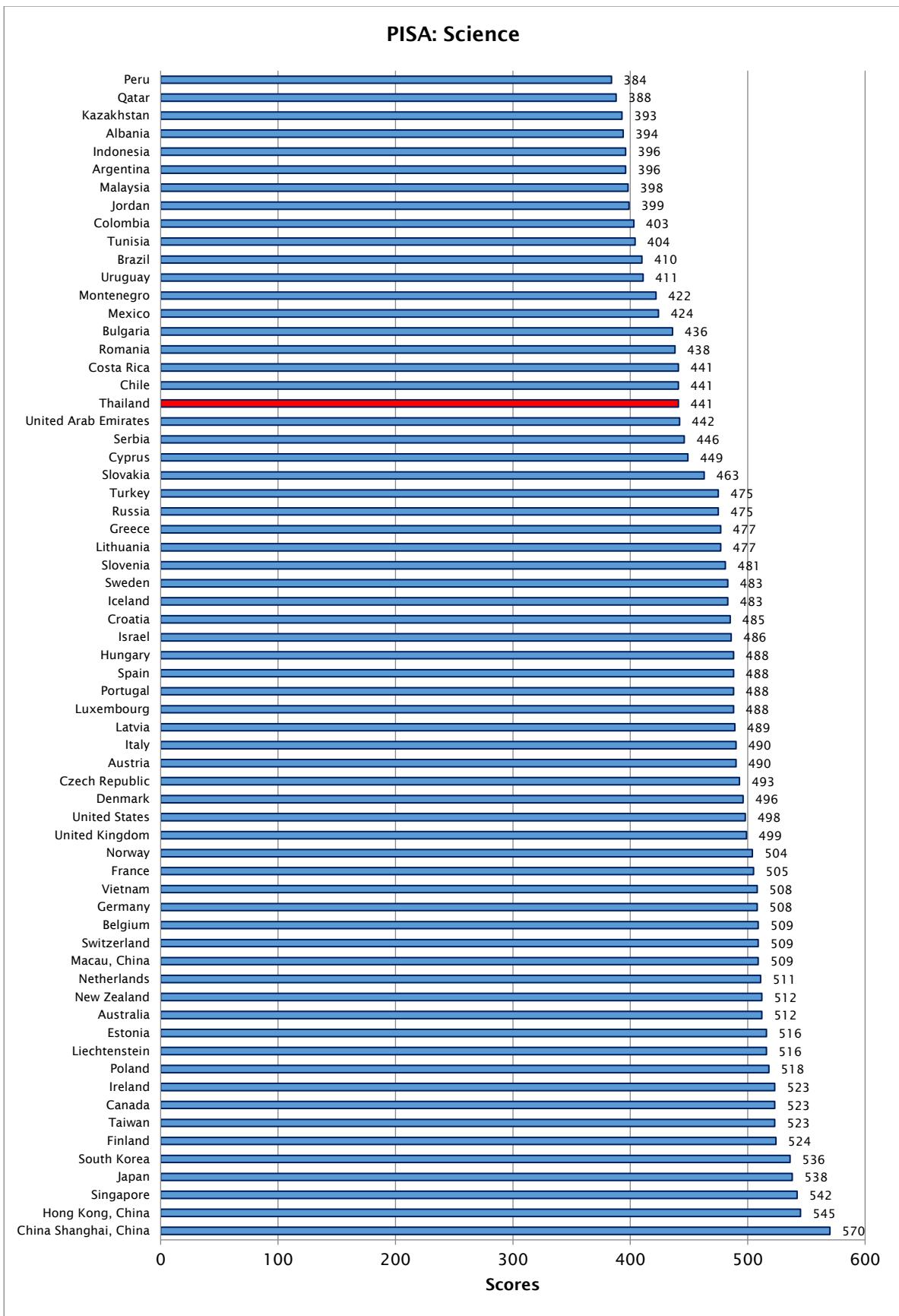


Figure 1-6 PISA scores for Science in 2012

[Source: OECD, 2014]

When the Thai educational system has been criticised for its low quality (Michel, 2010; Pongwat & Rupavijetra, 2010), it has been argued that this is a consequence of inadequate finance (Phongpaichit & Benyaapikul, 2013) and a lack of necessary input resources (Siamwalla, Tangkitvanich, & Lathapipat, 2012). Developing countries commonly face insufficient input resources and low budgets, but if we look at Thailand, for nearly two decades the national budget allocated to education has actually increased by nearly 240%, from 5,302 to 12,544 million Baht (see Figure 1-7), which accounted for approximately 4 percent of GDP (see Figure 1-8) and about 22 percent of the total national budget (see Figure 1-9). It is currently 3.8 percent of GDP, which is on par with Japan and higher than Singapore (at 3.3 percent), and higher than almost all neighbouring Asian countries (see Figure 1-10).

Despite this high level of investment in Thai education, the return on investment appears unsatisfactory judging by the low quality of education outcomes. An example of poor return on investment is evidenced in the international comparison of the time students spend studying Science. Thai students spent more time on Science than students in almost all other countries (see Figure 1-11) and this figure excludes privately funded tuition outside school (Siamwalla et al., 2012), so the overall poor quality of the Thai education system appears not to be directly linked to inadequate finance or a lack of necessary input resources, as many have suggested.

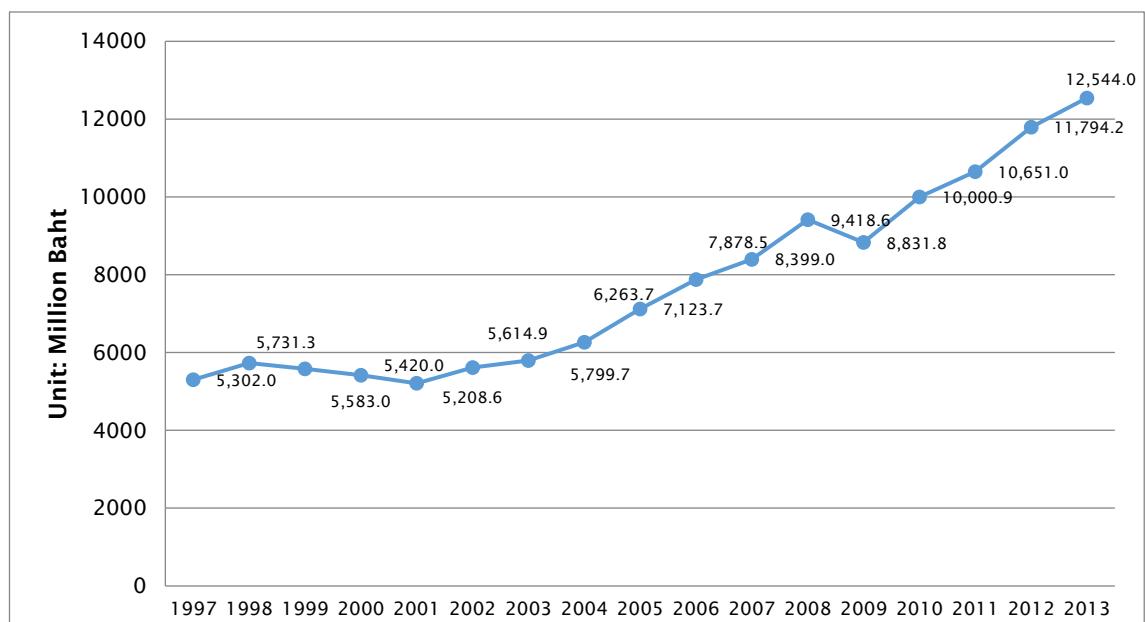


Figure 1-7 Education budget in Thailand in 1997-2013

[Source: Ministry of Education, n.d.-a]

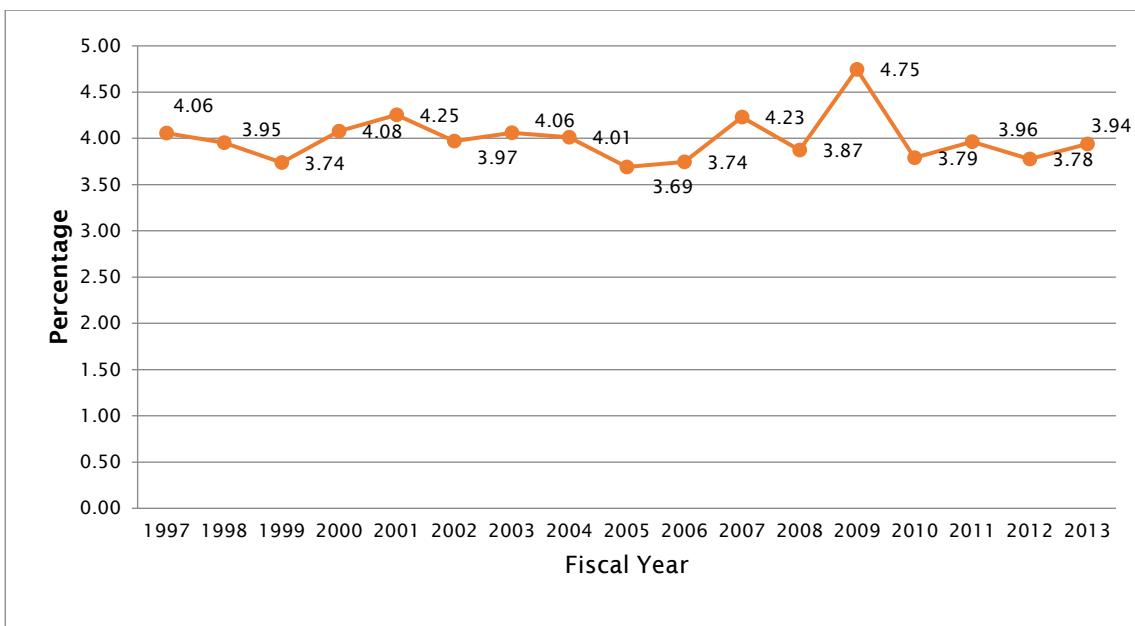


Figure 1-8 Percentage of educational budget in GDP of Thailand in 1997-2013
 [Source: Ministry of Education, n.d.-a]

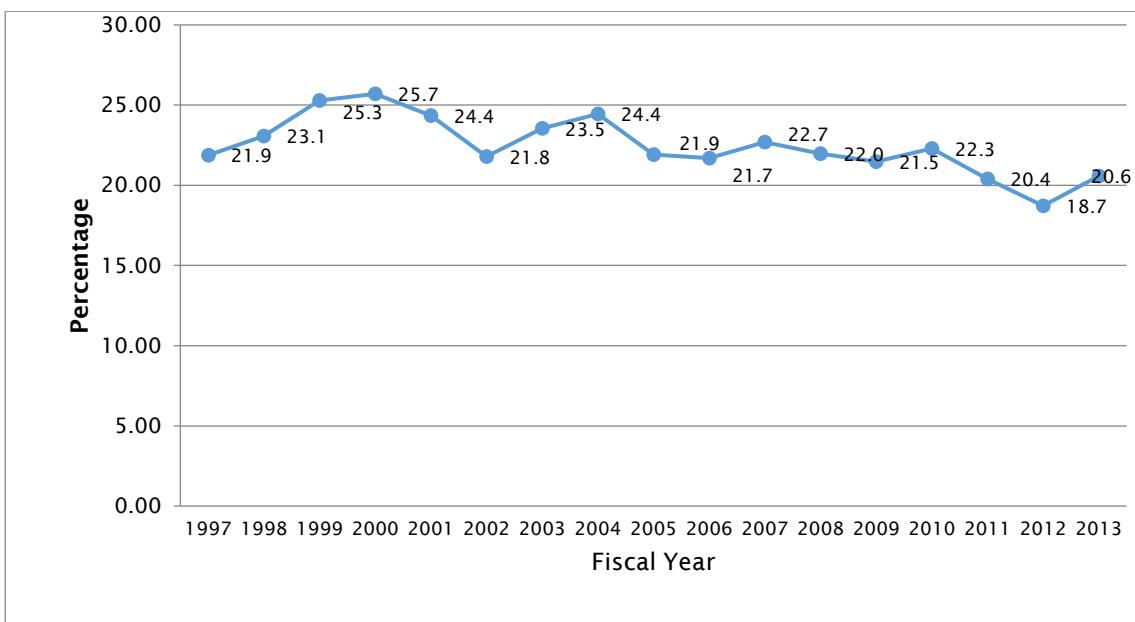


Figure 1-9 Percentage of educational budget out of the total national budget of Thailand in 1997-2013
 [Source: Ministry of Education, n.d.-a]

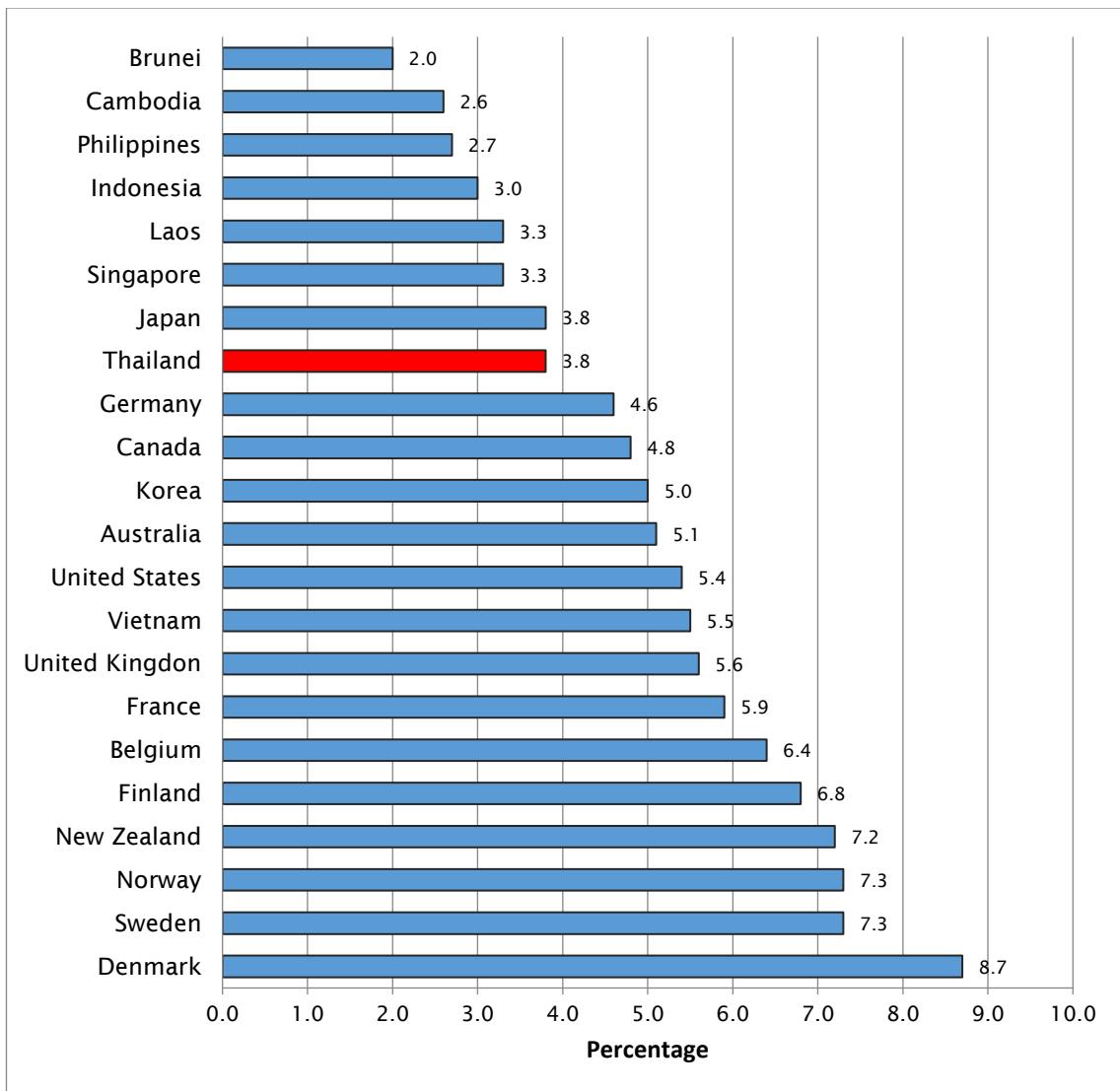


Figure 1-10 Percentage of government expenditure against GDP

[Source: UNESCO Institute for Statistics, 2012]

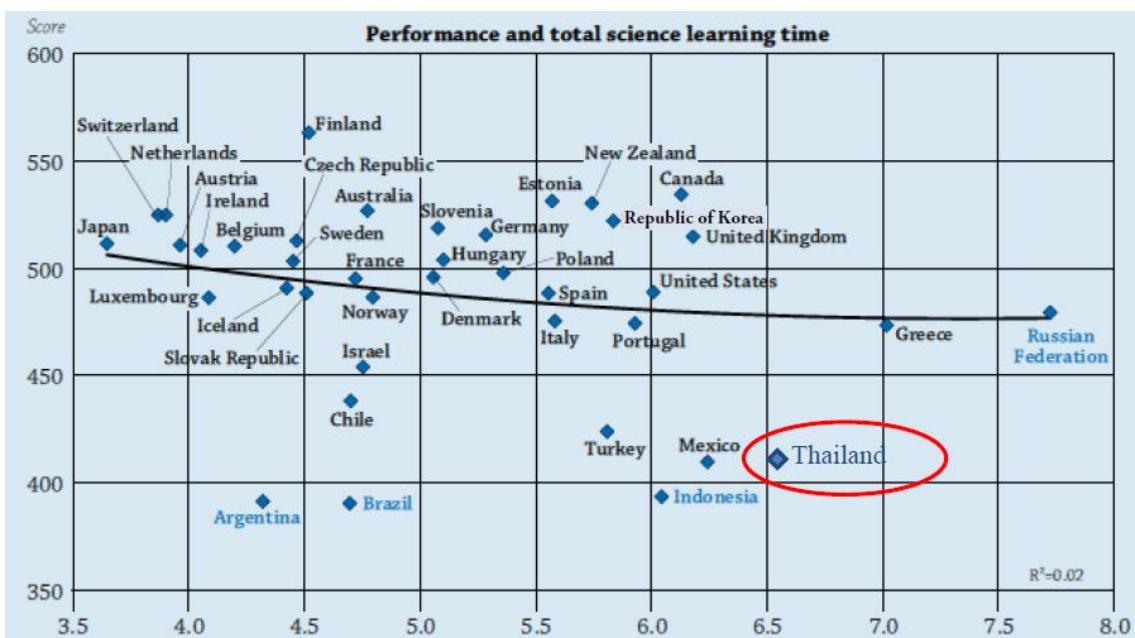


Figure 1-11 The international comparison of learning time in Science and PISA scores

[Source: OECD, 2014; Siamwalla, Tangkitvanich and Lathapipat, 2012]

According to evidence provided by Hanushek and Woessmann (2007), simply increasing expenditure on education (per capita) and expanding the physical resources does not guarantee an improvement in student performance. The inconsistency of a direct relationship between spending on education and quality of education highlights the structural problems of assessing inefficiency in educational institutions and systems (Phongpaichit & Benyaapikul, 2013). In Thailand, despite the increase in education investment mentioned above, the issue of a low quality of education remains.

'These factors, summarised in Education in Thailand (OEC 2004-2008) are budget endowment, number and quality of teachers, academic equipment (information and communication technology, libraries) and school management. There is no doubt that these factors are important, but they constitute a minimalist and superficial basis on which to improve educational quality' (Mounier & Tangchuang, 2010, p. 46).

'...increased spending in terms of physical infrastructure, general teacher pay rise, or universal provision of IT equipment would not buy Thailand a way out of the poor education quality problems'. (Phongpaichit & Benyaapikul, 2013, p. 22)

Many Thai scholars (e.g. Siamwalla, 2012; Tangkitvanich, Sasiwutiwat & Ngarmarunchote, 2012; Lathapipat, 2012) have argued that Thailand's low education quality has in fact stemmed directly from the lack of accountability of its educational system providers, and poor utilisation, so the suggestion is to establish a much stronger accountability system for providers, schools and teachers.

Typically, the accountability models suggested for the Thai education system comprise four main stakeholders: parents (including entrepreneurs); the government; schools; and teachers. This approach to accountability is then typically split into two main pathways: 'long routes' (parent-government-school-teacher) and 'short-routes' (parent-school-teacher) (see Figure 1-13). Many scholars argue that 'long-route accountability' may be too fragile; the political mechanisms for reforming education require more time to monitor and control schools than is typically available to reformers, and politicians do not always prioritise education as part of their agenda. Also, the asymmetric information in long-route accountability may cause principal-agent dilemmas where monitoring, controlling and ensuring accountability may become impossible even in the direct line of control / authority (Phongpaichit & Benyaapikul, 2013).

In practice, the 1999 National Education Act has established various educational structures in Thailand (see Figure 1-12). One of the educational mechanisms put to promote and raise the quality of education is the 'educational quality assurance'. Although its philosophy is meaningful, in practice, evaluating school performance through 'quality assurance' has unintentionally aggravated the quality of education. Such systems involve wearisome paperwork and tend to be seen as burdensome to staff, taking them away from time focusing on learning and teaching (Phongpaichit & Benyaapikul, 2013). Consequently, after the introduction of such a system in educational institutions, the quality of education seems to have suffered a further a drop in quality rather than an improvement. Mounier and Tangchuang (2010) argue that, in this system, the attention is focused on ensuring governance and efficiency of educational institutions rather than improving quality of education. It is also their view that the long-route accountability mechanism

which works via the public sector for Thailand seems to be very fragile and incompatible with real practices.

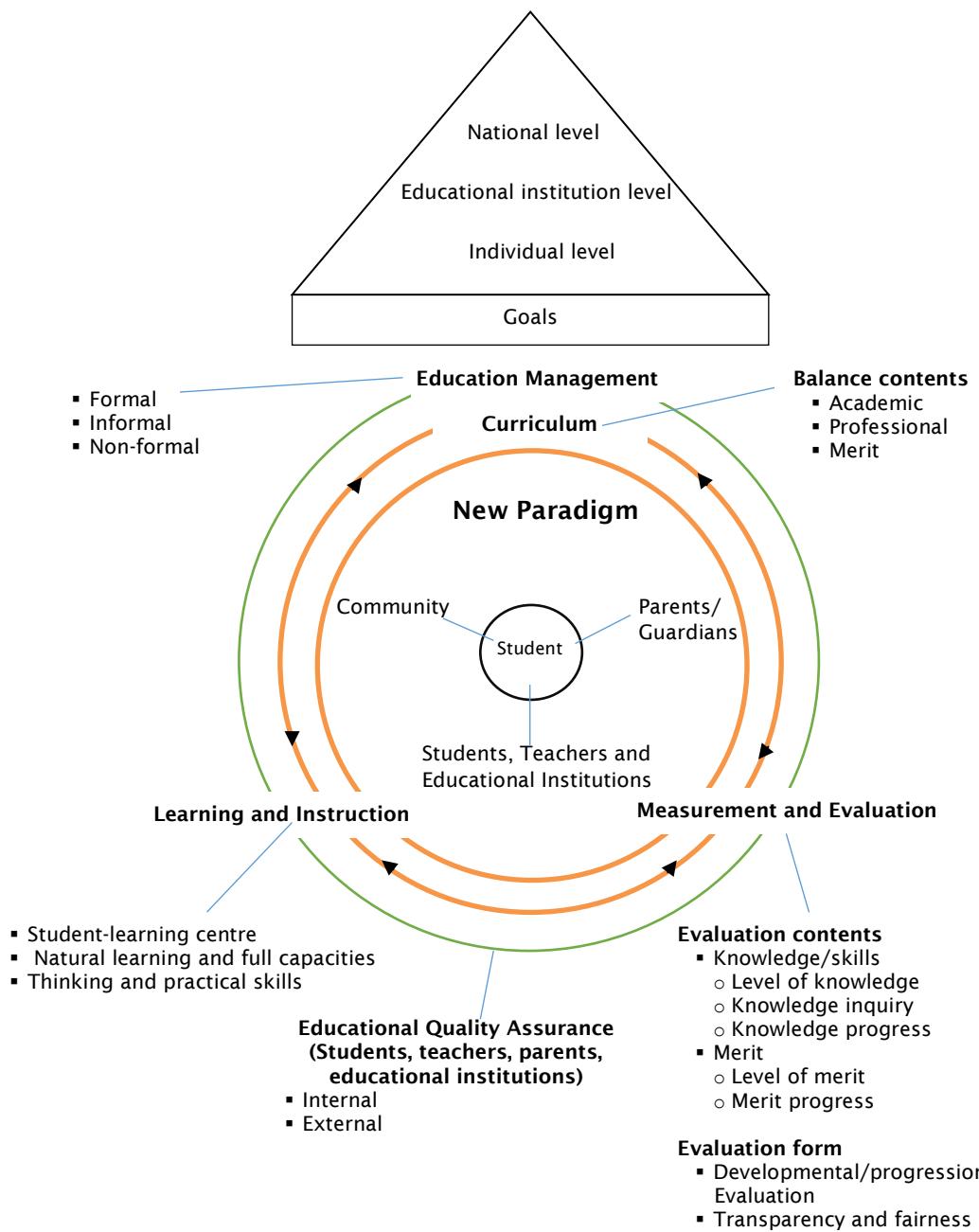


Figure 1-12 New educational paradigm according to the 1999 National Education Act of Thailand
[Source: Kanchanawasi, 2007]

A more interesting way to address the accountability challenge is via a more straightforward and practical guideline: the short-route. This path is established by shortening the accountability chain; for example, parents can directly monitor the various educational institutions (schools and teachers) and closely assess the education quality via disclosure of the student performance and scoring. This is supported by empirical evidence in the Thai education context based on the PISA database, provided by Lathapipat (2012) and Patrinos, Arcia, and Macdonald (2015). Interestingly, the findings revealed that disclosure of school performance to the public significantly enhances school efficiency, especially in less efficient schools. Incentives linked to student performance were also shown to significantly improve school efficiency, especially when parents closely monitor the quality of the provision of school education. It is argued that student performance via examination scores can be meaningful to the students themselves as well as their teachers and schools, and that student performance disclosure to the public should be encouraged and linked to teachers' and principals' incentives (Lathapipat, 2012). These steps are crucial to effectively dealing with the roots of poor quality issues in the Thai education system. In this research, we will be interested in the short-route accountability approach as a potential mechanism for ensuring that Thai educational institutions play a major contributing factor to the development of their students.

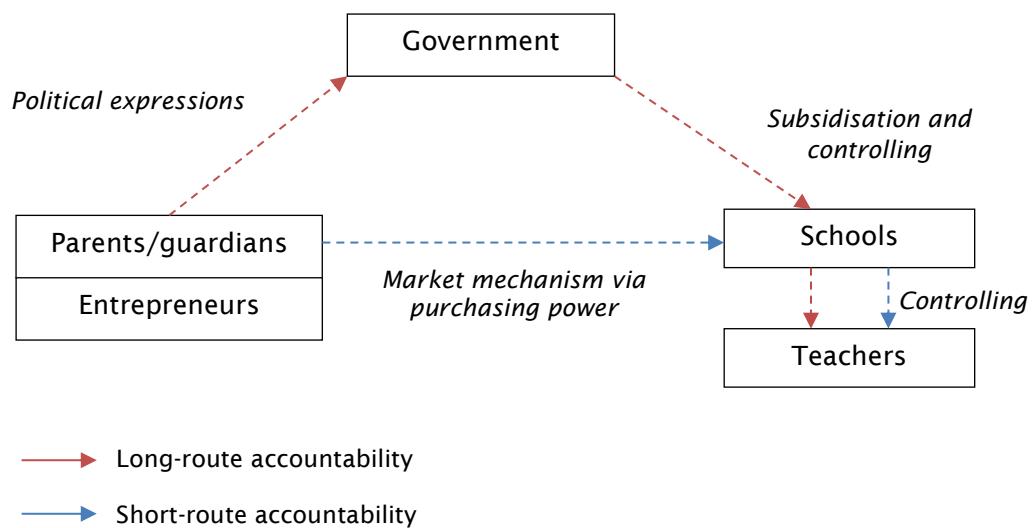


Figure 1-13 The framework of accountability in the education system

[Source: Tangkitvanich et al., 2012]

In addition to the efficient accountability chain stated above, the system of educational testing and measurement must also be considered an unavoidable dimension of accountability (Tangkitvanich et al., 2012). Like many countries, the Thai school accountabilities are linked with their student performances based on the national testing scores. The National Institute of Educational Testing Service (Public Organisation) was established in 2005 in Thailand as a central independent testing organisation. It is responsible for the national educational measurement and evaluation of Thai education at all levels in order to determine whether the quality of education achieves the national standards. This elaborate process measures the performance of stakeholders who are responsible for educational management at hierarchical levels such as teachers (departments/subjects), headteachers (schools) and other educational services. However, the practice widely used to reflect school performance is one of a '*status model*' which provides an information snapshot of student performance at any point of time. For example, the average scores of students at the school and educational district levels are used for comparing the goals among schools within the same educational district area, the average scores at the national level and school characteristics (e.g. school size, schools under the same organisation). To determine performance of schools and educational district areas over time, the mean scores for different cohorts or a cohort-to-cohort-change value are also used. These mean scores indicate the changes in performance at different points of time and for different groups of students. Although such methods provide important information about the effectiveness of schools at certain dates, being the threshold indicators, it is argued that such approach can result in *unfair* comparison as it fails to compare '*like with like*' (Kelly & Downey, 2011), since different students have different beginning points and certain characteristics (Ofsted, 2008). For example, in the UK student performance is considered on the basis of prior attainment, gender, month of birth, free school meal entitlement, special educational needs, ethnicity, mobility, in-care at current school and deprivation indicators (Ofsted, 2008). Therefore, it is our point in this research that the sole assessment of school performance based on student performance in Thailand does not clarify whether Thai schools make an actual difference to their students' quality of education.

A straightforward method for dealing with the school accountability challenge widely utilised in many countries like the US and UK is the school contextual value-added (Kelly & Downey, 2011; Ofsted, 2008). The distinguished feature of this method provides a fairer measure of school performance according to student

performance. As Kelly and Downey (2011, p.44) note, '*value-added models are best used for the (formative) purpose of school quality and improvement rather than the (summative) purpose of public accountability*'. It provides information whether schools produce at least *adequate student progress* from time to time. Like the basic value-added notion, the school contextual value-added reflects a school's relative performance rather an absolute performance i.e. whether a school produces better or worse results than other schools at the same level (Ofsted, 2008).

As stated above, the major task of educational reforms in Thailand has shifted from ensuring quantity to raising quality of education to all. This issue of poor quality of education in Thailand is complex to explain, and even more difficult to resolve. Many stakeholders have attempted to deal with this using several approaches such as educational reforms, changes in educational law and regulations, more investment in education and launching quality assurance. The focus of this research topic reinforces again the belief that more empirical evidence on school effectiveness in Thailand is highly needed, by collecting information about what makes schools effective and formulating some recommended guidelines to determine school performance linked to school accountability.

1.2.2 Unequal quality

In addition to the 'quality of education' and 'school effectiveness' dilemma, the issue of 'equity' in education is another area of major concern in Thai society, especially with regard to basic and compulsory education (NIETS, n.d.; Phongpaichit & Benyaapikul, 2013). As shown earlier, one of the major goals of the recent education reforms in the 1999 National Education Act is to provide equity where every child has the opportunity/chance to obtain good quality education. Although 'equity' in terms of opportunity seems to be achieved in Thai society, as reflected by the high rate of enrolment at almost all levels of basic education, 'equity' in terms of quality of education is yet to be achieved. According to both national and international assessments, the collected data on student performance outlines a very large difference in terms of educational affiliations and regions. In particular, the average scores (PISA and O-NET) of students in the demonstration schools affiliated with universities and the averages scores of those (O-NET) in Bangkok Metropolitan were the highest for all subjects. This reflects a discrepancy in the quality of education provided by various schools in various regions of

Thailand, meaning equal opportunity to receive education cannot guarantee an equal quality of education provided by all institutions.

Like several contexts shown in literature (e.g. Field, Kuczera, & Pont, 2007; Sammons, 2007), Thai students from disadvantaged family backgrounds are likely to achieve lower educational attainment (Michel, 2010). Such consequences have an impact on their future outcomes such as their earning potential and quality of life in micro aspects, leading to a vicious cycle from one generation to the next, and wider societal disparities in macro aspects. It is important that the school effectiveness research aims mainly at reinforcing the teachers' and schools' responsibilities, and suggests ways to provide equal opportunity to students according to their particular learning needs and backgrounds (Kyriakides & Creemers, 2011) so that they can achieve the desired educational outcomes (Field et al., 2007)

Interestingly, as Kelly (2014) notes, traditional school effectiveness research has placed much emphasis on micro sociological studies of equity related to sub-groups. The impact of different factors on students given the heterogeneity of student backgrounds such as gender, ethnicity and special needs are also extensively discussed. In Thailand the major attempts to deal with equity dilemmas has emphasised the provision of opportunity to access schooling at every level. As discussed earlier, Thailand achieved high success in terms of quantity of students, reflecting the success of the system in terms of equity of opportunity. However, the equity in terms of equal quality of education provided was rarely discussed in Thai society until now, where it can be explicitly highlighted in the country's national and international assessments. The variation of quality of education reflected through student attainment varies according to school size, educational affiliation (based on educational authorities) and regions. Generally, this issue of unequal quality has been extensively discussed at the *beyond-school level* (e.g. education system) rather than the *within-school level* (school and/or classroom level). However, we will argue that when researching the root of such problems in Thai education we cannot ignore the micro political levels of educational systems, that is the *within-school level*, which has been rarely addressed and studied in Thailand. Therefore, the significance of this study lies in the fact that the research will determine the factors contributing to the quality equity in the Thai education system, and contribute to the knowledge base in this area.

Both quality and equity of education are currently major issues in Thai education. Every sector and stakeholder in Thai society have struggled for a long time to

eliminate the vicious cycle of low educational quality and unequal quality. We explained that one potential method for addressing this issue is to link school accountability to student performance, i.e. to allow the parents/guardians to closely and directly monitor their students' performance. Therefore, student progress (indicating whether schools make any difference to students) will be considered as a crucial criterion for assessing school effectiveness and quality of education (including teachers and headteachers), and ultimately it can be a criteria linked to school incentives. Simultaneously, the gap in student outputs/outcomes between the bottom and the top scale needs to be minimised, mainly by raising the student outputs/outcomes at the bottom. In terms of measurement, as suggested by Kelly (2012), the school contextual value-added and attainment equity can serve as a powerful duo of measures to identify the strengths and opportunities for school improvements in terms of outcome and process-oriented focus.

The school contextual value-added estimate provides information in terms of the impact that schools have on their students, or how much students gain over time in their schools. The attainment equity index, on the other hand, indicates the magnitude of inequity in terms of student outcomes. Therefore, this study has adopted an approach using a combination of the two indicators to measure the different dimensions of school effectiveness research. Called *the power of the duo indices*, it provides a better understanding of ways to raise the quality of education and reduce the gap in student attainment between the bottom and the top students in Thailand.

1.3 Research questions

The main purpose of this research project is to provide empirical evidence on school effectiveness research, by measuring '*school effectiveness*' in terms of both quality and equity in the context of Thai education. As shown in Figure 1-15, taking into account the academic and practical contributions, this study includes both theory-testing and theory-developing sections. We used quantitative and qualitative approaches in our research and collected our own data for the knowledge base findings related to school effectiveness in Thailand. It is our view that school effectiveness research will be integral to future education reforms for raising the quality of education, and also reducing the unequal quality, in the provision of education in Thailand.

The study focuses on ‘*what makes schools effective*’ and ‘*how and why schools perform in this manner*’. More specifically, our research questions cover:

Question I: To what extent does student attainment vary at the student, classroom and school levels in Thailand? Which school factors significantly affect student attainment in Thailand?

Question II: What is the extent of student attainment equity in Thailand? Which school factors significantly affect attainment equity at the school level in Thailand?

Question III: Do schools perform differently in terms of quality and equity across subjects¹ within schools? How and why do schools perform in this manner?

1.4 Overview of the whole study

This study employs a methodology based on a pragmatic paradigm (see Chapter 5). A mixed research method with an explanatory design was used to investigate the research questions posed. Combining quantitative and qualitative methods provides the best way to investigate causal effects and causal mechanisms in terms of theory testing and theory developing. The standpoint of this study is located in the ‘*exploratory mixed methods research*’. As a result, the research project consists of the following main phases: the first phase is the quantitative research, relating to modelling school effectiveness and equity attainment; the second phase is the qualitative phase, which employs a multiple case study design.

¹ Learning standards of the 2008 Basic Education Core Curriculum of Thailand consist of eight main strands: (i) Thai Language, (ii) Social Studies, Culture and Religion, (iii) Foreign Language, (iv) Mathematics, (v) Science, (vi) Health and Physical Education, (vii) Arts, and (viii) Occupation and Technology.

Prototypical characteristics	Explanatory mixed method design in this study
Definition	<ul style="list-style-type: none"> Methods sequentially employed, commences with the quantitative phase (phase I) followed by the qualitative phase (phase II) Research design in phase II is based on the findings in phase I
Design purpose	<ul style="list-style-type: none"> Findings in the quantitative phase need more explanations with qualitative findings Findings in the quantitative phase are used to determine criteria for selection in the qualitative phase
Typical paradigm	<ul style="list-style-type: none"> Pragmatic paradigm <ul style="list-style-type: none"> Phase I: Postpositivism Phase II: Constructivism
Priority of strands	<ul style="list-style-type: none"> Quantitative dominant (QUAN and qual)
Timing of strands	<ul style="list-style-type: none"> Sequential, with the quantitative research followed by qualitative research (QUAN→ qual)
Primary point of interface for mixing	<ul style="list-style-type: none"> Data collection (Cases in phase II are purposively selected from those in the phase I)
Primary mixing strategies	<ul style="list-style-type: none"> Linking the two strands: <ul style="list-style-type: none"> From quantitative data analysis to qualitative data collection Use quantitative findings to indicate the qualitative research questions, participant selection criteria and data collection in phase II

Table 1-1 Overview of the whole study

[Adapted from Creswell and Clark, 2011]

In the study, the explanatory mixed methods design (Creswell, 2009; Creswell & Clark, 2011) or explanatory sequential design (Hesse-Biber, 2010) is implemented in two main phases: quantitative phase (phase I) and qualitative phase (phase II) (see Figure 1-14).

In Phase I, the major aim is to model school effectiveness and attainment equity in Thailand. This phase consists of four subparts, as follows:

Part A: Modelling school effectiveness – investigating factors affecting student attainment in Thailand, based on the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008). It investigates the extent to which student, classroom, and school factors have significant effects on

student attainment and what percentage of variation in student attainment is due to differences at student, classroom and school level using the multilevel analysis. In addition, the residuals at the school level from the multilevel, called school contextual value-added (school CVA), are used to identify the school quality.

Part B: Calculating attainment equity indexes – associated with school equity in terms of process-focus orientation, using Kelly's attainment equity and Theil's T index (Kelly, 2012).

Part C: Combining quality and equity among subjects which relate to school quality and equity in terms of school process-output focus (Kelly, 2012). The findings in this part are used for classifying typology across eight main subjects: high equitability (high quality and high equity), differentially effective (high quality, but low equity), low equitability (low quality and low equity), and uniformly ineffective (low quality but high equity) (Kelly, 2012).

Part D: Grouping schools based on the pattern of the school CVA and Kelly's AE across eight main subjects based on the findings in Part C.

Phase II, the qualitative phase, focuses on seeking the explanations derived from the quantitative findings (Part D), where schools are classified by similarities in quality and equity of education across eight main subjects. The multiple case study research is adopted in this phase.

The overall process of the mixed methods design including its procedures and outcomes in Phase I and II is briefly illustrated in Figure 1-14 and Figure 1-15.

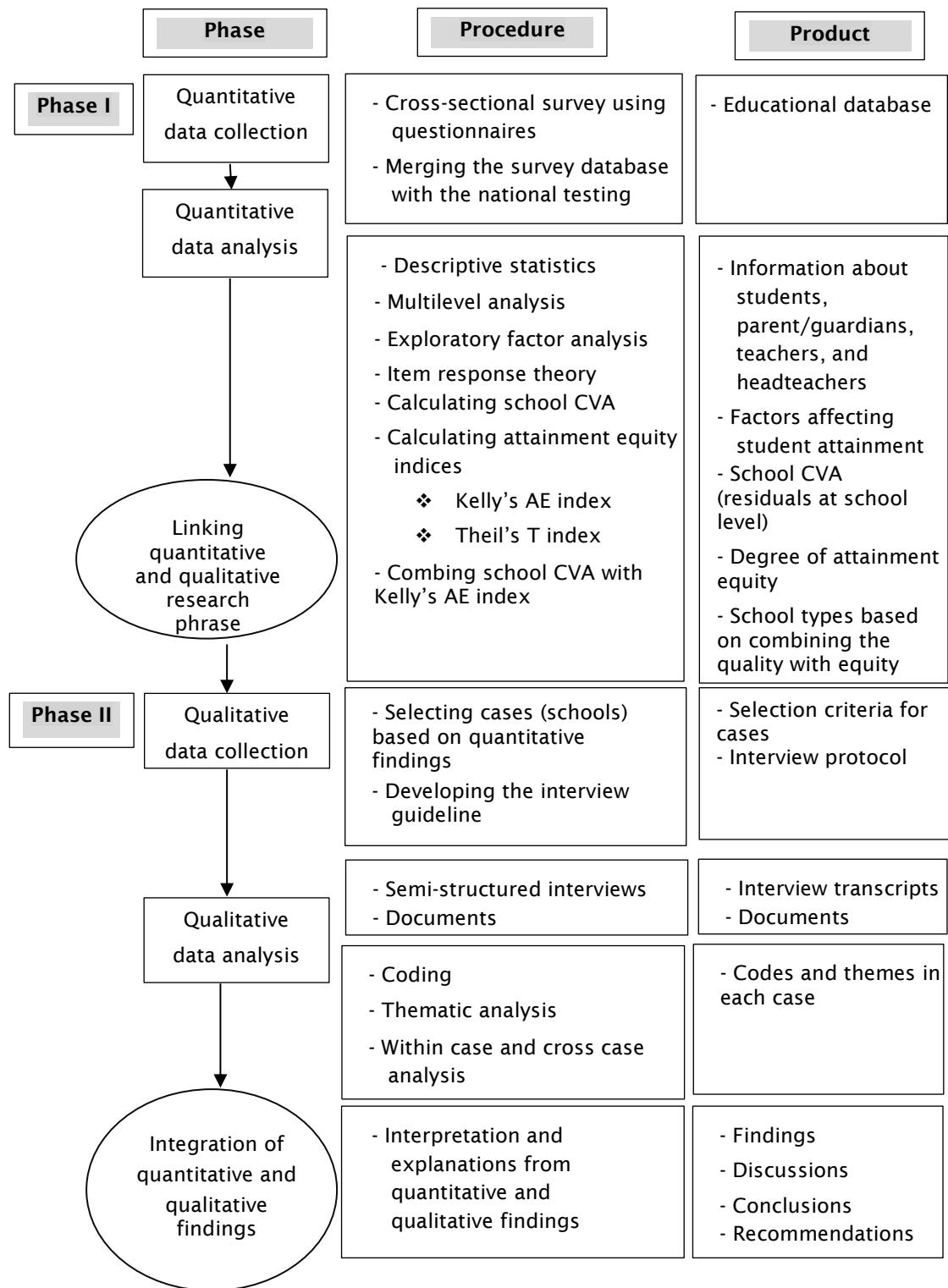


Figure 1-14 Process of the exploratory sequential mixed methods design and its procedure/outcome in two phases in the study

[Adapted from Creswell and Clark, 2011; Ivanka et al., 2006]

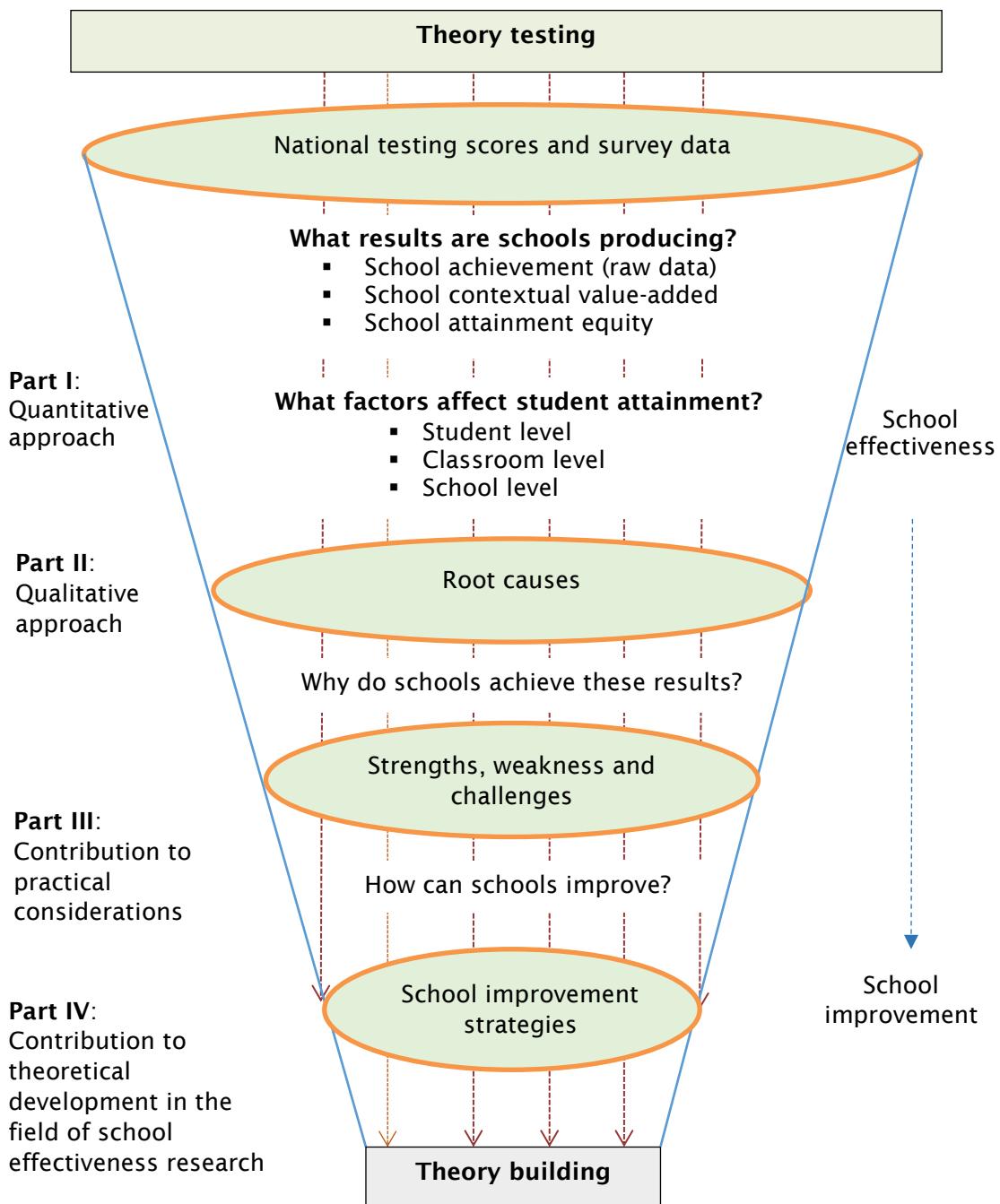


Figure 1-15 Linking research questions, research processes and contributions of the study

1.5 Outline of thesis

This thesis is comprised of 10 chapters:

Chapter 1 presents the background and justification of the theoretical and practical rationale behind the study.

Chapter 2 presents basic information about Thailand and an overview of the Thai education system.

Chapter 3 presents an overview of school/educational effectiveness.

Chapter 4 presents the concepts of attainment equity and its measurement methodology.

Chapters 5-7 describe the methodology and methods adopted in the study.

Chapter 5 begins with a discussion of the underlying philosophical principles linking school/educational effectiveness research to research methodology and methods. An argument on the integration of research paradigm and school effectiveness research is then undertaken to justify the adoption of the mixed methods design. Further, the mixed methods design adopted in the study is discussed. Chapters 6 and 7 present research methods used in quantitative and qualitative study, respectively.

Chapter 8 and 9 present the findings from quantitative and qualitative research, respectively.

Chapter 10 presents conclusion, discussion and recommendation.

1.6 Chapter summary

This introductory chapter identifies the significance and the justification of this research project in terms of theoretical and practical considerations. Although a large knowledge base of school/educational effectiveness has been accumulated through empirical evidence and can be used to generate some robust theoretical frameworks, we have argued that the existing theoretical frameworks are not readily compatible with the current model for the education system in Thailand. In terms of practical considerations, the recent Thai education reforms have shifted focus from quantity to improving quality and reducing unequal quality. It is our view that this study on school effectiveness in Thailand not only helps to address a critical issue in the country's education, but also contributes to the growth of

school effectiveness knowledge base for developing countries. Our research focuses on '*what makes schools effective*' and '*how and why schools perform in this manner*'.

2. Chapter 2: Thailand and the Thai education system

Any act of research is structured by and based upon a particular context. Better understanding of the context surrounding a phenomenon leads to a better comprehension of the reality. Thus, the purpose of this chapter is to provide a background of Thailand and an overview of Thai education. More specifically, this chapter will include an outline of the Thai education system and Thai legislative framework and key documents relating to setting major educational policies and implementations. In addition, the Basic Education Core Curriculum, which plays an important role as a basic guideline and framework of educational and human development at the national level, will be included.

2.1 Thailand

Thailand, officially the Kingdom of Thailand and formerly known as Siam, was established in the mid-fourteenth century. It is located in Southeast Asia and it is bound by the Myanmar and the Republic of Laos to the North, the Thai Gulf and Malaysia to the South, the Republic of Laos and Cambodia to the East, and the Andaman Sea and Myanmar to the West. With several advantages in terms of location, including a rich culture and natural resources, Thailand has been called the hub of Southeast Asia.

During the last decade, although Thailand has faced political instability and volatility, the Gross Domestic Product (GDP) went up from 126.88 billion US dollars in 2003 to 387.25 billion US dollars in 2013 and Thailand has been ranked among upper-middle income countries (The World Bank, 2014). The rapid growth of the Thai economy has been driven by the growth of service sectors and an increase in the export of manufactured goods. Therefore, the Thai economic structure has shifted from an agricultural base to a service and manufacturing base. This change was shown in the structure of Gross Domestic Product (GDP), that is, the contribution of the agricultural sector continuously decreased to 11.06 percent in 2012 while the non-agricultural sectors had an increasingly high proportion of GDP to 88.94 percent in 2012 (Office of the National Economic and Social Development Board, 2014). This transformation is the result of structural changes in the labour market, which requires middle and highly-skilled labour responding to the economic boom.

During the last fifty years, the demographic structure of Thailand has gradually changed and the proportion of the elderly has continually expanded to approximately 11.8 percent in 2010. The estimated percentage of elderly is projected to reach approximately 16.8, 19.8, 22.7 and 25.1 percent in 2020, 2025, 2030 and 2035, respectively (Wawattanawong & Prasartkul, 2006). Therefore, Thailand is facing the prospect of an ageing society.

Table 2-1 illustrates basic information on Thailand and Table 2-2 presents statistical data relating to Thai education.

Dimensions	Statistic	Year
Total population (2013)	66.67 million	2013
Labour force	39.40 million	2013
Unemployment rate	0.7 percent	2013
GDP per capita	387.25 billion US dollars	2013
Inflation rate (Consumer Price index: CPI)	2.2 percent	2013
Population below the national poverty line	7.75 percent	2010

Table 2-1 Basic information of Thailand

[Source: IMD Competitiveness Center, 2014; Office of the National Economic and Social Development, 2014]

Items	Value	Ranking (out of 60 countries)
Total public expenditure on education (% of GDP)	3.92	42
Total public expenditure on education per capita (US\$ per capita)	215.57	53
Total public expenditure on education per pupil (% of GDP per capita)	17.96	41
Pupil-teacher ratio in primary education	15.99	34
Pupil-teacher ratio in secondary education	19.91	54
Secondary school enrolment (% of relevant age group receiving full-time education)	74.05	55
Higher education achievement (% of population attaining at least tertiary education for persons aged 25-34)	18.00	50
Student mobility outbound (national tertiary level students studying abroad per 1,000 inhabitants)	0.38	50
Educational assessment - PISA	-	44
English proficiency - TOEFL	76	57
Education system (the education meets the needs of a competitive economy)	3.62	49
Science in schools (science in school is sufficiently focused)	4.05	44
University education (university education meets the needs of a competitive economy)	4.53	48
Management education (management education meets the needs of the business community)	4.89	42
Illiteracy rate (adult (over 15 years) illiteracy rate as a percentage of population)	5.90	50
Language skills	3.64	51

Table 2-2 Educational data in Thailand
[Source: IMD Competitiveness Center, 2014]

2.2 Thai education system

According to the 1999 National Education Act (Office of the National Education Commission, 2002), the Thai education system is motivated by three primary aspects: education for all, every part and sector of Thai society taking part in promoting and supporting education provision, and education for continual personal development in learning processes. Consequently, to promote the provision and opportunity of education for all Thais based on these three aspects, learning can be reinforced through three main types of education: formal, non-formal and informal education.

2.2.1 Formal education

Formal education consists of two main levels: basic and higher education. Basic education refers to twelve years of schooling prior to higher education (provided at lower degree and degree levels). For basic education, since 1977, the Thai basic education structure has been changed from a 4:3:3:2 model, four years of lower primary education (Grades 1-4), three years of upper primary education (Grades 5-7), three years of lower secondary education (Grades 8-10) and two years of upper secondary education, into a 6:3:3 system consisting of six years of primary education (Grades 1-6), three years of lower secondary education (Grades 7-9) and three years of upper secondary education (Grades 10-12) (UNESCO, 2008). However, upper secondary education can be further divided into two main tracks: academic and vocational tracks. The academic pathway aims at preparing students for universities whereas the vocational pathway prepares students to be skilled workers responding to the demands of the labour market. Higher education normally requires four years to complete a Bachelor's Degree; however, some programmes require more than four years such as Education (five years) and Medicine, Pharmacy, Dentistry and Architectures (six years). The Master's programme normally takes between one and two years while between two and four years are normally required by the Doctoral level.

According to the 1999 National Education Act (Office of the National Education Commission, 2002), in order to ensure that children spend a longer time on schooling in the education system, compulsory education has been extended by three years from the previous education structure, increasing compulsory education from six years to nine years, requiring children aged seven to enrol in educational institutes until they are sixteen years old or until they have completed lower secondary education (Grade 9). Although compulsory education has been

extended to up to nine years, all are expected to complete at least Grade 12 as the National Education Act proclaimed '*education for all free of charge up to Grade 12 for all Thai citizens*' (Office of the National Education Commission, 2002).

Figure 2-1 presents the Thai formal education system at each level including approximate ages and the periods of basic education, compulsory education and free-of-charge education.

Age (approx)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	...													
Grade	-		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24										
Level of education	Early year education		Primary education						Lower secondary education			Upper secondary education		Higher education																						
														Bachelor's degree			Graduate level																			
															Vocational education																					
															Lower certificate of vocational education		Diploma in technical education																			

Figure 2-1 Education system in Thailand

[Adapted from UNESCO, 2008]

2.2.2 Non-formal education

Non-formal education is characterised by having a flexible outlook on various aspects: aims, modalities, management, procedures, period of time, assessment and conditions of study completion (Office of the National Education Commission, 2002) . Therefore, the layout of the educational process in terms of curriculum and content strongly intends to tailor education to match individual learners' needs and requirements. In this regard, non-formal education is considered a means of providing lifelong learning and life skills and of enhancing opportunities to people outside the school system which includes childhood and adult education (Ministry of Education, 2008b). Learning procedures can be undertaken through both structured and unstructured programmes at workplaces and at local community centres which sometimes utilise shared educational resources with formal educational institutions.

2.2.3 Informal education

Informal education is propagated with the vision of learning development that learning can actually take place anywhere and at any time (Office of the National Education Commission, 2002). Therefore, it is a continuous process, not limited by the requirement of a formal classroom. In addition, it promotes and supports self-learning based on individuals' interests, potential, readiness and opportunities from several available societal knowledge sources such as local and community libraries, science museums and educational television and radio programmes (Ministry of Education, 2008b).

2.3 Thai educational legislative framework and related key documents

2.3.1 The constitution of the Kingdom of Thailand

The 1997 and 2007 Constitution of the Kingdom of Thailand (The Constitutional Court of the Kingdom of Thailand, 1997, 2007) provided the pathway for educational development. Regarding the provision of education to ensure literacy for all Thais and the quality of Thai education system, the Constitution stipulated:

- Every person would have an equal right to obtain free education for a period of twelve years. The quality would be assured with the cost of education provided by the State.
- Poor, disabled, handicapped and indigent people would also have equal rights to education according to paragraph one of the Constitution and the State would ensure that the rights of these people would be protected.
- The State would protect and promote education and training provided by professional or private organisations, alternative education of the public, self-directed learning and lifelong learning.
- Academic freedom would be granted to all Thais
- The State would protect education, training, learning, teaching research and disseminating research in accordance with academic rules unless they were not contrary to the civic duties of individuals and morals.

2.3.2 The 1999 national education act and amendment second national education act in 2002

The 1999 National Education Act and Amendment Second National Act in 2000

(Office of the National Education Commission, 2002) were formed in order to

respond to the requirements of the provisions of the Constitution of Thailand.

They serve as the fundamental laws for administration and provision of education and dealt with educational problems relating to quality, equity and financing.

Policy proposals had been confined to certain dilemmas and reform processes had been ineffective and inefficient. In the 1999 Act, it can be said that there was a shift in philosophical underpinning behind the educational policy and it encouraged major changes to the education system which included the structure of education, learning and teaching systems.

- Provision of twelve years of free education for all Thais
- Stipulation of nine years of compulsory education (to Grade 9)
- Reform of higher education providing more public universities with autonomy in terms of budget and governance
- Decentralisation of education by establishing local educational service areas
- Emphasis on the utilisation of local wisdom and knowledge
- Promotion of new student- and learner-centred model of pedagogy
- Emphasis on active learning and less rote learning
- Emphasis on a holistic approach to reform every stakeholder in the overall system to include schools, teachers and students

- Promotion of national, master and teachers as part of a network of educational innovators by utilising new pedagogy
- Standardisation of teachers' licences
- Promotion of quality assurance by establishing the Office for National Education Standards and Quality Assurance
- Promotion of innovative teacher learning (particularly in site-based training)
- Promotion of ICT for student and teacher learning
- Emphasis on lifelong learning for all Thais
- Emphasis on variety of learning systems and sources for all level of education
- Establishment of the Office of Education Reform to foster implementation of educational reform

2.3.3 The national education plan 2012-2016

The National Education Plan for 2012-2016 (UNESCO, 2008) aims to promote education in all dimensions of life and emphasises human-centred development by combining schemes of education, religion, arts and culture in order to enhance quality of life. The plan provides a path for developing basic education, vocational education, higher education, religion, arts and culture in Thai society. More specifically, it aims to:

- Establish a knowledge-based society and economy
- Promote continuous learning and lifelong learning
- Include all sectors of society for planning and decision making in education
- Empower Thais to respond to globalisation while maintaining Thai identities and developing desirable characteristics in virtues of competency, happiness and self-reliance

2.4 The basic education core curriculum

The 2008 Basic Education Core Curriculum is a main guideline and system for educational institutions and local communities to produce school curricula for the acquisition of knowledge, abilities and skills necessary in a fast-changing society and a globalised environment (Ministry of Education, 2008a). It also attempts to formulate activities concerning learning and teaching processes for the children at the basic education level and ensure a lifelong learning process for Thai students so that they can improve their skills and increase their knowledge. The learning

strands proposed by the Ministry of Education can be divided into eight main strands: Thai Language, Social Studies, Culture and Religion, Foreign Languages, Mathematics, Science, Health and Physical Education, Arts, Occupation and Technology (See Figure 2-2).

The Ministry of Education (2008a) has also specified learners' competencies at every level of education in accordance with the 2008 Basic Education Core Curriculum:

- **Primary education:** the first priority of the compulsory education system is to improve basic skills such as reading, writing, calculation, thinking, communication, social learning processes and life skills. It tries to balance improvement of the quality of life with physical, intellectual, emotional, social and cultural elements.
- **Lower secondary education:** the compulsory education system also promotes the development of aptitudes of people and their personal interests so that their personalities can develop and they can obtain important skills such as creative thinking, problem solving and other technological and life-related skills. The qualities of virtue, pride, nationalism and knowledge are emphasised and it is expected that these qualities and skills will enhance standards of education and living.
- **Upper secondary education:** it emphasises the development of individuals' skills related to academic, technological and application skills and it encourages skill development related to high level thinking processes. It also focuses on practical application so that individuals can increase their knowledge, improve their lives, develop their communities and contribute to national growth in a way that fulfils their responsibilities.

Figure 2-2 illustrates the relationship among visions, goals, core competencies and desired characteristics for learner's quality development based on the 2008 Basic Education Core Curriculum.

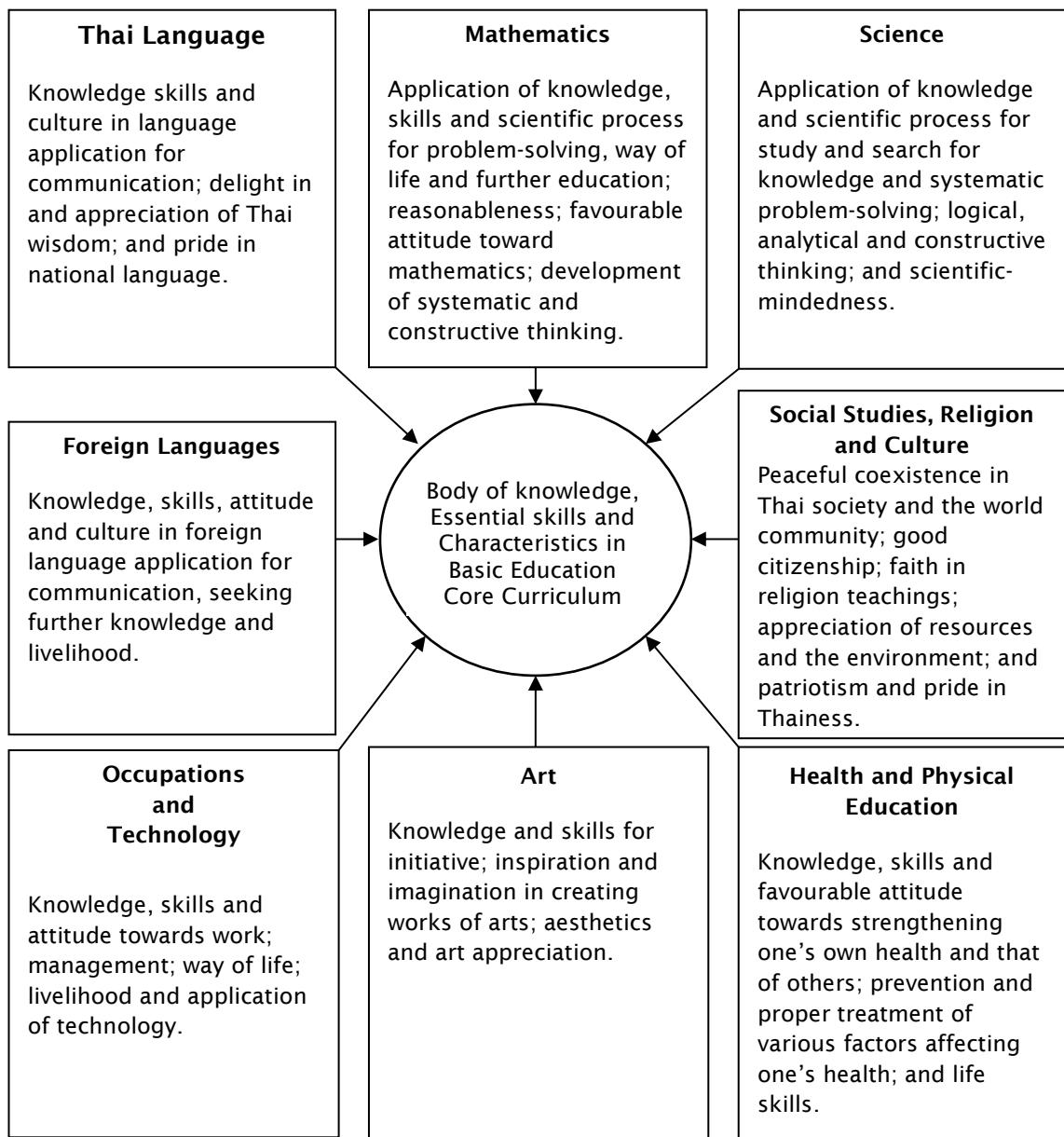


Figure 2-2 Learning areas of the 2008 Basic Education Core Curriculum of Thailand

[Source: Ministry of Education, 2008a]

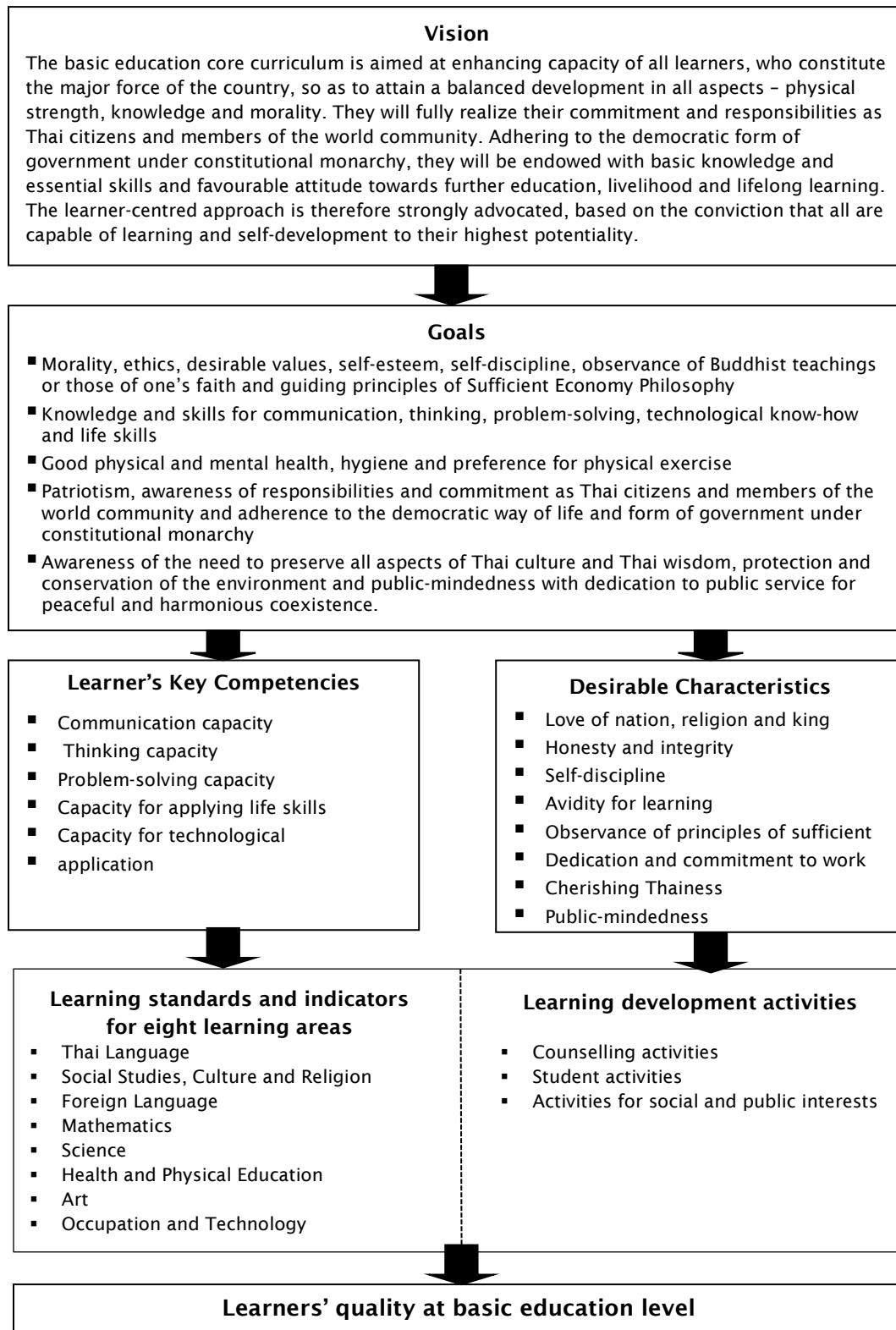


Figure 2-3 The model of development of learners' quality according to the 2008 Basic Educational Core Curriculum of Thailand
 [Source: Ministry of Education, 2008a]

2.5 Chapter summary

This chapter has presented the background of Thailand and the overview of Thai education system. According to the 1999 National Education Act, the Thai education system is motivated by three aspects: (i) education for all, (ii) every part and sector of Thai society taking part in promoting and supporting education provision, and (iii) education for continual personal development in learning processes. To promote the provision and opportunity of education for all Thais based on these three aspects, learning can be reinforced through three main types of education: formal, non-formal and informal education. Currently.

Thai educational policies attempt to raise the quality of education both quantitatively and qualitatively and to enhance the equity of education, granting all people equal rights to obtain education and at the same time generating and advancing the quality of the education system. In addition, the 2008 Basic Educational Core Curriculum has been introduced as a main guideline and system for educational institutions and local communities to produce school curricula for the acquisition of knowledge, abilities and skills necessary in a fast-changing society and a globalised environment.

3. Chapter 3: School effectiveness models

The arena of school effectiveness research concerns itself with investigating the source of student attainment variations. In other words, in the most basic terms, educational effectiveness examines the relationship between student outcomes and the factors that affect these outcomes at different levels (Creemers, Kyriakides, & Sammons, 2000). To conceptualise these dynamic factors at student, classroom, school and beyond-school levels one needs to build upon the body of knowledge and guidelines existing in the field. Therefore, the aims of this chapter are to present an overview of the development of educational effectiveness research. Furthermore, this chapter undertakes a detailed review of school/effectiveness models, from the earliest to the most up-to-date.

3.1 Overview of school/educational effectiveness research

Educational effectiveness is an important concept with the educational sciences. A comprehensive analysis of the effectiveness of education, taking the different levels of educational system into account, can in a way be seen as the core of educational science and research. Educational research in this field is aimed at explaining the variance in educational outcomes, based on a theory about causes and effects in education. In this sense, a theory of educational effectiveness can be seen as an integral theory about education which takes into account the outcomes of education, the inputs, the processes and the contexts in which education takes place (Creemers, 1997, p. 109).

The origin of educational effectiveness research stems largely from economically driven input-output studies, sociological studies and psychological-oriented studies (Creemers & Kyriakides, 2006; Reynolds et al., 2000). The economic-oriented approach emphasises variables associated with resource inputs and educational outcomes, widely known as an education production function, based on the assumption that an increase in student outcomes can be attained by an increase in input (Creemers & Kyriakides, 2006; Hanushek, 1986; Monk, 1992). The sociological approach mainly focuses on family and educational backgrounds, such as SES, social class, peer effects and ethnicity (Creemers & Kyriakides, 2006; Scheerens, 2013). In the psychological approach, on the other hand, variables

related to motivation, aptitude, and learning processes that exist in the environment of the classroom are targeted (Creemers & Kyriakides, 2006).

However, educational effectiveness research has increased greatly since it began as a reaction to the most seminal works on the subject of *inequality in education* that were conducted by, firstly, Coleman et al. (1966) in the document widely known as the 'Coleman Report' and, secondly, Jencks et al. (1972) in 'Inequality: A Reassessment of the Effects of Family and Schooling'. Both sets of authors undertook their research in the United States but adopted different disciplinary approaches: psychological and sociological-oriented perspectives, respectively. Interestingly, their findings shed doubt on whether a *school made a difference*, since the amount of variation in student outcomes accounted for by school factors was only a small percentage. These studies consequently established the basic mechanisms for a new line of educational effectiveness research known as school effectiveness research.

Early school effectiveness research, such as studies by Edmonds (1979) and Rutter, Maughan, Mortimore, and Ouston (1979), both of which addressed similar questions and employed similar methodologies but were undertaken in different countries (the United States and the United Kingdom, respectively), drew similar conclusions: schooling plays an important boosting role in making a difference among students and schools producing greater effectiveness than other factors, when student characteristic backgrounds are controlled. In its early stages the educational research programme was further enhanced. Even the findings demonstrated substantiation that these net school effects existed in the form of school-process characteristics. For this reason, it was suggested that school-process variables such as school climate, leadership, and school organisation (Scheerens, 1992) are so influential that school effectiveness research would need to be widened to include input-process-output.

Besides that stated above, a further development in the body of knowledge of school effectiveness research has also included teacher and instruction aspects, which are crucial factors in school effectiveness research and are widely known as *teacher effectiveness* and *instructional effectiveness*. The findings from research syntheses, such as that of Walberg (1984), Hattie (1987) and Hattie (1992) and the review in Carroll (1963), point out that the quality of teachers and the instruction given to students is closely associated with outcomes. The catalytic effect of these factors – teacher behaviours and instructional conditions such as the learning process, and the quality of instruction and the time spent on tasks – was identified

and recognised and these factors were incorporated into the next stage of educational effectiveness research.

Recent educational effectiveness models have had in common their integrated nature (input-process-context-outcome studies) (Reynolds et al., 2000), achieved by combining the outstanding features from the early input-output studies, teacher effectiveness and school effectiveness models (Creemers & Kyriakides, 2006; Creemers, Kyriakides, & Sammons, 2010). Moreover, development in statistical techniques provides the opportunity to develop and test models at the hierarchical level, capturing the real educational nature at hand (Goldstein, 1995; Kennedy & Mandeville, 2000). Consequently, the common characteristic of recent models has been to combine factors at different levels – beyond-school, school, classroom and student level – in the hierarchical structure. The sample multi-level educational effectiveness models include the integrated model of school effectiveness (Scheerens, 1990), the QAIT-MACRO model (Stringfield & Slavin, 1992), the integrated model of secondary school academic effectiveness (Sammons, Thomas, & Mortimore, 1997), the comprehensive model of educational effectiveness (Creemers, 1994) and the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008).

In their detailed discussion of the theoretical development of educational effectiveness, Creemers et al. (2010) identified the sequential phases according to the types of research questions addressed and model development. Teddlie, Reynolds, and Sammons (2000) also describe the chronological phases of the evaluation of school effectiveness. The establishment of the connection between educational effectiveness research and school effectiveness research are illustrated in Table 3-1.

Phase	Creemers et al. (2010)	Teddlie et al. (2000)
Phase 1	The size of school effects – establishing that ' <i>school matters</i> '	Input-output studies – investigating the school effects on student outcomes (economic studies)
Phase 2	The characteristics of effectiveness – investigating the factors determining the better student outcomes	Input-process-output studies
Phase 3	Modelling educational effectiveness – developing the theoretical models specifically indicating the reason of importance of factors explaining the variations in student outcomes	Input-process-output studies – linking to school improvement
Phase 4	Modelling educational effectiveness with complexity, details and change over time – establishing the complex models as the nature of educational system	Input-process-context-output studies – linking to school improvement

Table 3-1 Phases of educational effectiveness research and school effectiveness research

3.2 School effectiveness models

3.2.1 Educational production function

Educational production function was developed from the production function in the economic sense, which commonly describes the outputs as a function of inputs used to produce goods and services (Hanushek, 1986; Monk, 1992; Scheerens, 2013). In the same way, in education the production function can be elaborated with regard to the relationship between the educational outputs/outcomes (e.g. student achievement) and a set of educational inputs (e.g. school characteristics), taking into account student characteristics (e.g. SES, social class, family background, ethnicity and intelligence) (Bowles, 1970). Mathematically, the education production function can be written as:

$$Y = f(X_1, X_2, \dots, X_n; Z_1, Z_2, \dots, Z_m)$$

where Y is the educational outputs/outcomes (e.g. student achievement), X_1, X_2, \dots, X_n are school resource factors and Z_1, Z_2, \dots, Z_m are student background factors. Moreover, besides this, explanatory variables used in the model include

not only the inputs used in the educational production but also the stakeholders' behaviours, such as students, parents/guardians, teachers and headteachers. These behaviours are derived in terms of the utility function, subject to constraints, so that the decision making process is formulated in terms of rational choices between the task-based behaviours and self-rated behaviours (Scheerens, 2013).

However, the drawback is that the majority of input-output studies tend to be snap-shot studies (cross-sectional studies) in which the outcomes of students are measured at a single point in time. In addition, the education production function frequently fails to classify the variation explained by inputs and outputs, so that the processes seem to be identified as the black box which contributes to educational outcomes (Gamoran & Long, 2006). Consequently, it is argued that the educational production function itself illustrates the empirical models, rather than the educational theory in school effectiveness studies (Coates, 2003; Scheerens, 2013)

3.2.2 School learning model by Carroll (1963)

The model of school learning was initially introduced by Carroll (1963) and has been the most basic and prominent model for educational effectiveness research, influencing the development of several educational effectiveness models in later stages. The main assumption informing this model is that learning is proportional to time for learning and opportunity for learning. As combining the input-process-output matters, this model explains how students input quality of interaction between teacher and student, time and quality of instruction all play an important role in learning, as shown in Figure 3-1.

Carroll (1963) distinguishes five main factors which are beneficial for the educational effectiveness of instruction: quality of instruction, aptitude, perseverance, opportunity, and capability of comprehending said instructions. *Aptitude* refers to the time required for a student to learn given tasks. It is also known to be a unit of instruction or programme of study regarding suitable mastery criteria within the finest instruction conditions and motivation of the student. *Opportunity for learning* refers to the total time obtainable for learning at home and in class. It is claimed that learning opportunity is not available as frequently as required to increase the student's aptitude. *Ability to comprehend instructions* refers to information required for understanding, such as language

comprehension and learning skills. *Quality of instruction* refers to a fine instructional design, which is elaborated within behaviourist structures; however, if the instruction quality is poor it will require more time to explain. *Perseverance* implies the quantity of time that a student desires to spend on a particular piece of work or unit of instruction, while this also tends to be a measurable and operational description of motivating for learning.

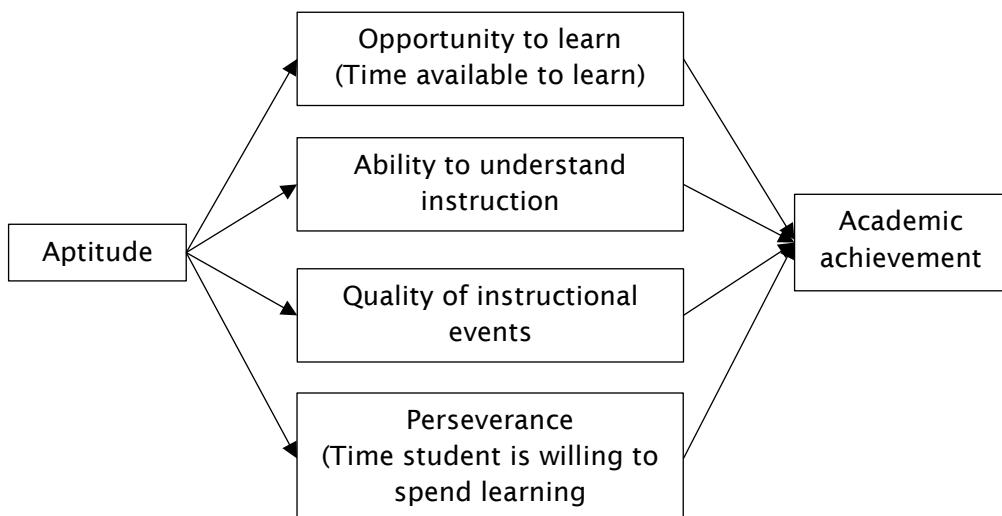


Figure 3-1 Carroll's model of school learning
[Adapted from Carroll, 1963]

However, the major criticism of the process-product approach is that school and classroom processes are not adequately measured and context variables are not included in the model. In addition, school variance takes into account family background factors rather than educational processes. Therefore, the results of this approach have been challenged by the more recently developed cognitive and particularly constructivist perspectives, based on learning and instruction.

3.2.3 Integrated model of school effectiveness by Scheerens (1990)

The integrated model of school effectiveness proposed by Scheerens (1990) was another important effectiveness model for the evaluation of educational effectiveness. It was elaborated on via assimilating Carroll's model (1963). In this model, school inputs were integrated to explain the students' outcomes regarding contribution of context, school process and classroom process (shown in Figure 3-2). Besides its various advantages in terms of attempting to distinguish input-process-context-output matters, it is argued that this model has a major

inadequacy in that it is unable to obviously distinguish among the processes at the school and classroom levels, even though both these levels are on a similar tier.

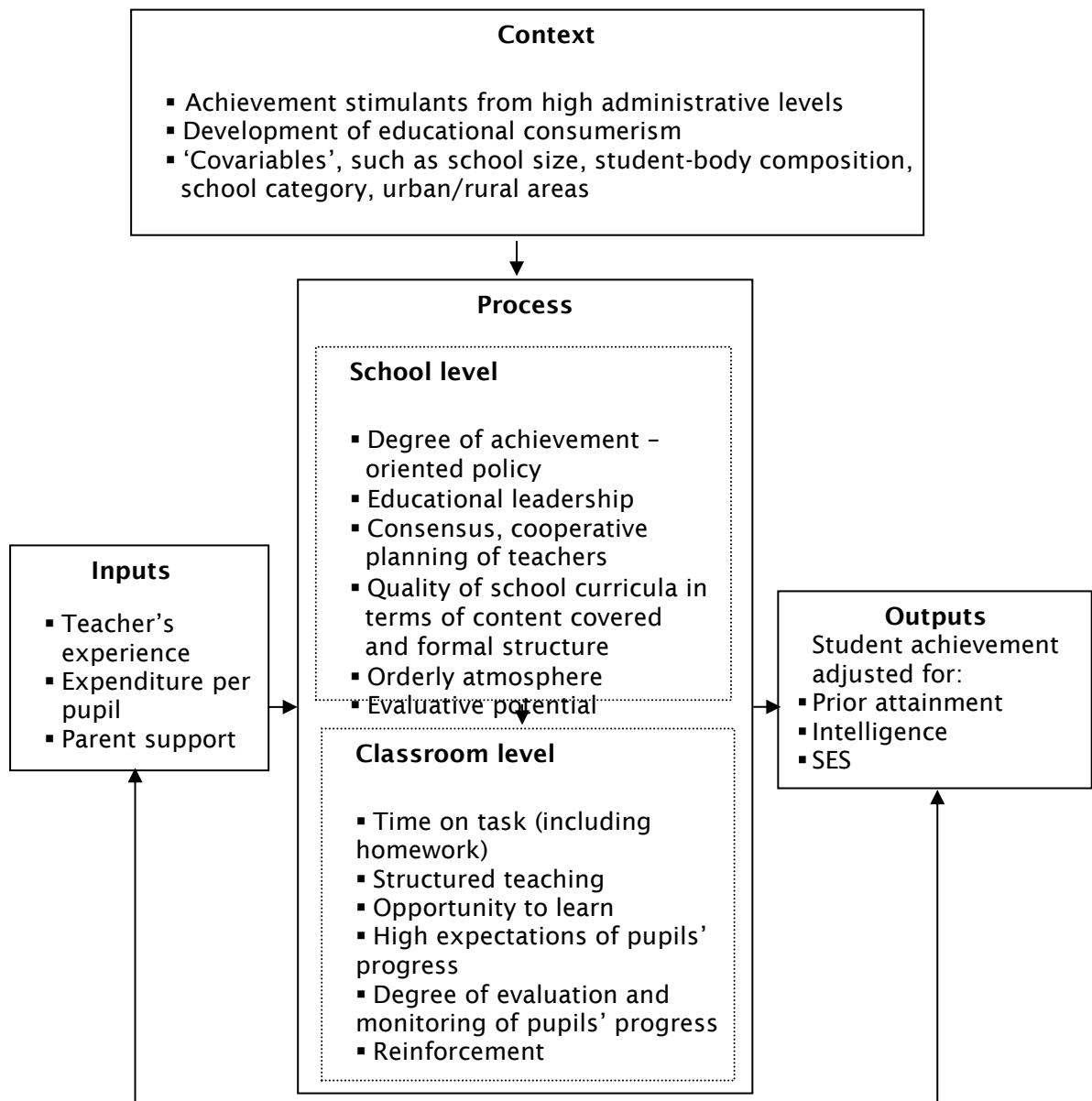


Figure 3-2 The integrated model of school effectiveness

[Source: Scheerens, 1990]

3.2.4 Comprehensive model of educational effectiveness by Creemers (1994)

The comprehensive model of educational effectiveness by Creemers (1994) was elaborated on based on the previous educational effective models of Carroll (1963) and Scheerens (1992). As seen from Figure 3-2, the model is based to some extent on school learning, which differentiates variables into four main levels: context, school, classroom and student. It is assumed that the conditions at the higher level influence the lower levels. This refers to the fact that conditions of the national and school levels provide support to the instructional level in order to fulfill the learning process and, thus, accomplish the desirable student outcomes. Besides, the comprehensive model connects what occurs within the classroom, between classroom and within school, so that each depends upon consistency, cohesion and control.

Concerning the classroom level, education effectiveness depends on *time for learning* and *opportunity to learn*. Also, the quality of instruction in the class contributes to the effectiveness of learning; however, it is mediated by *time* and *opportunity*, which are in turn affected by quality of instruction and teacher effectiveness (Creemers, 1997). Likewise, at the school level and context level, factors related to time and opportunity and quality, in both educational and organisational aspects, all play an important role in the conditions for educational effectiveness (Creemers, 1997).

Creemers (1994) identifies the operation of effectiveness via four criteria: control, constancy, consistency, and cohesion. *Control* does not merely specify the factors relevant to teachers' behaviors and student's outcomes but these factors are also assessed with respect to the significance of the school climate. Furthermore, control also relates to the fulfillment of teachers' responsibilities for efficacy. *Constancy* refers to the provision of effective instruction throughout the academic career of students. *Consistency* refers to conditions of effective instruction which are associated with grouping procedures, teaching behaviors, and curricular materials present. *Cohesion* refers to the fact that every team member is required to show effective teaching attributes, and also teach efficiently and honestly.

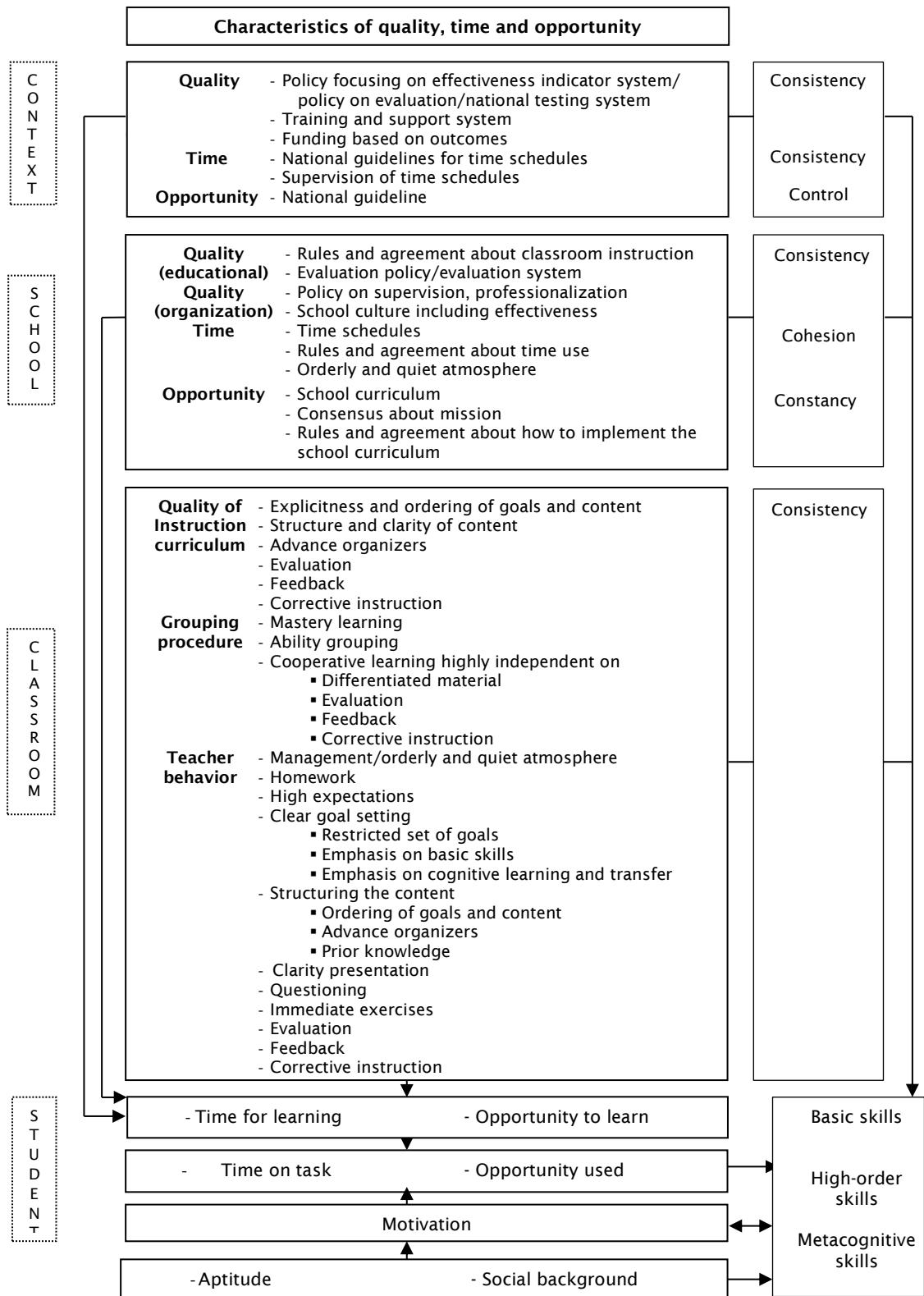


Figure 3-3 The comprehensive model of educational effectiveness

[Source: Creemers, 1994]

3.2.5 Dynamic model of educational effectiveness by Creemers & Kyriakides (2008)

The dynamic model of educational effectiveness is the most up-to-date educational effectiveness model by Creemers and Kyriakides (2008), developed mainly from the comprehensive model of educational effectiveness by Creemers (1994).

Furthermore, the model extended its development based on a critical study of the theoretical models and on a critical review of major outcomes of educational effectiveness research in respect of three main aspects (Creemers & Kyriakides, 2008). Firstly, it has been widely argued that the educational effectiveness model should be regarded as the new goal of education, that is to say, student outcomes should be measured beyond their own basic skills. Secondly, the practical model established should provide the guidelines for policy makers and practitioners to improve and launch educational practices through optimal-fit effectiveness factors. Thirdly, the model needs to identify the in-depth details of the complexity of education. Consequently, models are expected to capture the interrelationships between variables within and between levels.

Regarding the essential characteristics of the desired model, based on the major criticisms and limitations of the previous model, several features could be used as the initial steps in developing an effective and enhanced dynamic model. In accordance with the input-process-context-output matters, certain important aspects have been enhanced in the improved comprehensive model (Creemers & Kyriakides, 2006, 2008; Kyriakides & Creemers, 2012; Scheerens, 2013):

- An emphasis on several factors of effectiveness that function at different levels. It is anticipated that several factors functioning at the same level are linked with each other. Thus, it is essential to state grouping factors.
- A focus on development for a certain period of time (longitudinal), rather than snap-shot (cross-sectional). This would also be for independent variables as well as dependent effect variables.
- Considerations of non-linear relationship between dependent and explanatory variables
- Interest in cross-level interactions, particularly emphasising the interrelationship of factors at particular levels.
- A broad view of the variety of student outcomes beyond the basic skills that a student should gain from schooling (cognitive, affective, psychomotor and new learning)
- Particular measurement dimensions of effectiveness-improving factors.

Considering school level, it is presumed that the features at this level should not just directly impact student outcomes but also have indirect influences on classroom factors. It is indicated that, when compared with school level, classroom level is more important (Creemers & Kyriakides, 2010b; Kyriakides, Campbell, & Gagatsis, 2000). Thus, based on this, it is anticipated that school factors would even impact classroom-level factors, particularly teaching practice (Creemers & Kyriakides, 2010b). Nevertheless, the dynamic model relates to school-level factors that are linked with the same basic concepts of quality of teaching, quantity of teaching, and provision of learning opportunity. However, the model does not include several variables, as observed in the previous models, as the dynamic model signifies that school factors are not concerned with who formulates and implements the school policies and the kinds of activities that are carried out in school (Creemers & Kyriakides, 2008; Kyriakides, Creemers, & Antoniou, 2010). One of the main favored assumptions is that it does not place emphasis on individuals, but on the impact of the activities or policies carried out at various levels of the educational system. For instance, at the school level, factors that relate to leadership – like formation of school policy on teaching, school policy on the learning environment, evaluation of the effect of school policy on teaching and evaluation of the school learning environment regarding the major impacts on teaching and learning environment of school – should be focused on, rather than the leadership of the headteacher/principal.

Nevertheless, one of the main criticisms of the educational effectiveness models is that the measurement of each effectiveness factor is not clearly referred to. On the contrary, it is usually presumed that these factors signify unidimensional constructs because when effectiveness factors are regarded as multidimensional constructs, it leads to a better depiction of what factors enable the school and teachers to be more effective (Creemers & Kyriakides, 2006). It also assists policy makers in forming more suitable approaches for the enhancement of educational practices. Creemers and Kyriakides (2008) propose five major dimensions: frequency, quality, stage, focus and differentiation.

- *Frequency* refers to the number of activities related to effectiveness factors that exist in a classroom, school, or education system.
- *Quality* implies the properties of the particular factors themselves as these are reviewed in literature.

- *Stage* refers to the phase in which they occur and it is presumed that the factors would take place for a long period so that a continual direct or indirect impact on student learning could be guaranteed.
- *Focus* refers to the purpose of factors at school, the classroom and the education system measured in the context of specificity and the total reasons for which an activity is carried out.
- *Differentiation* refers to the degree to which activities related to a factor are applied in the same way for all the subjects that are linked with it.

Table 3-2 presents the operational definitions and ways of measuring five major dimensions in the dynamic model of educational effectiveness at the school level in this study.

Dimensions	Definition	Measuring
Frequency	<i>The quantity of school activity that is connected to an effectiveness factor, is present in a school.</i>	<ul style="list-style-type: none"> - How many tasks/activities are used? - How long does each task/activity take place for?
Focus	<i>The function of the effectiveness factor at school level; measured in terms of specificity and the number of purposes/objectives the school activities achieve.</i>	<ul style="list-style-type: none"> - Are the tasks/activities specific or general? - How many purposes/objectives are expected to be achieved?
Stage	<i>The period of time that tasks/activities take place for, to ensure that the effectiveness factors continue for a long period of time and have a continuous effect on learning and student outcomes, both directly and indirectly.</i>	<ul style="list-style-type: none"> - When does the task/activity take place? (Based on the data that emerged from this question, data about the continuity of the existence of a factor are collected)
Quality	<i>The properties/characteristics of the specific effectiveness factors mentioned and/or discussed in the literature and school/educational effectiveness theory.</i>	<ul style="list-style-type: none"> - What are the properties/characteristics of the tasks/activities associated with a factor that reveal the functioning of each factor? - To what extent is the function of each task in keeping with the literature?
Differentiation	<i>The extent to which tasks/activities, linked with effectiveness factors, are implemented using the same approach for all subjects within school.</i>	<ul style="list-style-type: none"> - To what extent are different tasks/activities linked with each effectiveness factor provided to different groups participating in all subjects connected with this factor?

Table 3-2 Definition and measurement of five dimensions in the dynamic model of educational effectiveness

[Source: Creemers and Kyriakides, 2008]

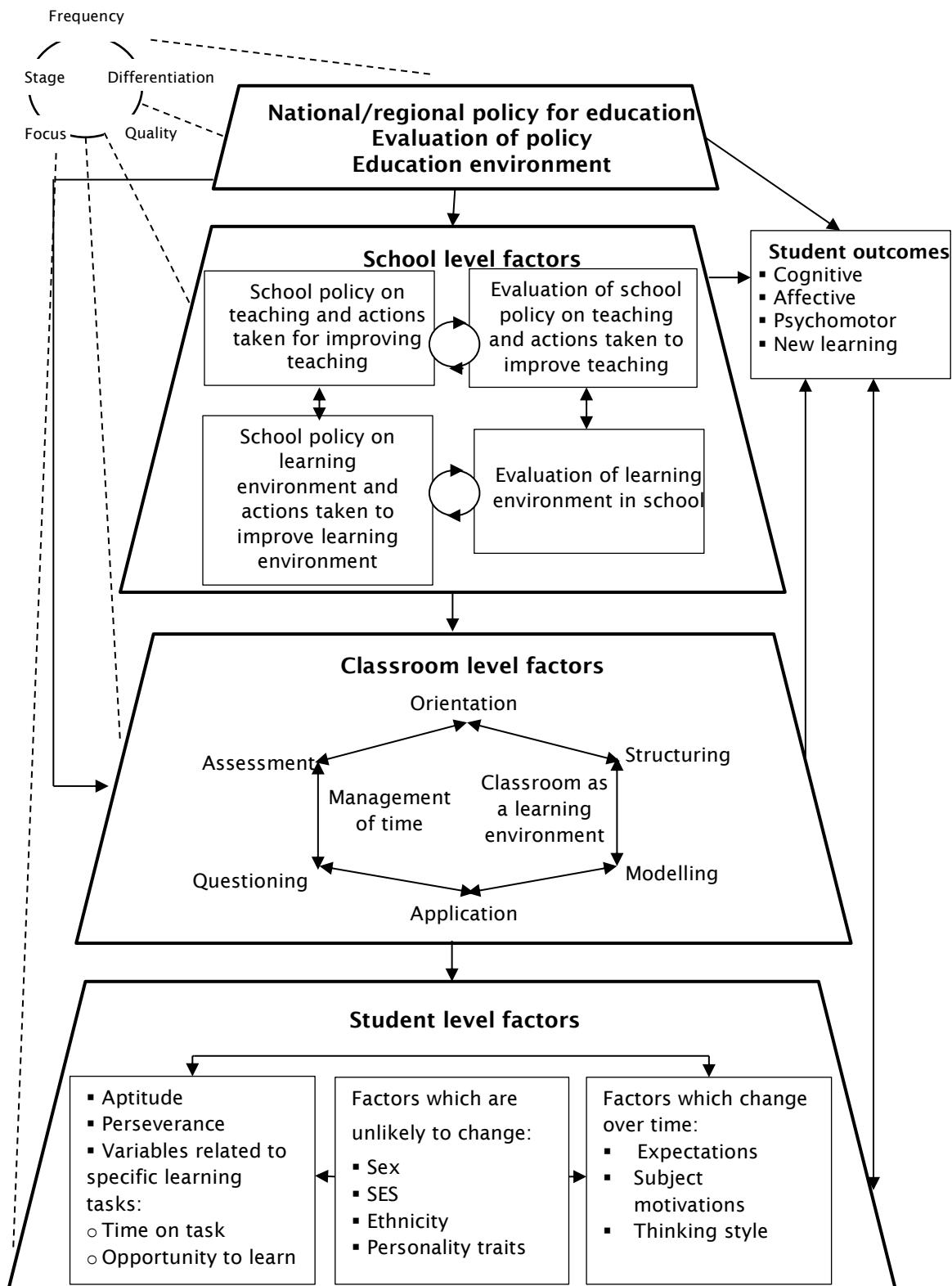


Figure 3-4 The dynamic model of educational effectiveness

[Adapted from Creemers and Kyriakides, 2008]

3.3 Chapter summary

The chapter began with an overview of educational/school effectiveness research in the different stages of theoretical development. This was followed by a breakdown of the major models which have been crucial for theoretical development in educational effectiveness research: the educational production function, the model of schooling, the integrated model, the comprehensive model and the dynamic model. Recent models of educational effectiveness research have had much in common with integrated and multilevel educational effective models combining student, classroom, school and beyond-school factors. In addition, it is interesting that the most up-to-date the models, like the comprehensive model and the dynamic model, have been defined and measured in different dimensions, for all factors. Consequently, it can be seen that school/educational effectiveness models have advanced to be more complex and diverse in terms of the measurement facets.

4. Chapter 4: Conceptualising equity concepts in terms of attainment

The aim of this chapter is to present an overview of equity concepts and to justify the methodology used for equity measurement in this research. The discussions will link to the concepts in the particular equity research into the school effectiveness. The desirable properties and characteristics of measurement methodologies will be discussed and extended so as to apply these potential metrics in the educational context, particularly in relation to student attainment at the school level. Such discussions are important since a proper understanding of methodological strengths and limitations, based on their inherent properties, leads to the selection and justification of an appropriate approach to examining the degree of inequity in the context of education.

4.1 Overview of equity in education

Undoubtedly, an increase in school effectiveness is too frequently seen as being synonymous with an increase in aggregate student attainment (National Research Council & National Academy of Education, 2010); that is to say, with the progress that students make in terms of value added (Goldstein, Huiqi, Rath, & Hill, 2000; Kelly & Downey, 2011; Morley & Rassool, 1999). The majority of school/educational effectiveness studies define school effectiveness in relation to quality (Creemers, 1996; Sammons, 2007), but describing schools or systems as effective only in these terms, while in part is necessary, is not entirely sufficient. This is because, when schools are regarded only for their level of quality, the overall effectiveness of the school can be distorted and conclusions can be misleading. Bloom [cited in Hutmacher (2002)] states that schools and educational systems are responsible for achieving three major goals: an increase in the average student attainment level; a decrease in student attainment variance; and a reduction in the correlation between student attainment and socio-economic background. Therefore, quality and equity should not be separated in education effectiveness research. Each aspect must necessarily complement the other. As Demeuse, Crahay, and Monseur (2002, p. 87) point out, reducing inequity links to fostering quality:

[...] the growth in disparities among students and among schools prevents all systems seeking to apply an equitable policy from being fully effective because they neglect at least one of the parameters. This perspective guides research on effectiveness to give a central place to problems of equity, and not to focus exclusively on average scores. [...] While we suggested equity in the beginning as a factor of the effectiveness of democratic system [...] there can be no effectiveness without equity.

As stated earlier, equity has long been a fundamental concept in educational research, and a subject of debate in terms of public policies and educational resourcing in local, national and international contexts. However, there is a consensus that, although public policies and practices cannot and should not aim to achieve equity in the sense that everyone in society has homogeneous outcomes – a notion that would seem both impossible and undesirable – different outcomes should not correlate too closely with differences in other dimensions (Levin, 2003); for instance, differences in educational achievement should not correlate too highly with differences in social backgrounds (Field et al., 2007; OECD, 2012a).

Equity in matters of education remains a matter of concern in many countries as the basic requirement of contemporary democracy shifts from a consensus about the *right* of education to the *duty* of education, although this differs from time to time and from one society to another (Herrera, 2006). Indeed, judgements about equity in education cannot avoid judgements on what is possible and acceptable in wider society (Gewirtz, 2004) because equity in education is inevitably elaborated through political concepts like equality, social justice, democracy and social inclusion (Ainscow, Dyson, Goldrick, & West, 2012). Thus, debates on equity policies and practices tend to link with questions about who gets what, who is treated in what way, and who can do what (Ainscow et al., 2012). Ultimately the question can be reduced in practice to a philosophical one about what degree of inequity is socially acceptable (Levin, 2003) and flowing from this there have been attempts to define equity pragmatically. An agreement on the conceptual frameworks for understanding equity in education is reported in the OECD publication '*No More Failures*' (Field et al., 2007). It defines equity in a colloquial manner, pinpointing two key dimensions: *fairness* and *inclusion*. Equity is widely accepted and understood as fairness; the idea that 'every human being has a right to benefit from the outcomes of the society on the basis of fairness and according to need'. This specifies that individual circumstances – gender, ethnicity, socio-economic status, and family background – should not hinder fulfilling one's

educational potential, but this notion, perhaps unrealistically, promotes the idea that the influence of any existing 'identity' can and should be overcome. As Opheim (2004, pp. 1-2) states:

If all were alike, equity in education would simply be a question of providing equal distribution of educational resources to all pupils and students. But because there are individual differences between pupils and students as well as differences in the learning resources they may have obtained through family and environment, their individual need for training will vary.

With the attitude that minority identities must be overcome, the difficulty arises that students are different in their endowments and backgrounds, which directly and indirectly affects their leaning. Thus fairness *equates equity with differences* (Public Policy Institute, 2011).

The other OECD dimension of equity relates it to inclusion: '*equating equity with equality*' (Public Policy Institute, 2011) and '*a minimum basic standard of education for all*' (Field et al., 2007). This idea pertains to the idea that all students should achieve at least the minimum basic threshold of socially desired knowledge and skills, that individual and social backgrounds should not cause disparities, and that every student should have equal opportunity for educational attainment (Public Policy Institute, 2011).

Whether the OECD's two equity dimensions, fairness and inclusion, are realisable can be investigated systematically from different perspectives. Meuret (2002a) suggests that inequity among individuals and groups of people can be considered in terms of initial endowments, the process of inequity formulation, the effects of inequality and the side-effects of the means used for reducing inequity. To identify inequity in school and educational systems, a framework can be deployed to assess the educational production process, reflecting the past, present and future dimensions of both short- and long-term effects. This covers context (individuals' endowments and backgrounds), school processes (the treatments and opportunities for learning), internal results (concurrent outputs of schooling), and external results (outcomes in later life) (see Figure 4-1). According to Berne and Stiefel (1994), equity can be investigated through horizontal and vertical dimensions. Horizontal equity implies the equal treatment of those who are equals in order to enhance equity; vertical equity refers to the suitably *unequal* treatment of those who are unequal in order to reduce inequality. Horizontal equity is a pre-

condition to achieving vertical equity, which is warranted for specific groups; for example, the disadvantaged and students with special needs.

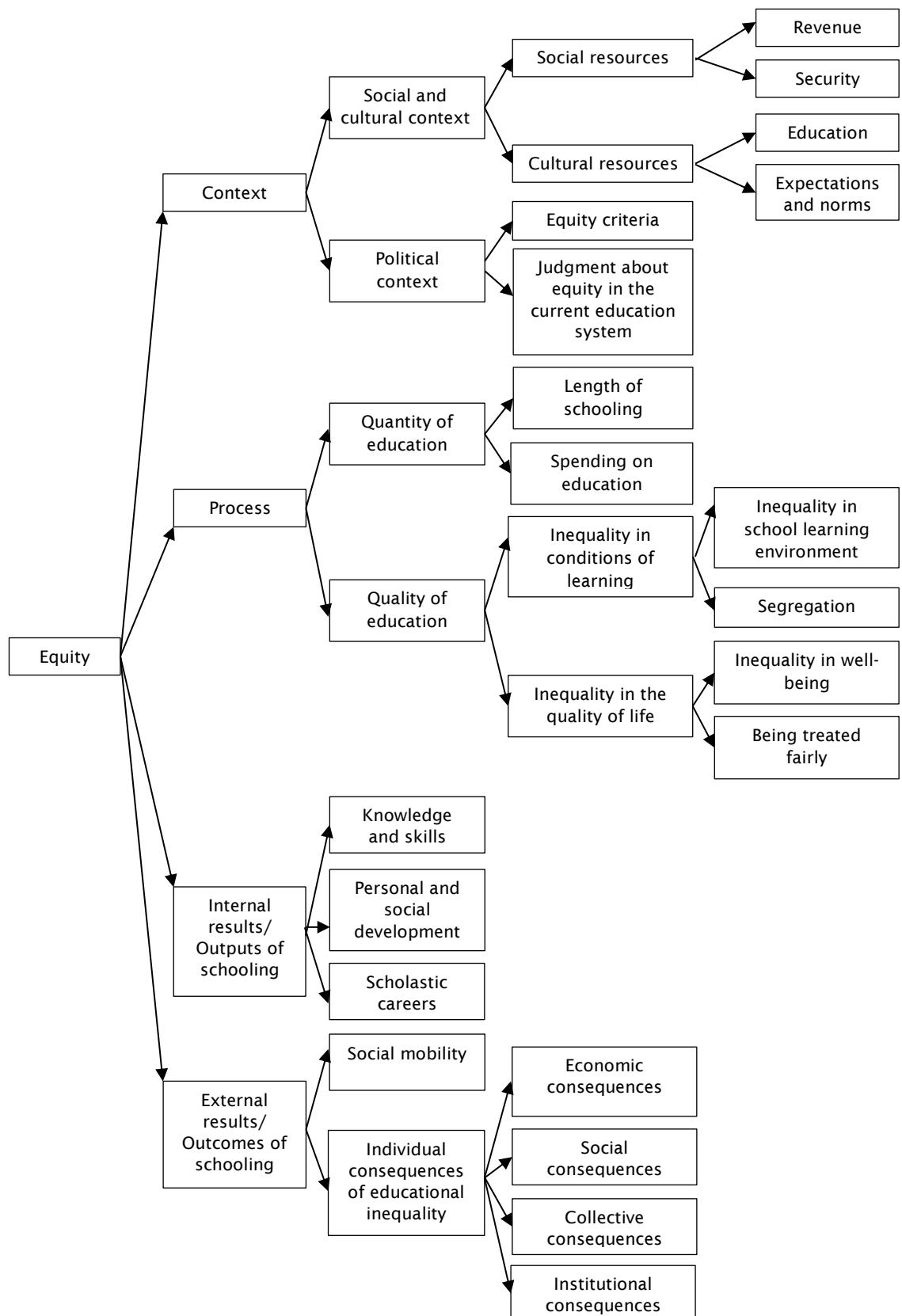


Figure 4-1 Dimensions and indicators of equity in educational contexts
 [Developed from Meuret, 2002b]

In small-scale political power structures such as a school, inequity can be generated if the organisation lacks suitable practices, processes and interactions (Morley & Rassool, 1999). A framework by Field et al. (2007) regarding school accountability shows that the roots of inequity are closely related to both the micro (individual student) and macro (school and education systems) levels. The widely accepted notion that student failure (in both academic and non-academic aspects) is due to individual personal background has been replaced by the notion of school responsibility. By looking at the school level, failure is implicitly and explicitly reflecting a lack of sufficient provision and a perceived lack of quality, the suggestion being that the school-level system cannot provide education appropriate to the different needs of the different groups of students (see Figure 4-2).

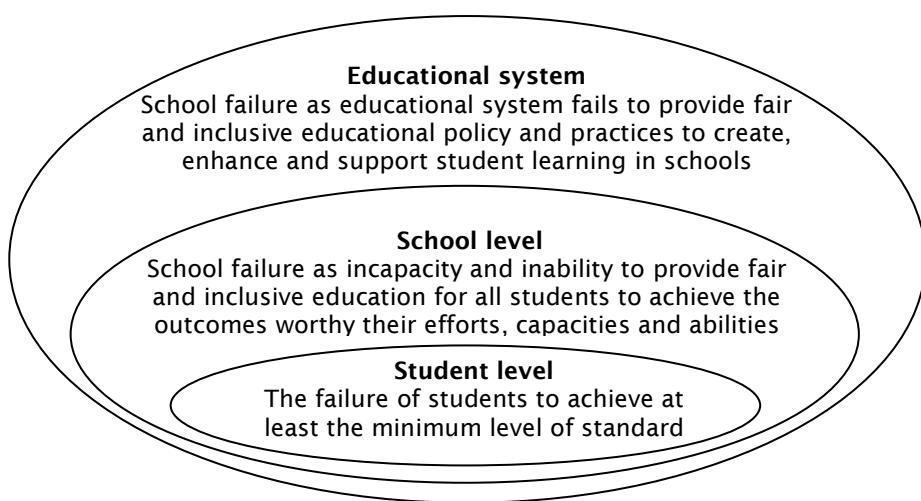


Figure 4-2 School failure in terms of fairness and inclusiveness
 [Developed from Field et al., 2007; OECD, 2012a]

Most arguments concerning potential frameworks for promoting educational equity have focused largely on the role and duty of schools. A variety of school effectiveness models – for example, the dynamic model (Creemers & Kyriakides, 2008), the comprehensive model (Creemers, 1994), and the integrated model (Scheerens, 1990) – seem to deal with the notion that effectiveness and improvement in educational outcomes depends almost entirely on driving and changing power structures within educational institutions themselves, especially in relation to teacher and schools factors (Ainscow et al., 2012; Kyriakides & Creemers, 2011). For example, as synthesised from several empirical studies by Hattie (2003), the sources of major variation that make significant differences in

student outputs include *within-school* factors (e.g. teachers, principals, peers and school learning environment) and *beyond-school-control* factors (e.g. students and home/family), but both seem to play an equally important role for student outputs. Regarding the difference between schools in their economic settings, the evidence from developing countries clearly indicates that the variation in student outputs can be explained by within-school factors, rather than beyond-school factors like student background, whereas most of the variation can be explained by student background in developed countries (see Figure 4-3). For this reason, particularly in developing (or limited-resources) countries, the challenging implications for practice is that efforts to promote educational equity should focus primarily on what happens *within* schools (Ainscow et al., 2012), given the heterogeneity of student backgrounds.

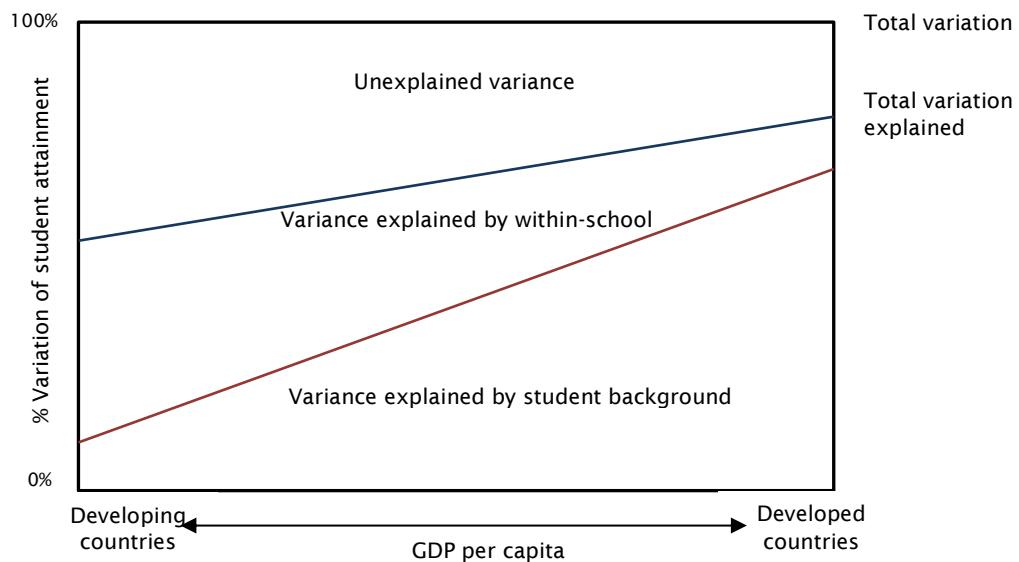


Figure 4-3 Variation of student attainment in the different economic-context countries

[Source: Heyneman and White, 1986]

With such a diversity of concepts being used to theorise equity and its implications, views about society's role and responsibility in dealing with this issue have naturally been viewed differently. Judgement on inequity depends upon the factors being examined. As Foster, Gomm, and Hammersley (1996, p. 44) state:

'the most distinction is probably between equity relating to distribution of some good(s), and that concerning the distribution of opportunities to obtain a good'.

However, this concern requires us to address the question of access to a particular level in educational systems and a recognition that society has a responsibility to provide the same opportunity for all to participate in the education system.

Besides equity of opportunity, equity in terms of educational outcomes is also a major concern. From this point of view, providing the same 'chance' is not sufficient, since different students need different treatment and resources; that is to say, some groups of students need more support to achieve to their potential, or even to achieve the minimum basic education standard.

These nuanced perspectives mean slightly different approaches for policy and practice. Achieving equity of *opportunity* requires only a fair distribution of *access* to education; the requirement for equity in *outcomes* requires different *provision* for different people with different needs. Consequently, education policy and practice has steadily shifted with the realisation that a one-size-fits-all approach is not sufficient and that there needs to be a substantial degree of measurable success in terms of student attainment (OECD, 2012a), though in fact, this in itself (success in terms of student attainment) might not be sufficient either unless it reflects a better life (Clifton & Cook, 2013).

We could summarise these different standpoints on equity alongside their potential indicators as follows:

- The philosophical and ethical standpoint is to promote fairness, to improve the quality of life and opportunities for different groups of people, and to enhance a positive attitude to learning, self-esteem and self-efficacy (Sammons, 2007)
- The political standpoint is to promote social cohesion, inclusion and trust, and to empower people in active citizenship
- The economic standpoint is to enhance future prosperity, social and economic mobility, security, and efficacy for individuals and their families; to reduce crime and the socio-economic 'burden' within society (Causa & Chapuis, 2009; Sammons, 2007); and to contribute to economic well-being and economic growth (Hanushek, 2005).

An increasing emphasis on equity of outcomes logically entails a commitment to the significance of education for all; the belief that the '*education system must provide successful educational outcomes for all students*' (OECD, 2012a, p. 17). An emphasis on the importance of education outcomes as a driver of position in later life (and upward social mobility) implies a belief that the wider the gap in educational outputs, the wider the consequent social and economic gaps in society and that a more equitable system of schooling itself can narrow the socio-economic inequality in society as a '*forward linkage*'. The contrary view of '*backward linkage*' implicitly and explicitly reflects which schools provide sufficient support or additional facilities to meet the different needs of different students so that they reach the desirable threshold, leading to a reduction in the disparities between the strongest and the weakest, or between the advantaged and the disadvantaged, while maintaining the minimum standard of provision required by society.

4.2 Equity measures and their properties

4.2.1 Equity measures

Equity has been at the core of social science disciplines; both theoretical and conceptual frameworks endeavor to explain the phenomenon. As the discipline has progressed, it has become increasingly clear that its methodology for measurement needs to be simultaneously developed in order to quantify the degree of inequity in society and also to make comparisons among different groups or situations. Based on previous literature relating to equity and/or equality measurement (see Table 4-1), equity measures are categorised into six main groups:

Group I: equity measures based on range. The measures include range, restricted range, range ratio, federal range ratio and inter-quartile range.

Group II: equity measures based on median. The measures include the median, absolute deviation from the median and Mcloone index.

Group III: equity measures based on the average deviation and/or variance. This measure includes relative mean deviation, variance, coefficient of variance, logarithm variance, variance of logarithm, concentration index, Yule's characteristic and the Herfindahl index.

Group IV: equity measures based on quantile function and Lorenz curve (including ranking). The measures include GINI coefficient and Patt's index.

Group V: equity measures based on social welfare function. The property of social function can itself be illustrated through the societal preferences in terms of equity; that is, social welfare increases when anyone is better off and no one is worse off – widely known as the '*pareto improvement*' (Foster & Sen, 2001). The measures include Atkinson's index and Dalton's index.

Group VI: equity measures based on information theory. Information entropy theory concerns the problem of evaluating the value of information and is used to quantify the level or degree of randomness or uncertainty of probability distribution (Cowell, 2009). The measures based on information theory are Theil's T index, Generalised Entropy and Herfindahl index.

Measures	Allison (1978)	Egghe and Rousseau (1991)	Litchfield (1999)	Figini (2000)	Picus, Odden, and Fermanich (2004)	Sherman and Poirier (2007)*	Cowell (2009)	Hao and Naiman (2010)	Kelly (2014)
Equity measures based on range									
Range					✓		✓	✓	
Restricted range					✓				
Range ratio					✓	✓			✓
Federal range									✓
Inter-quartile ratio range									✓
Equity measure based on the median									
McLoone index					✓	✓**			✓
Equity measures based on the average deviation and/or variance									
Relative mean deviation	✓	✓					✓		
Variance		✓					✓	✓	
Coefficient of variance	✓		✓	✓	✓	✓	✓	✓	✓
Logarithm of variance		✓					✓	✓	
Variance of logarithm	✓	✓					✓	✓	
Concentration index		✓							

Table 4-1 Summary of equity measures in the literature

Measures	Allison (1978)	Egghe and Rousseau (1991)	Litchfield (1999)	Figini (2000)	Picus et al. (2004)	Sherman and Poirier (2007)	Cowell (2009)	Hao and Naiman (2010)	Kelly (2014)
Yule's characteristic		✓							
Equity measures based on quantile function and Lorenz curve									
GINI coefficient	✓	✓	✓	✓	✓	✓	✓	✓	✓
Patt's index		✓			✓				
Equity measures based on social welfare function									
Atkinson's index		✓	✓				✓	✓	✓
Dalton's index		✓					✓		✓
Equity measures based on information theory									
Theil's T index	✓	✓		✓	✓		✓	✓	✓
Generalised entropy		✓	✓	✓			✓	✓	
Herfindahl's index				✓			✓		

Note: * This does not include the correlation coefficient, slope and elasticity. ** Adjusted McLoone

Table 4-1 Summary of equity measures in the literature (*Continued*)

4.2.2 The desirable properties of equity

Given the number of equity measures above, it is frequently uncertain which method is the appropriate metric for the study and what the strengths and shortcomings of the measures are. To answer this question, the researcher needs to scrutinise the desirable properties or axioms of metrics. In general, there are five main desirable properties, as follows:

- **Boundary of measure:** This property means that, when there is perfect equity in society, the measure must be '0'. On the contrary, the metrics should be '1' if perfect inequity occurs. Therefore, it can be said that the metrics should vary from '0' to '1' (Egghe & Rousseau, 1991; Hao & Naiman, 2010).
- **Principle of transfers:** this property concerns the social welfare function change when a transfer occurs between two persons in society, which sometimes is called the *Pigou-Dalton transfer principle* (Dalton, 1920; Litchfield, 1999; Pigou, 1912). In simple terms, the degree of inequality declines when a transfer occurs from the lower to the higher, *ceteris paribus*; that is to say, the distribution of post-transfer is less unequal than that pre-transfer. A transfer from the higher to the lower causes a decrease in equity which is known as the *weak principle of transfer* (Dalton, 1920). Nevertheless, the weak principle of transfer does not mention whether the degree of equity alters when the transfer is made; such a consequence leads to the *strong principle of transfers* (Hao & Naiman, 2010). Therefore, the weak principle is a pre-requisite to satisfying the strong principle. It states that a transfer decreases inequality and the amount of a decrease in inequality remains unchanged if the same transfer with the same distance occurs between two persons, regardless of the person's rank or position in the distribution.
- **Scale invariance/independence:** the inequality measures remain unchanged if shifting in scale or increasing (or decreasing) in a fixed proportion or percentage for everyone and the equity measures should decrease when adding the positive constant to everyone (Hao & Naiman, 2010; Litchfield, 1999).
- **Principle of population:** colloquially, the inequality measure of the cake distribution, for instance, is not based on the number of the cake-receivers: that is to say, quantifying the inequity measure should not be affected by

the population size, but should depend on its distribution in the population (Hao & Naiman, 2010; Litchfield, 1999).

- **Decomposability:** This property refers to the coherent relationship of society, which is stratified into sub-groups or strata. Given inequality measures, the decomposability requirement is satisfied if the total inequality can be partitioned or expressed into between-group inequality and within-group inequality (Hao & Naiman, 2010; Litchfield, 1999).

In addition, these properties can be written in the mathematical expressions shown in Table 4-2.

Properties	Descriptions
Boundary of the measure	Lower bound: $I(X_1, X_2, \dots, X_n) = 0$ where all $X_i, i = 1, \dots, n$ are equal. Upper bound: $I(X_1, X_2, \dots, X_n) = 1$ where all $X_i = 0$ except one
Principle of transfers	For every $X_i, (X_1, X_2, \dots, X_n) \leq X_j$ and $0 < a \leq X_i$: $I(X_1, \dots, X_i - a, \dots, X_j + a, \dots, X_n) > I(X_1, \dots, X_i, \dots, X_j, \dots, X_n)$
Scale invariance/independence	For every (X_1, X_2, \dots, X_n) and $b > 0$: $I(bX_1, bX_2, \dots, bX_n) = I(X_1, X_2, \dots, X_n)$
Principle of population	If $(X_{11}, X_{12}, \dots, X_{1n})$ and $(X_{21}, X_{22}, \dots, X_{2n})$ are identical, $I(X_{11}, \dots, X_{1n}) = I(X_{21}, \dots, X_{2n}) = I(X_{11}, \dots, X_{1n}, X_{21}, \dots, X_{2n})$
Principle of decomposability	$I_{Total} = I_{Between group} + I_{Within group}$

Table 4-2 Mathematical expressions of the desirable properties of equity measure
[Source: Litchfield, 1999; Egghe and Rousseau, 1991]

4.3 Equity measures and their properties in educational effectiveness research

Equity has long been an issue of major concern in various disciplines, and methodologies have increased exponentially in several fields to reflect this – such as Economics (e.g. Bellu & Liberati, 2006; Foster & Sen, 2001), Statistics (e.g. Cowell, 2009; Hao & Naiman, 2010), Sociology (e.g. Allison, 1978), and Actuarial Science (e.g. Promislow, 1987). However, existing methodologies in

school/educational effectiveness research that might quantify the degree or severity of equity seem to be limited in scope, even where the literature and policy issues in equity of education have been widely discussed and are a matter of great concern in local, national and international contexts.

Traditionally, the use of attainment equity measurement has been limited for test score reports; that is, student attainment description has been restricted to the passing rates, regardless of the distribution or composition of scores.

Interestingly, a substantial increase in concentration on educational outputs/outcomes, as represented by student-based equity measures of student attainment, is strongly emphasised by educational policy makers. As Kelly (2014) points out, even the use of indicators (for example, the minimum threshold pupil learning standard or school contextual value-added indicators) as accepted quantitative metrics is not guaranteed to quantify the extent to which student outcomes are equitable. In addition, comparison of inequity among cases is still problematic for policy makers. Therefore, developing equity measurement methodology in the field of school effectiveness research can play an important role in determining how far teachers, principals and policy makers cope with reducing the inequitable and unjustifiable differences in outcomes of schooling.

There have been several methods for measuring equity in practical terms. However, as discussed in relation to the generally desirable properties in metrics used to quantify inequity, such properties may vary from discipline to discipline, according to their specific nature. For education, the subject here, Kelly (2014) discusses the desirable properties and characteristics of metrics, particularly in the attainment equity measures shown below:

- **Zero and positive value:** in a case where every student gains the same scores in his/her test, any inequity measure should equal zero and it should produce a positive value when the inequity has been found (Kelly, 2014).
- **Scaling:** in the case of the interval-scale variables with a lack of a theoretically fixed scale, any equity measures are not appropriate even when comparing the interval scale at the same origin as a change in origin leads to different conclusions (Allison, 1978). On the other hand, it can be said that it is meaningful to measure inequity when using ratio-scale variables. However, as Allison (1978) points out, a comparison of inequity with the interval-scale data will be valid when a nonnegative ratio

underlying the interval scale is assumed. In the same way, Kelly (2014) notes that zero achievement is not meaningful or is unrealistic, since every student in fact explicitly and inexplicitly gains some advantages from socialising in school.

- **Scale invariance:** the use of scale invariance for the measurement of equity means that, when multiplying by any constant term, increasing in the percentage and changing the units, the relative measure should be unaltered and, when adding the constant to every student's attainment, the measures decrease (Kelly, 2014). This property addresses the educational context, since it allows comparison among measurements with different units and it does not matter whether measuring is done with the adjusted or unadjusted scores. In addition, for changes in real percentage, students gain the absolute term although the relative term remains unaltered, while adding the positive constant to each individual makes differences among student attainment, but becomes less important because the raw score increases.
- **Transferability:** in the educational context, when the student attainment is transferred from the weak (the low-score student) to the strong (the high-score student), the equity metric should decrease (Kelly, 2014).
- **Sensitivity:** this property is closely connected to transferability. Although the equity measures satisfy the requirement of transferability, sensitivity has been differentially affected at different points of the scale; that is, the degree of sensitivity depends on the ranks of the transferor and transferee and/or the ratio of attainment between the transferor and transferee (Kelly, 2014).
- **Transforming the limits (upper and lower bounds):** the equity measures selected may depend on their boundaries (or upper and lower limits) and/or whether they respond to the population size (Allison, 1978). Therefore, it is greatly significant if the equity measures can be transformed into the boundary limits, which relates to the interpretation in terms of degree of inequity.
- **Ungrouped and grouped data:** dealing with ungrouped and grouped data relates to the estimation and statistical testing in the sample data. For the ungrouped data (or individual data), applying the relevant population formula to the sample mostly yields the consistent and efficient

estimators; nevertheless, it seems to be difficult to calculate the standard errors and confidence intervals in statistical testing (Allison, 1978). If the individual data is not available, the grouped data using the mid-points of intervals as their representativeness of the intervals can also be applied (Kelly, 2014).

- **Marginal utility value of educational attainment:** Kelly (2014) noted that the marginal utility in attainment in the context of equity measurement is ambiguous, that is, it can be increasing, diminishing or decreasing. In essence, if the attainment is the diminishing marginal utility (that is, an increase in utility obtained is due to an increase in examination success), a transfer of attainment among the low-attainment students yields higher effects than that among the high-attainment students. Consequently, different equity measures are preferred to different marginal utility values of educational attainment (as discussed in the section on sensitivity).

Besides the above properties, attainment equity may be analysed via sub-groups (e.g. sex, races, ethnic groups and SES). The suggested desirable properties may include '*decomposability*'. The equity measures may be decomposed by sub-groups of population such as sex, race, ethnicity, family backgrounds, or disability. This property requires that the equity measure of the whole population should equal to the sum of its sub-group (Litchfield, 1999).

4.3.1 Kelly's AE index

Kelly's AE index is a statistical measure of equity in schooling-output (or output-focused equity measure) adopted in 2012 by Kelly, an educational theoretician specialising in educational effectiveness. In essence, Kelly's AE index is developed on a GINI-based coefficient basis – initially formulated by the Italian statistician and sociologist Corrado Gini in 1992 and widely used to quantify the degree of equity and equality in various arenas such as Economics (Atkinson, 1970; Bellu & Liberati, 2006; World Bank Institute, 2005), public health (Nishiura et al., 2004) and Education (Kelly, 2014; Thomas, Wang, & Fan, 2000).

In the education context, policy makers have focused on the outcome-based equity of schooling in policies at every level of the education system but especially within the school context. However, the connection among the equity, accountability and public examination is conceptually intuitive but still doubtful in terms of defining and measuring the outcome equity (Kelly, 2012). With an attempt by Kelly (2012, p. 977) as a beginning point, the outcome-equity measurement methodology has

been developed from the question: *how far is a school (or group of schools) from having a “fair” proportion of its examination success attributable to a fair proportion of its student population?* On the other hand, it might be said that, for equity as *fairness* in schooling outcomes, for example at the school level, it is expected that a given proportion of student grades is attributable to the equal student-population proportion within the school; that is to say,

- 20% of students within school should gain 20% of public examination scores
- 40% of students within school should gain 40% of public examination scores
- 60% of students within school should gain 60% of public examination scores
- 80% of students within school should gain 80% of public examination scores
- 100% of students within school should gain 100% of public examination scores

In detail, to quantify the potential metric – Kelly’s AE index (the GINI-based metric) – for capturing the output-focused equity of schooling, here, it can be calculated in two approaches: The Lorenz-based derivation and covariance-based deviation:

❖ Kelly’s AE index with the Lorenz-based derivation

Initially, Kelly (2014) developed his attainment equity index, called Kelly’s attainment equity (AE) index, by employing the concept of the GINI-based measures through Lorenz curve derivation. The GINI is commonly derived from the Lorenz curve. To apply this in the schooling-outcome-equity context, the Lorenz curve represents the cumulative percentage of students and the cumulative percentage of student attainment and can be mathematically defined as (Hao & Naiman, 2010):

$$L(m/n) = \frac{\sum_{i=1}^m Y_{(i)}}{\sum_{i=1}^n Y_i}$$

where $L(m / n)$ is the proportion of student attainment attributed to the m individual having the lowest scores. Therefore, the Lorenz curve at point m / n provides the share attributes to the bottom $100*(m / n)\%$ of students. If the nominator, $\sum_{i=1}^m Y_{(i)}$, equals to the denominator, $\sum_{i=1}^n Y_i$, at any point of m , that is, $L(m / n)$ equals 1 at any point of m then it is perfect equity in the distribution of

student attainment over the student population where the straight line $Y = X$ (Figure 4-4).

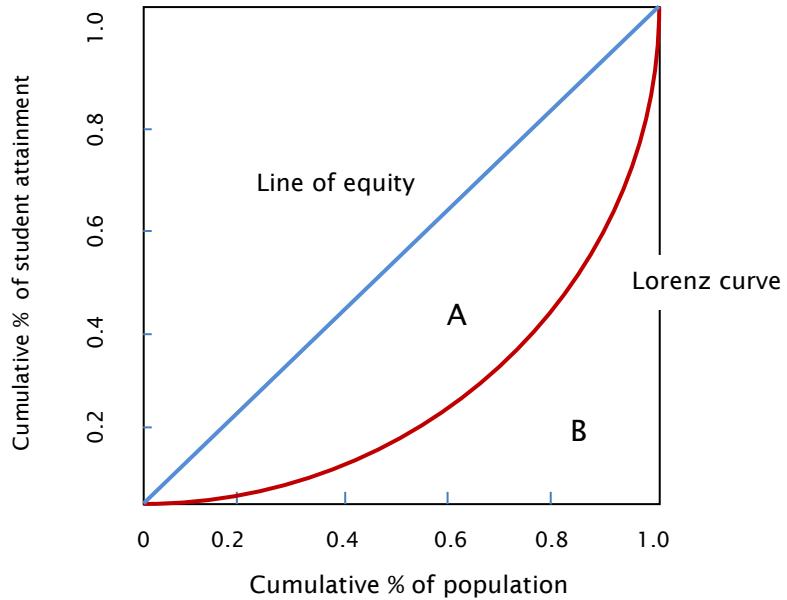


Figure 4-4 Lorenz curve

[Source: Kelly, 2014]

On the contrary, if inequality exists, then the Lorenz curve is not a straight line: that is, $Y \neq X$. When A is the area between the line of equity and the Lorenz curve (or concentration area), and B is the area below the Lorenz curve, then the GINI coefficient is simply given by:

$$GINI = \frac{A}{A + B}$$

If the axes are normalised, then the area $A + B$ is equal to 1 and the GINI coefficient equals $2A$ or $1 - 2B$. Therefore, when defining the GIN coefficient as $1 - 2B$ and the Lorenz curve is expressed by the function, $L(X)$, then the GINI coefficient can be mathematically written as:

$$GINI = 1 - 2 \int_0^1 L(m/n) dx$$

In the same way as the GINI coefficient, Kelly's AE index varies from 0 to +1 where '0' represents the perfect equity, whereas '1' expresses perfect inequity.

Therefore, the further the Lorenz curve is away from the equity line, the higher the degree of inequity (Figure 4-5).

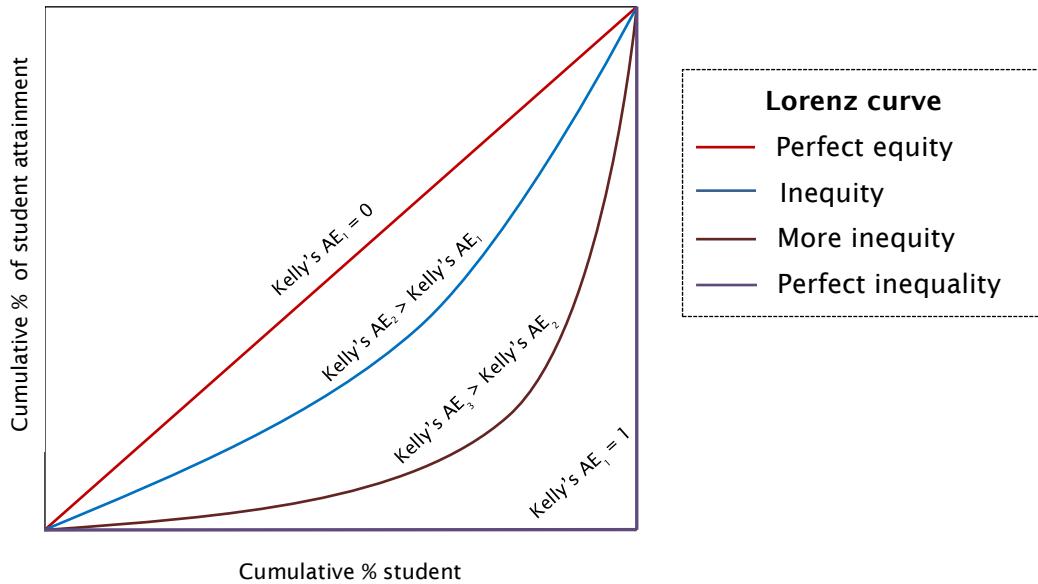


Figure 4-5 Kelly's AE index and Lorenz curve at the different levels of inequity

However, in the case where the Lorenz function is unknown or undefined, Kelly (2014) also developed his index using the continuous piecewise linear function. By doing this, the Lorenz curve is taken into account at the different points of cumulative percentage of students: for example, at 20%, 40%, 60%, 80% and 100%. Therefore, the area underlying the Lorenz curve can be approximated to trapezoids, as shown in Figure 4-6.

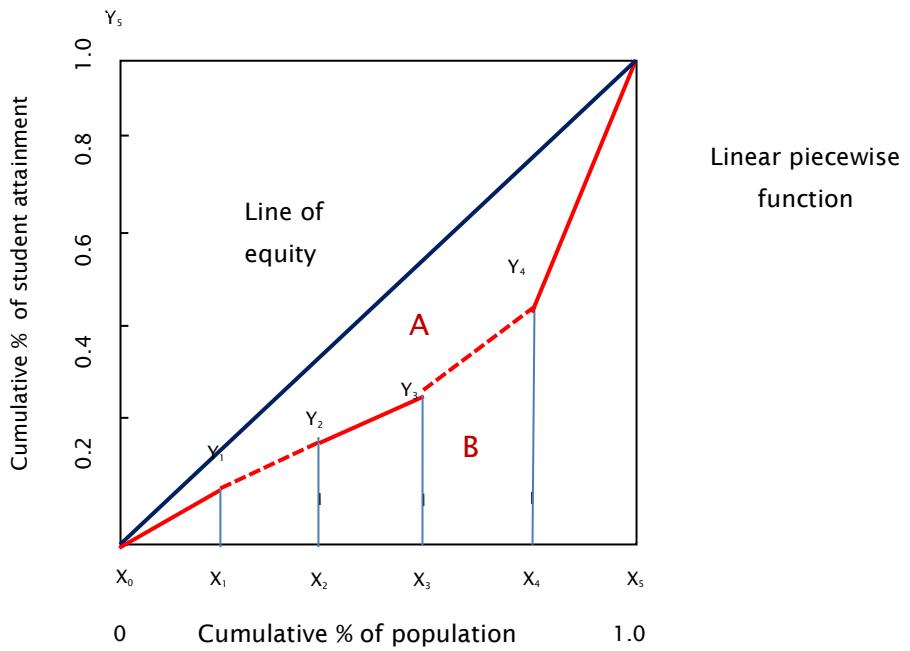


Figure 4-6 The Lorenz curve with the linear piecewise function

[Source: Kelly, 2014]

As shown in Figure 4-6, the area of each B_i is given by:

$$B_i = \frac{(X_i - X_{i+1})(Y_i + Y_{i+1})}{2}$$

The summation of all these areas ($\sum B$), B , is therefore equal to:

$$B = \frac{1}{2} \sum_{i=1}^n (X_i - X_{i-1})(Y_i + Y_{i-1})$$

Using the area B to calculate the area A , the area A is given by:

$$A = \frac{1}{2} - \frac{1}{2} \sum_{i=1}^n (X_i - X_{i-1})(Y_i + Y_{i-1})$$

Therefore, Kelly's AE index can be shown as follows:

$$AE = \frac{\frac{1}{2} - \frac{1}{2} \sum_{i=1}^n (X_i - X_{i-1})(Y_i + Y_{i-1})}{\frac{1}{2}}$$

that can be rewritten as:

$$AE = 1 - \sum_{i=1}^n (X_i - X_{i-1})(Y_i + Y_{i-1})$$

In conclusion, if the Lorenz curve is found to be a continuous function, $Y = L(X)$, Kelly's AE index can be given by $1 - 2 \int_0^1 L\left(\frac{m}{n}\right) dx$. On the other hand, if the Lorenz curve can be approximated as a piecewise linear function by using the trapezoids, Kelly's AE index can be calculated by $1 - \sum_{i=1}^n (X_i - X_{i-1})(Y_i + Y_{i-1})$.

❖ Kelly's AE index with the covariance-based calculation

Besides Kelly's AE index, calculation via the Lorenz curve, another potential method to calculate the index can be directly derived from the covariance between variable Y and the cumulative distribution of Y , that is, educational attainment and its cumulative distribution [see Bellu and Liberati (2006)]:

$$AE = \frac{Cov[Y, F(Y)] * 2}{\bar{Y}}$$

where Cov is the covariance between the educational attainment, Y , and its cumulative distribution, $F(Y)$, and \bar{Y} is the average educational attainment. However, the covariance can be written as:

$$Cov[Y, F(Y)] = E[Y - \bar{Y}][F(Y) - \bar{F}(Y)]$$

Therefore, Kelly's AE index, based on the GINI-based using the covariance-based approach, is given by:

$$AE = \frac{2 * E[Y - \bar{Y}][F(Y) - \bar{F}(Y)]}{\bar{Y}}$$

❖ Kelly's AE index and the sample size

The general rule of thumb for the standard error is: the larger the sample size, the lower the standard error. However, although Kelly's AE (GINI-based) index satisfies the principle of population (Hao & Naiman, 2010; Litchfield, 1999), the index seems to be sensitive with small cohorts – as shown by Kelly (2012) with his analysis excluding small cohort. Consequently, it is questionable whether Kelly's AE index still produces robustness in the small sample size. If not, which size of school should be considered in the analysis?

According to Kendall, Stuart, and Ord (1994), underlying the symmetrical distribution assumed, the approximation of the SE of GINI coefficient is given by:

$$SE = GINI * \sqrt{\frac{0.8086}{N}}$$

It can be said that the standard error of the GINI coefficient varies with the magnitude of the GINI and sample size: that is, the lower the sample size, the higher the SE and the higher the GINI coefficient and the higher the SE. Given the fixed Kelly's AE indices at 0.1 (based on the findings), the SE monotonically and continuously decreases when the sample size increases (see Figure 4-7). The cutting-point sample size in this study is given by:

$$N = 0.8086 * \left(\frac{GINI}{SE} \right)^2$$

In this study, the researcher set the acceptable level of the SE as 0.02. Therefore, schools included in the study are:

$$N = 0.8086 * \left(\frac{0.1}{0.02} \right)^2 = 20.215$$

The optimal size for schools included in the study is schools with twenty or more Grade 9 students.

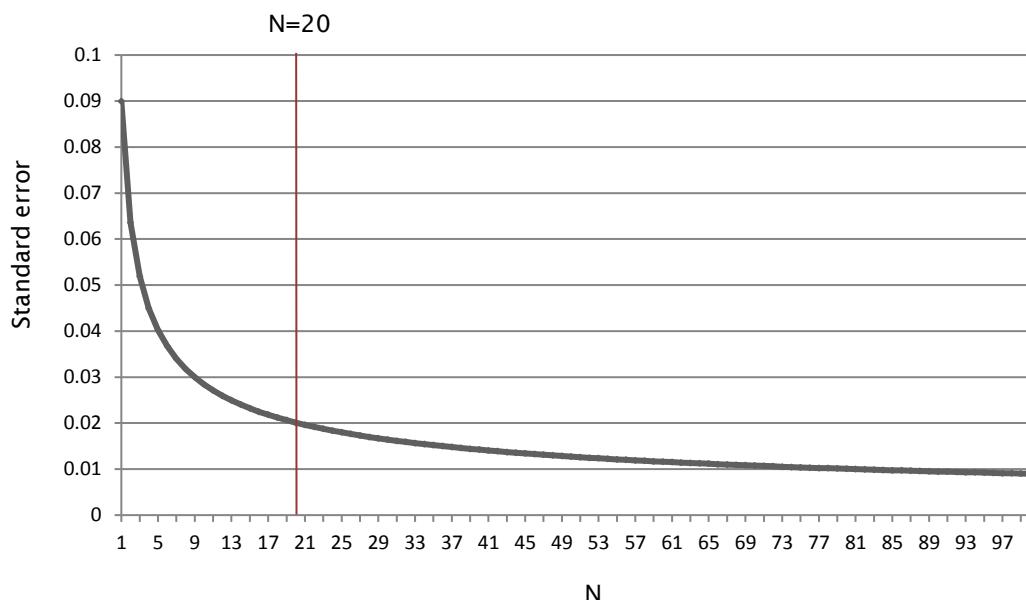


Figure 4-7 Standard error approximation of the GINI coefficient (Kelly's AE index at 0.1) based on Kendall et al. (1994)

In practice, particularly in the educational context, although Kelly's AE index is limited in the decomposability condition, which is used for sub-group inequity analysis, the index is a potential metric to measure the degree or severity of the attainment equity as an output-oriented measure for various aspects. The index is derived from the strong theoretical underpinning of the GINI-based metric (the most widely-used metrics of equity and equality in economics that has been applied to several fields). In addition, it is connected with and derived from the meaningful sense of the Lorenz curve (every point on the Lorenz curve reflects the Pareto principle) and social welfare functions, which can adopt the ranking and the transfer principle to improve the desired level of social welfare. Moreover, Kelly's AE index has exact upper and lower boundaries (between 0 and 1), so that it is a well-equipped metric in terms of interpretations and comparisons in the degree and severity of equity, even in the case of unbalanced population size and intersectionality of Lorenz curves. In addition, it satisfies the scale invariance condition: thereby, using student attainment with adjusted and unadjusted scores would make no difference to their results. The sensitivity of transfer of Kelly's AE index depends on the shape of distribution of data: most educational data is normally distributed. Therefore, the index is well captured in the transfer around the middle point (or mean) of the distribution. In addition, this index still yields robustness even when outliers occur, although all data is taken into account as a part of the index.

4.3.2 Theil's T index

Besides Kelly's AE index, Kelly (2014) also recommends another potential index: Theil's T, a statistic to measure attainment equity. Theil's T index (or Theil entropy index) was initially proposed by econometrician Henri Theil in 1967, derived from the notion of entropy (uncertainty) using Claude Shannon's information theory, which attempts to quantify the value of information (Foster & Sen, 2001). To modify Shannon's information theory, the expected information content, $h(X)$, is a decreasing function of the probability event that occurs, X , and can be expressed in the form (Foster & Sen, 2001):

$$h(X) = \ln \left(\frac{1}{X} \right).$$

When there is a set of n possible events, then $\sum_{i=1}^n X_i = 1$ and the sum of the expected information content, $H(X)$, is given by:

$$H(X) = \sum_{i=1}^n X_i h(X_i)$$

so that:

$$H(X) = \sum_{i=1}^n X_i \ln\left(\frac{1}{X_i}\right).$$

The information content gains the maximum value of $\ln(n)$ when X_i is equal to $1/n$; in other words, the maximum information obtained from one event occurring in the maximum uncertainty. Hence, if subtracting $H(X)$ from $\ln(n)$, it is well-known as Theil's T measure of equity which can be written as follows:

$$T = \frac{1}{n} \sum_{i=1}^n R_i \ln R_i$$

where R_i is the ratio between individual's amount, V_i , and the average amount, μ . To apply this in the educational context, Theil's T index measuring the attainment equity can be rewritten (Kelly 2014):

$$T = \frac{1}{n} \sum_{i=1}^n \left[\left(\frac{V_i}{\mu} \right) \cdot \ln \left(\frac{V_i}{\mu} \right) \right]$$

where n is the number of students, V_i is the value of student attainment for student i , and μ is the average student attainment. As V_i/μ is the proportion of the individual score to overall mean, the natural logarithm of V_i/μ indicates that each individual Theil component is a positive or negative point. Thus, if the individual score is higher than the overall mean, its component will be positive; if less than the overall mean, it will produce a negative value; and it will be '0' if the individual score equals the overall mean. Therefore, if all have the same scores or every study gains the exact same score, equally to the overall mean – in other words, when perfect equity occurs, Theil's T index will be lower the limit of '0'. However, when only one student gains everything and any other student gains '0' – that is to say, perfect inequity occurs – Theil's T index will be at the upper limit of ' $\ln(n)$ ' for a finite population and of ' ∞ ' for the infinite population. According to the shortcoming of the upper limit, Kelly (2014) identifies that its consequences may be misleading when comparing schools. Theil's T index of schools with more students will be higher than the index of those with fewer students, even if these two schools, in fact, are identical in terms of attainment equity.

4.4 Summary of properties of Kelly's AE index and Theil's T index

Since there are several choices of equity metrics to measure attainment equity, it is imperative to consider their properties before selecting the one to adopt. In general, criteria to select the potential metrics are regarded as their properties: lower and upper bound, scale invariance, transferability, and sensitivity. Table 4- illustrates the main properties of both Kelly's AE index and Theil's T index, using sample data with different scenarios according to their properties.

Student	Raw scores	Lower bound	Upper bound	Scale invariance			Transferability and sensitivity	
		Perfect equity	Perfect inequality	A change in unit	All scores increased by 20%	All scores increased by 10 points	Transferring 5 points for the strongest to the weakest	Transferring 5 points for the student 5 to student 4
1	10	55	0	1	12	20	15	10
2	20	55	0	2	24	30	20	20
3	30	55	0	3	36	40	30	30
4	40	55	0	4	48	50	40	45
5	50	55	0	5	60	60	50	45
6	60	55	0	6	72	70	60	60
7	70	55	0	7	84	80	70	70
8	80	55	0	8	96	90	80	80
9	90	55	0	9	108	100	90	90
10	100	55	550	10	120	110	95	100
Total	550	550	550*	55	660	650	550	550
Kelly's AE	0.300	0.000	0.900	0.300	0.300	0.254	0.284	0.298
Theil's T index	0.151	0.000	2.303	0.151	0.151	0.105	0.132	0.150

Note: * The upper limit of the GINI coefficient is $(n - 1)/n$ and it is close to '1' for a large population or an infinite population (Allison, 1978; Bellu & Liberati, 2006) . However, this sample data is small-scale, so that the upper limit for perfect inequity is not 1.

Table 4-3 The illustration of properties of Kelly's AE index and Theil's T index

Properties	Equity measures	
	Kelly's AE index	Theil's T index
Lower limit (<i>Perfect equity</i>)	0	0
Upper limit for infinite population (<i>Perfect inequity</i>)	$\frac{n-1}{n}$ (Kelly's AE index is close to 1 when a large population exists)	$\ln(n)$ (Theil's T index relies on the sample size when perfect inequity exists)
Upper limit for finite population (<i>Perfect inequity</i>)	1	∞
Scale invariance	Yes	Yes
Transferability, sensitivity and marginal utility of educational attainment	Sensitive to transfers around the middle of the distribution and to a low level of student attainment (as most educational data is normally distributed)	<ul style="list-style-type: none"> ▪ Sensitive to transfers around the middle of the distribution and to a low level of student attainment ▪ Sensitive to a transfer among low-attainment students
Decomposability	No	Yes

Table 4-4 Summary of properties of Kelly's AE index and Theil's T index
 [Summarised from Kelly, 2014; Allison, 1978]

4.5 Chapter summary

Equity is the fundamental core of educational research effectiveness, linking to notions of social justice, social inclusion, inequality and democracy. There is a general preference for a wide definition of equity as divided into the twin concepts of *fairness* and *inclusion* in different dimensions: context, process, output (internal result) and outcome (external result). Traditionally, school effectiveness research has viewed equity with a focus on educational opportunity and process, especially for disadvantaged pupils. However, it is argued that equity in terms of opportunity is necessary, but not sufficient. Hence, there must also be measurement in terms of student attainment as an output of schooling, since this is closely related to later life: a reduction in the disparity in outputs of schooling also narrows the social and economic gap. In terms of output-equity measurement methodology in general, the desirable properties should satisfy the requirement of limit boundary, scale invariance, transferability, principle of population and decomposability. The

measures adopted in measuring attainment equity in the study consist of Kelly's AE index and Theil's T index both of which satisfy those properties, except that Theil's T index fails the upper bound of the measure, whereas Kelly's AE is limited in terms of decomposability.

5. Chapter 5: Methodology and methods: Philosophical underpinning and research design

This chapter presents a coherent research methodology and outlines the methods used in the study. The chapter begins with a discussion of philosophical frameworks closely associated with the research process, and goes on to describe the philosophical standpoint of the study, linking the strategies of enquiry and the educational effectiveness paradigm. Such discussions are important for the researcher to consider in order to select the most suitable methods, which in this case were to adopt a mixed methods design.

5.1 Philosophical underpinning

Researchers need to locate their studies within broader elected frameworks of theoretical and philosophical viewpoints, which typically we define as paradigms (Blaikie, 2008; Doyle, Brady, & Byrne, 2009). The term 'research paradigm' refers to a set of basic beliefs, practices, values and assumptions that are shared in researcher communities and are based on the nature of research-forming (Johnson, Onwuegbuzie, & Turner, 2007; Morgan, 2007). Put simply, they can be used to identify what researchers believe and where their standpoints are located.

Paradigms, as epistemological stances, also refer to the generic dimensions of social enquiry; namely, ontology (the nature of reality), epistemology (knowledge of reality) and methodology (the ways of comprehending reality) (Blaikie, 2008; Corbetta, 2003). These distinct approaches employ different research techniques for conceptualising and conducting research and in so doing contribute toward a body of knowledge (see Figure 5-1). Moreover, paradigms provide a guideline of reasoning in terms of what types of research questions are significant, and can help in establishing answers to these questions (Robson, 2011). Similarly, based on certain aspects of research development as proposed by Crotty (1998), the differences in worldview that are inherent in paradigms play an important role in how to justify the questions posed in terms of the investigation of epistemology, theory and methodology used in a research project (see Figure 5-1).

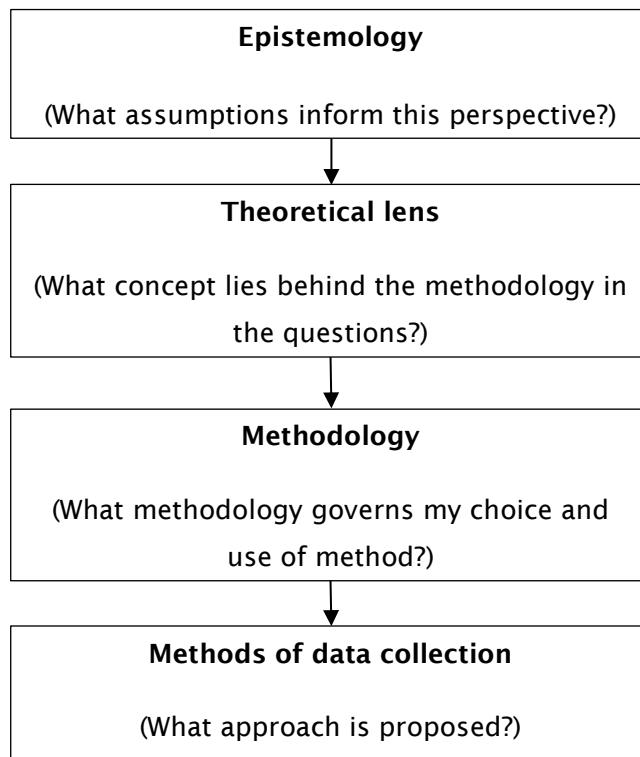


Figure 5-1 Four elements of developing a research project

[Source: Crotty, 1998]

For instance, in social enquiry, researchers can work with one of two distinctive paradigms: positivism/post-positivism, which is related to a quantitative approach; or naturalism/constructivism, which is connected with a qualitative approach (Johnson & Onwuegbuzie, 2004). The traditional 'quantitative versus qualitative' debate holds that these two paradigms are mutually exclusive: that it is impossible to merge these two paradigms because they are incompatible in terms of method, logic, epistemology, axiology, ontology and causal links – as shown in Table 5-1. For this reason, traditionally, researchers were forced to choose a '*monomethod*' design, deciding between either positivism/post-positivism or naturalism/constructivism.

Positivism is frequently referred to as a scientific method used to develop general laws in explaining and predicting the social world (Blalock, 2008; Mackenzie & Knipe, 2006; Robson, 2011). Positivists believe that social knowledge can be obtained through a deductive approach using hypothesis-testing (Lincoln & Guba, 1985). Corbetta (2003) notes that the boundary of the positivist paradigm employs the conceptual framework, measurement techniques, mathematical-statistical analysis and inference procedures of natural science. However, positivism has

been subjected to stern criticisms from various philosophical perspectives; principally, that it is doubtful that scientific knowledge can be directly obtained through one's own personal experiences. Science should deal with observable, not abstract, phenomena, and fact and value should be kept separately (Blaikie, 2008). As a result of these issues, positivism was succeeded by what is known as post-positivism, which contends that social knowledge is real, but it is knowledge that has probabilistic features, in that its results are probabilistically true and can change over time.

Constructionists/interpretivists, who have also been called 'qualitative purists', contradict the beliefs of the positivists and post-positivists (Johnson & Onwuegbuzie, 2004). They believe that social attributes are created via human interactions, rather than existing in their own right (Robson, 2011). This approach is often called 'interpretation'. According to this view, they emphasise inductive logic, which flows from the specific to the general in the generation of theory. The nature of research is subjective and can involve multiple realities, and researchers typically reflect this by supplying quotes to exemplify the different points of view (Creswell & Clark, 2011). Thus, neither context-free nor time-free findings are valid. In other words, understanding contexts in a research setting is essential; value, and the causal link between cause and effect, cannot be separated in this kind of research.

It is, however, widely acknowledged that competition between these two opposing camps is not advantageous for social research. Instead, *combining* them can make use of their individual strengths, while reducing associated weaknesses (Sale, Lohfeld, & Brazil, 2002). In philosophical terms, a pragmatic paradigm can integrate different perspectives and approaches, and bridge the gap in terms of common criticisms of either approach (see Table 5-1). Doyle et al. (2009, p. 178) claim that pragmatism advances "*the notion that the consequences are more important than the process and therefore that the end justifies the means*", so pragmatic approaches to research cannot in practice be driven by data or theory alone and processes that move back and forth between deductive and inductive approaches are permitted within the same project.

Dimensions	Research paradigm			
	Positivism	Post-positivism	Constructivism	Pragmatism
Methods	Quantitative	Quantitative	Qualitative	Quantitative and Qualitative
Logic	Deductive	Deductive	Inductive	Deductive and Inductive
Epistemology	Objective	Modified dualism, results likely objectively true	Subjective	Objective and subjective
Axiology	Value-free	Involving value which may be controlled	Value-bound	Values substantially influence the interpreting findings
Ontology	Naïve realism	Critical or transcendental realism	Realism	Accept external reality and select explanations that produce the desired findings
Casual links	Real causes temporally precedent to effects	There are some lawful, reasonably stable relationships among phenomena, but these may not be known perfectly. Causes are identifiable in a probabilistic sense that changes over time	All entities simultaneously shape each other and it is impossible to separate causes from effects	Causal relationship

Table 5-1 Comparisons of four main research paradigms

[Source: Tashakkori & Teddlie, 1998]

5.2 Mixed methods research

Mixed methods research is described as the ‘third research paradigm’ (Denscombe, 2008) or a ‘third wave’ approach (Johnson & Onwuegbuzie, 2004), in that it attempts to supersede the prevailing quantitative versus qualitative division by providing an alternative choice of logical and intuitive appeals (Johnson & Onwuegbuzie, 2004). The driver for this mixed methods approach is philosophical pragmatism. Pragmatists believe that the world is not absolutely unified, and so *multiple* paradigms, as opposed to any one paradigm, should be applied to research (Creswell, 2009). Pragmatism allows researchers to employ freely both quantitative and qualitative approaches, if suitable and as required.

It is recognised as worthwhile to combine quantitative and qualitative approaches in a single study because it encourages researchers to enhance perspectives by adopting multiple worldviews (Creswell & Clark, 2011). It can be said that the strengths of the quantitative approach are the weaknesses of the qualitative approach, and vice versa. For instance, the common criticism of quantitative orientations is that there is insufficient understanding of context, poor attention paid to the opinions of participants and too little discussion around interpretation; while the qualitative approach is criticised for being too open to personal interpretation, which can easily lead to biased results that are difficult to generalise to a larger population (Creswell & Clark, 2011). Therefore, mixed method research, as noted by Teddlie and Sammons (2010), usefully integrates the differences of typologies in both quantitative and qualitative approaches, creating flexibility and originality in construction and implementation. Additionally, as stated by Johnson and Christensen (2012, p. 432), mixed methods advises researchers to:

thoughtfully mix or combine qualitative and quantitative research methods, approaches, procedures, concepts, and other paradigm characteristics in the way that produces an overall design with complementary strengths (broadly viewed) and nonoverlapping weaknesses.

Teddlie and Tashakkori (2009) claim that mixed methods design provides greater understanding than a single approach design could provide. Firstly, questions identifying both confirmatory and exploratory issues can be simultaneously addressed in mixed methods research. For example, studies aim to answer two main questions: which particular variables significantly affect the interested

variables, and how and why do such relationships occur? Secondly, mixed methods research produces stronger points of view. Finally, mixed methods research provides diversity of viewpoints and voices.

Greene (2007) claims that using the mixed methods approach makes for a better understanding of social phenomena for the following reasons:

- Enhances the validity and credibility of results
- Provides a broader, deeper and more inclusive understanding of social phenomena
- Unsettles the settled, probes the contested, challenges the given, engages the multiple - often with a discordant set of perspectives and lens
- Does not just illuminate the political and value dimensions of work, but also engages with each other about differences in opinion to promote dialogue.

In practice, the essential attributes of the mixed methods approach involve: collecting and analysing both quantitative and qualitative data; combining the two sets of data; prioritising one or both of the sets of data; utilising these processes or procedures in a single study or series of studies; organising these processes or procedures within philosophical worldviews and theoretical lenses; and then merging these processes or procedures into specific research designs.

5.3 Rationale of mixed methods research

It is accepted that each type of research (quantitative, qualitative and mixed research) may prove superior under different circumstances (Johnson & Onwuegbuzie, 2004). Broadly speaking, quantitative research is about *testing* theory, whereas qualitative research is important for *building* theory. Mixed methods research, on the other hand, is an integration of these two approaches, which can be greatly beneficial, especially in situations where one approach alone is not enough to fully understand a phenomenon. Nevertheless, it does not supersede or replace either of the two main approaches in social enquiry; instead it is used to draw out advantageous attributes and avoid disadvantageous ones of both approaches.

Greene (2007) identifies five main purposes for undertaking mixed methods approach, which are consistent with Bryman's (2008b) research findings:

- *Triangulation*: investigating whether the findings are consistent or convergent by comparing the findings derived from each approach

- *Complementarity*: examining or overlapping different dimensions or aspects of phenomena
- *Development*: utilising the methods sequentially; that is, the findings from one method informs the use of another method
- *Initiation*: searching for differences or paradoxes of the same phenomena
- *Expansion*: extending the range or scope of research by using different approaches to assess different phenomena.

5.4 Strategies of enquiry and school effectiveness research

School effectiveness research stems from concerns about current matters in educational strands, often issues that are highly ambiguous in nature.

Sophisticated strategies may be required to address these ambiguities. Under the existing umbrella of school effectiveness research, emphasis is on the phenomena throughout schools (Teddle & Sammons, 2010). Research can be divided into three main traditions: school effects research, effective school research and school improvement (Reynolds et al., 2000). Reynolds et al. (2000) discuss common enquiry strategies relating to the development of school effectiveness:

- **School effects research** – This research mainly involves the investigation of scientific properties of school effects. In this research field, the aim is to investigate the correlation of student, classroom and school level with effectiveness. Mathematical and statistical studies on school effects have been developed from, for example, a study of Coleman et al. (1966), widely known as '*the Coleman Report*', which conducted research on the educational production function with multiple regression models through the use of multilevel modelling [e.g. Kyriakides and Creemers (2012), Muijs and Reynolds (2003), Rumberger and Palardy (2004), and Goldstein (1997)]. In addition, other advanced statistical methods extended from the traditional multilevel model, such as multilevel structural equation modelling [e.g. Goldstein and Rocher (2007) and Mahimuang (2005)], multilevel latent growth curve model [e.g. Choi and Goldschmidt (2010), van der Werf, Opdenakker, and Kuyper (2008)] and multilevel structural equation modelling [e.g. Steele, Vignoles, and Jenkins (2007)] have also been widely used. Therefore, it can be said that improving advanced statistical techniques plays an important role in developing and enhancing the body of knowledge in the field of school

effects research, which can be used to build more complex models to understand the nature of real education.

- **Effective school research** – This research is primarily concerned with the process of effective schooling. Reynolds et al. (2000) state that, in the early stages, studies were focused on extreme cases, such as a study by Edmonds (1979) concerning effective schools for urban poor areas. Knowledge in this area has been accumulated to identify effective schools, as summarised by Reid, Hopkins, and Holly (1988), Reynolds, Sammons, Stoll, Barber, and Hillman (1997) and Harris, Jamieson, and Russ (1997). The descriptive statistics, based on the quantitative orientation for explaining the characteristics of effective schools, are used to incrementally enhance an explanation in the case study based on qualitative orientation. Therefore, these studies are fundamentally orientated to qualitative rather than quantitative data collection. However, the quantitative approach is also meaningfully adapted to different purposes in terms of collecting narratives, thereby requiring the mixed methods approach.
- **School improvement research** – this relates to school process and school change. Reynolds and Stoll (1996) point out that this study focuses on dynamic orientation (school as it has been or might be), and the journey to school improvement, rather than its final destination. Studies on school improvement are based primarily on the quantitative approach. Nevertheless, mixed method research can also provide understanding in this field.

5.5 Mixed methods research and school effectiveness research

As evident in the previous section, it can be claimed that the majority of studies are based on the quantitative approach (Fidler, 2001; Teddlie & Sammons, 2010). However, the mixed methods approach has also received considerable attention and has been adopted in studies as researchers become more aware of the limitations of using one method alone to fill the gap of knowledge. As mentioned by Teddlie and Sammons (2010, p. 129),

'Combining QUAN and QUAL methods may be the best way to answer comprehensively important EER [educational effective research] questions related to both causal effects and causal mechanisms, thereby allowing the further development of theoretical models.'

Teddlie and Tashakkori (2009) describe three main ways that the mixed methods approach has contributed to educational effectiveness research. Firstly, the mixed methods approach can deal simultaneously and comprehensively with a range of exploratory and confirmatory issues. In relation to a causal effect and causal mechanism as a key nature of the educational effectiveness research, the mixed method enables research to both verify and generate theory in the same study. Secondly, it can provide finer and more robust meta-inferences, due to the use of various data sources and perspectives. The findings from mixed methods research thus gains broader and deeper information. Finally, it provides a wealth of divergent viewpoints. Furthermore, it provides an opportunity to understand inconsistent results and to subsequently design further studies.

Their discussions on applications of mixed methods research to educational effectiveness research in terms of methods, logic and generalisation are as follows:

- **Methods**

Considering the methods used in educational effectiveness research, almost all studies are fundamentally based on the quantitative approach. It is believed that research projects can augment some values including qualitative orientation (Teddlie & Sammons, 2010). Moreover, mixed methods research significantly improves the level of methodological triangulation. Such triangulation may generate convergent or divergent findings, which allow researchers to revise conceptual frameworks and assumptions.

- **Logic**

The process related to the theory and hypothesis testing associated with the inductive approach is called '*context of justification*', while the process connected with the theory and hypothesis generations referring to deductive approach is called '*context of discovery*' (Teddlie & Sammons, 2010). However, Teddlie and Sammons (2010) state that mixed methods research requires both the context of justification and of discovery within the same research studies. Consequently, conducting educational

effectiveness research with the mixed methods research relates to theory or hypothesis testing under the theoretical framework combined with research questions or topics about which little is known. The derived results from this approach presumably generate a body of knowledge eliciting answers to research questions using the inductive approach.

- **Generalisation in EER**

In terms of generalisation, it is believed that pragmatists tend toward constructing ideographic statements (Teddlie & Sammons, 2010). For example, the generic theory study in educational effectiveness by Creemers and Kyriakides (2008) was designed to be conducted in different settings across the global research community, although it is typically accepted that the factors directly and indirectly affecting students, teachers or schools may differ between countries. Regardless, these differing aspects are consolidated into a unifying generic theory of educational effectiveness.

5.6 Standpoint of philosophical underpinning in the study

As mentioned in the previous section, each research paradigm implicitly manifests the standpoints of the individual researcher's beliefs, values and assumptions (Morgen, 2007). Nevertheless, ideally the selection of method should be based on both maximising strengths and minimising weaknesses in order to fully comprehend the phenomena being studied. In this study, the mixed methods approach under the pragmatic paradigm is adopted – since it is worthwhile to take the strong points of both quantitative methods associated with post-positivism, and qualitative methods relating to constructivism.

The objectives of the study feature questions relating to '*what*', '*how*' and '*why*'. To answer questions such as these, Teddlie and Tashakkori (2009) identify that the pragmatic paradigms associated with mixed methods research are the most appropriate path to adopt. In particular, the quantitative approach is a better method for studying the '*causal effect*', such as an investigation of whether X brings about Y because the researcher has better control of extraneous variables in research designs. Conversely, the qualitative approach is a better option in situations where the researcher needs to investigate the process or causal mechanism, for example, how does X cause Y?

Figure 5-2 depicts the standpoint of research paradigms and types of mixed methods research, combining the quantitative method with qualitative method used in the study on a research continuum. Although this study employs the pragmatic paradigm to support the mixed methods approach, the degree of mixed method gives the quantitative approach dominance, since the nature of school effectiveness research is entirely based on quantitative research. In other words, the qualitative data is used to enhance and support the quantitative findings. This design, therefore, is called *quantitative dominant mixed methods research* (Johnson et al., 2007), *explanatory mixed methods design* (Creswell & Clark, 2011) or *partially mixed sequential dominant status design* (Leech & Onwuegbuzie, 2009). However, it is to be understood that, while quantitative data dominates, the qualitative data provides advantages that quantitative data could never achieve alone.

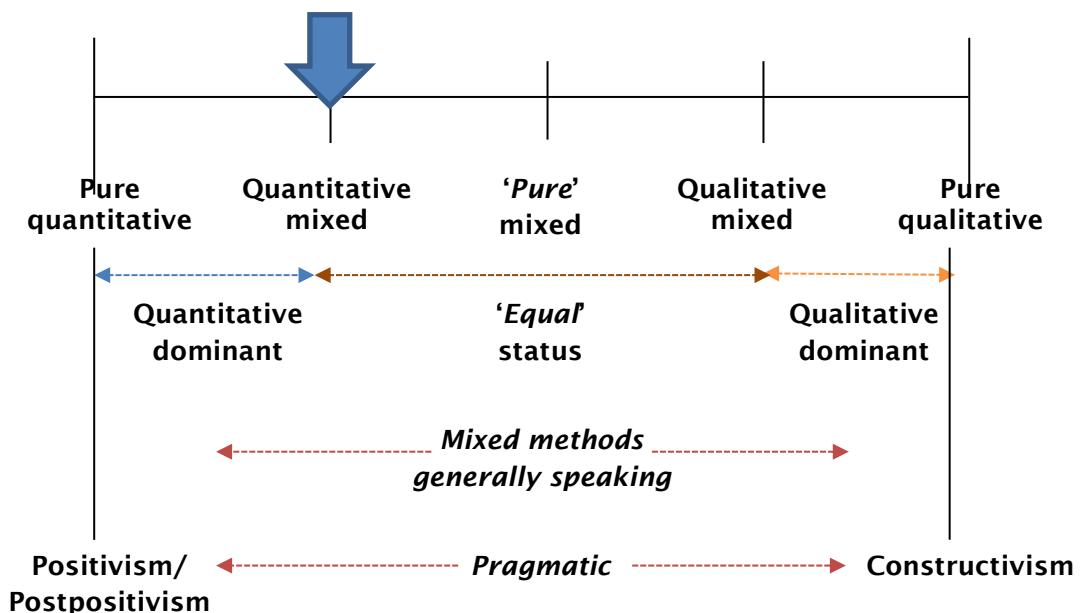


Figure 5-2 Diagram of a standpoint in research paradigms and the types of mixed methods research applied in the study
 [Developed from Johnson et al, 2007]

5.7 Research design in the study

Colloquially, the research design is a logical plan for getting from here to there, where here may be defined as the initial set of questions to be answered, and there is some set of conclusions (answers) about these questions (Yin, 2009, p. 26).

Research designs work as a plan of action for conducting research closely connected with philosophical assumptions, strategies of enquiry, and research methods (see Figure 5-3). Their function is to establish the proposed research plan, so that each procedure and activity is accomplished efficiently and effectively while ensuring that any evidence obtained allows the researcher to answer the research questions with as little ambiguity as possible (Kumar, 2014). This means all schemes need to meet the requirements in terms of validity, objectivity and accuracy in to answer the research questions.

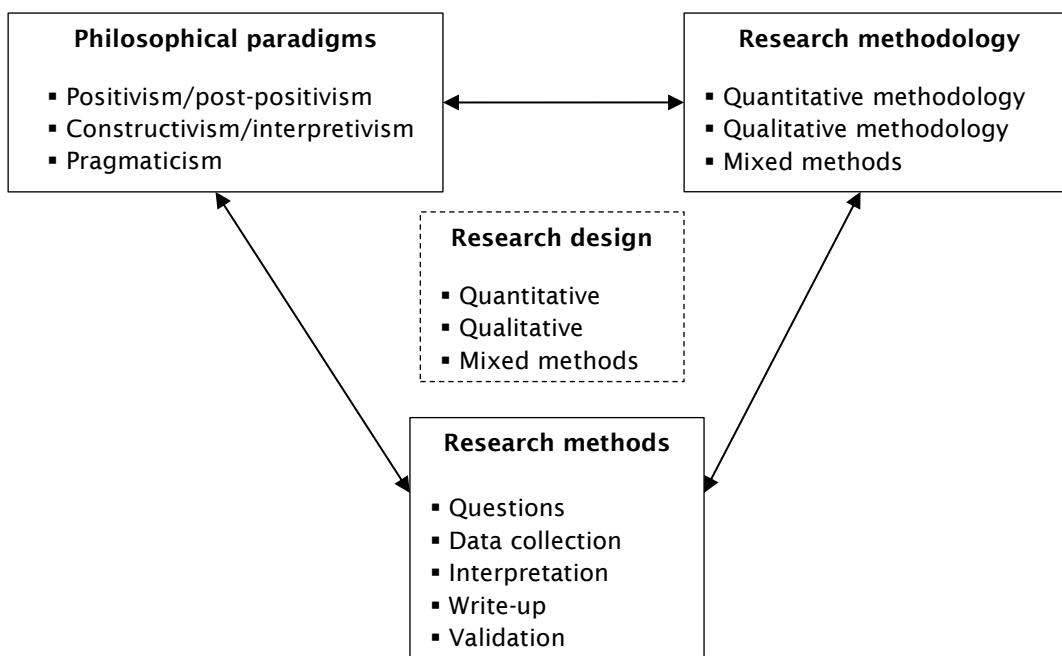


Figure 5-3 Research design as intersection of philosophical paradigms, research methodologies, and research methods

[Source: Creswell, 2009]

The quality of research for answering given research questions is determined by research design. For this reason, prior to discussing which research design is used in the study, major criticisms surrounding methodological issues, derived from the previous empirical studies in school effectiveness research, will be considered in order to improve the research design in the study. This study, therefore, follows major methodological concerns as summarised by Teddlie et al. (2000); the proposed approaches are described in Table 5-2.

Topic	Explanation	Approach used in the study
Overreliance on quantitative methods and data	An emphasis on quantitative approach only in the studies	Mixed methods research with quantitative dominant in the study
Sampling	The use of narrow, skewed and small sample sizes (the problem in generalisation)	<ul style="list-style-type: none"> ▪ Collecting data from whole target population ▪ Focusing on studying in the large-and-complete scale dataset in a particular province ▪ Testing how representative the data is if data is not one-hundred-percent complete.
	Small sample sizes may cause insufficiencies in the unit of analysis (Kennedy & Mandeville, 2000)	
	Exclusion of a typical school level in outlier studies	
	Sampling and measurement error in the large-scale studies	
	Selection bias	
Specification of school-level process variables	Measuring process variables as the black box	School-level process variables based on the dynamic model of educational effectiveness developed by Creemers and Kyriakides (2008) adopted in the study
Specification of measure of school outcomes	Limited use of school outcomes	Student outcomes used in the study consist of eight main strands according to Basis Education Core Curriculum B.E. 2551 (A.D. 2008) from the Ministry of Education, Thailand. These are closely connected to the learners' key competencies: communication, thinking, problem-solving, applying life skills and technological applications.
Unit of analysis	Use of aggregated data to the upper level causes biased estimators	Hierarchical data structure based on the nature of educational system including: <ul style="list-style-type: none"> ▪ Student ▪ Classroom ▪ School
Number of levels	<p>The number of levels included in the multilevel model</p> <ul style="list-style-type: none"> ▪ the higher level, the lower the stability in the findings ▪ omitting the important levels at the hierarchical data structure causes misleading 	
Lack of longitudinal data	Falling along a continuum of growth or development at any point of time (e.g. student progress)	Measuring student outcomes in the study uses two-period outcomes: prior attainment (Grade 6) and post attainment (Grade 9)

Table 5-2 Major methodological concerns in school effectiveness research and the approaches adopted in the study

[Source: Teddlie et al., 2000; Kennedy & Mandeville, 2000]

With regard to the philosophical standpoints addressed earlier, mixed methods research is adopted in this study. Importantly, selecting the most suitable type of mixed methods design in the study depends upon which approach can best answer research questions and which major rationales for employing the mixed methods design are taken into account (Doyle et al., 2009). Table 5-3 outlines the dimensions and questions which need to be considered in selecting the type of mixed methods in the study, and Figure 5-4 depicts the hierarchical procedure of alternative pathways in the mixed methods design.

Dimensions	Questions concerned	This study
Timing	<ul style="list-style-type: none"> ▪ What is the timing of qualitative and quantitative methods? ▪ In which order does the researcher collect and use data? ▪ Is the design concurrent or sequential? ▪ Does data conversion occur? 	<p><i>Sequential design</i></p> <p>Quantitative ↓ Qualitative</p>
Weighting	What is the relative importance, weight or priority given to quantitative and qualitative methods to answer the research questions?	<p><i>Quantitative dominant</i></p> <p>QUANTITATIVE (QUAN) ↓ qualitative (qual)</p>
Mixing	<ul style="list-style-type: none"> ▪ How are quantitative and qualitative mixed? ▪ How are two data sets merged? ▪ Is the study mixed in the experiential stage, across stages, or other mixture? 	<p><i>Connect</i> (Quantitative data build upon qualitative data)</p> <p><i>Embed</i> (Qualitative data is used for supporting quantitative data)</p>
Functioning	Which function does the research serve?	<p><i>Complementarity</i> (Elaboration by using qualitative data to provide deep understanding whereas quantitative data provides broad understanding)</p> <p><i>Expansion</i> (Using qualitative data to explain the finding of quantitative data)</p> <p><i>Sampling</i> (Selecting the qualitative informants based on the quantitative findings)</p>

Table 5-3 Types of mixed methods design adopted in the study

[Adapted from Teddlie and Tashakkoori, 2006; Cresswell and Clark, 2011]

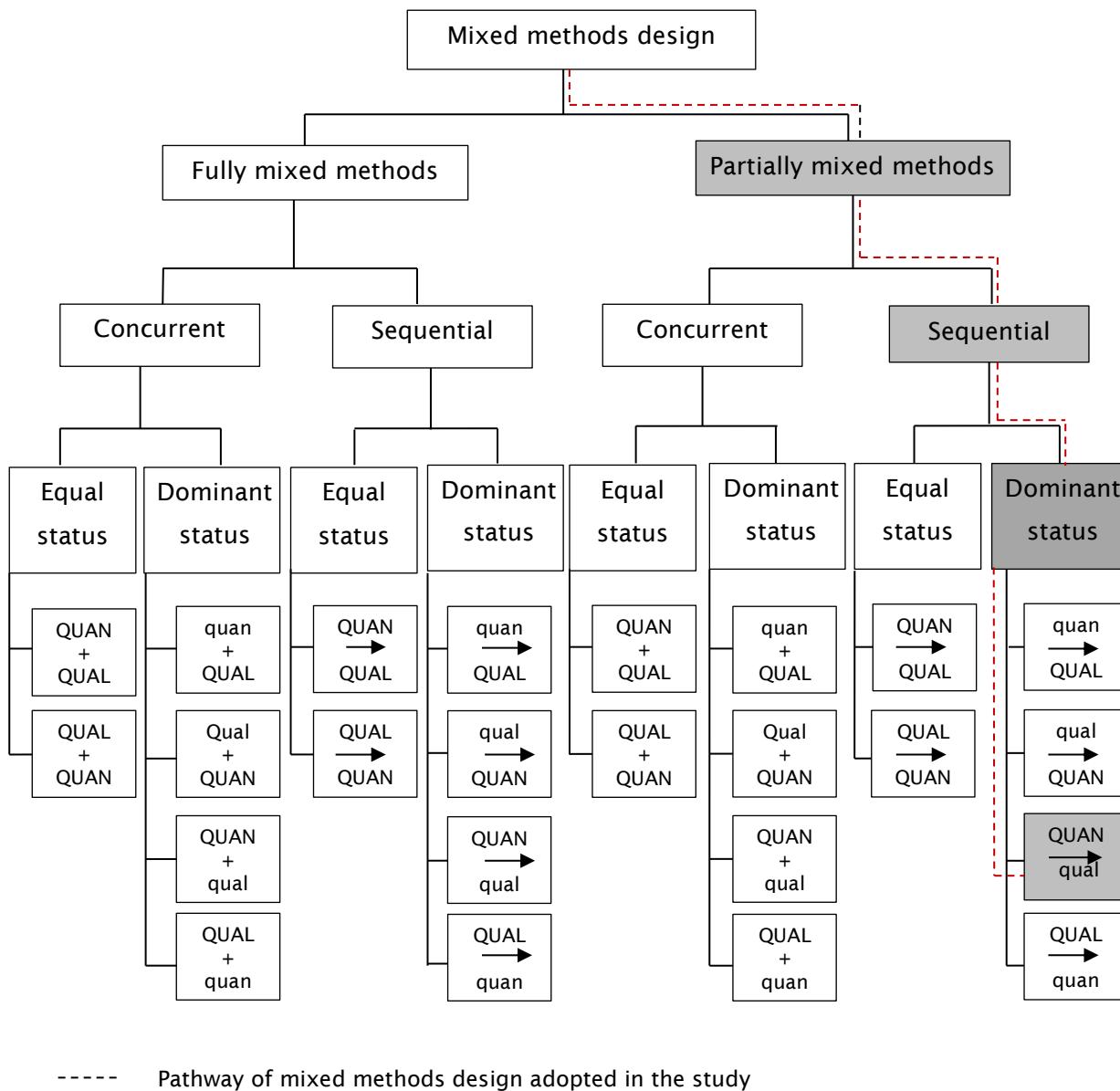


Figure 5-4 Typology of mixed methods design adopted in the study

[Source: Leech and Onwuegbuzie, 2009]

As for the rationale to illustrate the various advantages and capacities of the mixed methods design in the study, the significant issues raised by Creswell and Clark (2011) include three main dimensions, namely: timing, weighting and mixing. The possible answers cause the differences in the mixed methods design in terms of:

- Providing the options to enhance the validity and reliability of qualitative results

- Exploring contradictory findings existing in the quantitative and qualitative findings
- Enhancing the generalisation of qualitative findings
- Determining criteria for selecting a subsample from a population

With regard to timing, weighting, mixing and functioning as criteria for selecting the mixed methods types, the type of mixed method adopted in this study is the ‘sequential explanatory design’ (Creswell & Clark, 2011; Ivankova, Creswell, & Stick, 2006), ‘sequentially mixed design’ (Teddlie & Tashakkori, 2009) or ‘partially mixed sequential dominant status design’ (Leech & Onwuegbuzie, 2009). It consists of two main phases: the quantitative phase and qualitative phase. The study commences with the quantitative phase (phase I), followed by the qualitative phase (phase II) (see Figure 5-5). The significant feature of this design is that it commences with a strong quantitative design and the design itself induces emergent approaches for the later qualitative phase, which is formulated from the quantitative phase (Creswell & Clark, 2011). To comprehend the phenomena, new possible questions emerging from the quantitative results that cannot be explained by the quantitative results will be developed in the later qualitative phase. Moreover, it enables the researcher to identify the criteria of participant selection in the qualitative research (Creswell & Clark, 2011). It also allows the researcher to clarify the subsample from the population, based on the particular findings from the quantitative study as a representative of the target population. It is useful in reflecting the broader population and enhancing ability for the generalisation of qualitative findings; moreover, it helps to scope a specific population of interest in the study, which is sometimes difficult to identify (Hesse-Biber, 2010).

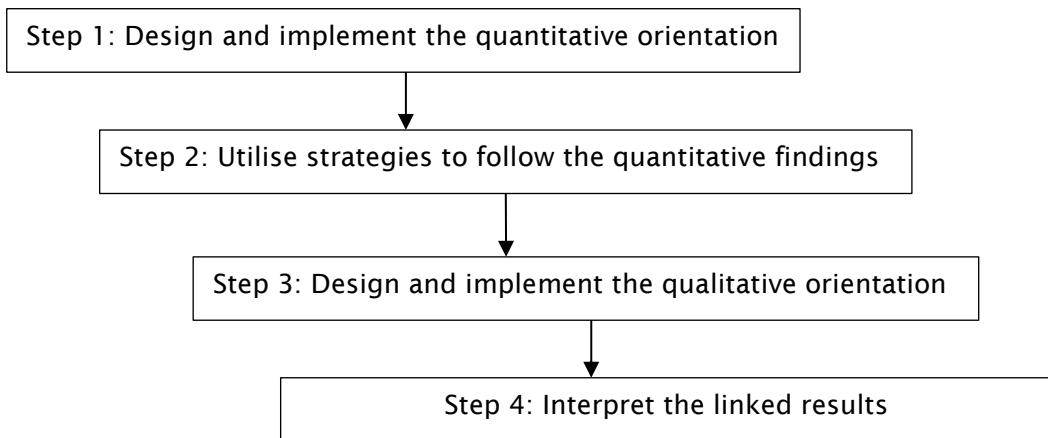


Figure 5-5 Procedures in implementing the explanatory mixed methods design

[Source: Creswell and Clark, 2011]

The prototypical characteristics of explanatory mixed methods design adopted in the study are illustrated in Table 5-4.

Prototypical characteristics	Explanatory mixed method design in this study
Definition	<ul style="list-style-type: none"> Methods sequentially employed, commences with the quantitative phase (phase I) followed by the qualitative phase (phase II) Research design in phase II is based on the findings in phase I
Design purpose	<ul style="list-style-type: none"> Findings in the quantitative phase need more explanations with qualitative findings Findings in the quantitative phase are used to determine criteria for selection in the qualitative phase
Typical paradigm	<ul style="list-style-type: none"> Pragmatic paradigm <ul style="list-style-type: none"> Phase I: Postpositivism Phase II: Constructivism
Level of interaction	<ul style="list-style-type: none"> Interactive
Priority of strands	<ul style="list-style-type: none"> Quantitative dominant (QUAN and qual)
Timing of strands	<ul style="list-style-type: none"> Sequential, with the quantitative research followed by qualitative research (QUAN→ qual)
Primary point of interface for mixing	<ul style="list-style-type: none"> Data collection (Cases in phase II are purposively selected from those in phase I)
Primary mixing strategies	<ul style="list-style-type: none"> Linking the two strands: <ul style="list-style-type: none"> From quantitative data analysis to qualitative data collection Use quantitative findings to indicate the qualitative research questions, participant selection criteria and data collection in phase II
Common variants	<ul style="list-style-type: none"> Explanations Participant selection

Table 5-4 Summary of prototypical characteristics of explanatory mixed methods design used in the study

[Adapted from Creswell and Clark, 2011]

5.8 Chapter summary

This study employed a methodology based on a pragmatic paradigm. A mixed research method with explanatory designs was used to investigate the research questions posed. Combining quantitative and qualitative methods provided the best way to investigate causal effects and causal mechanisms in terms of theory testing and theory developing. The standpoint of this study was located in the '*quantitative dominant mixed methods research*'. As a result, the research project consists of the following main phases: the first phase is the quantitative research, relating to modelling school effectiveness and equity attainment; the second phase is the qualitative phase, which employs a multiple case study design.

6. Chapter 6: Methodology and methods: Quantitative phase

The purpose of this chapter is to present a coherent quantitative research methodology, which addresses the research questions described in the previous chapter. The chapter begins with a description of the research setting and scope of the study. It then continues with a discussion of the research instrument, the variables and their measurements, the data collection process, and the data analysis. The final section includes a conceptual framework and discusses the limitations of the quantitative research phase.

6.1 Research setting

Prachin Buri Province is located in the east region of Thailand (see Figure 6-1), which is approximately 136 kilometres from the Bangkok Metropolitan area. It covers 4,762,362 square kilometres and has a population of 468,342 people, making it the 57th most populous province (of 76) in Thailand. In administrative terms, Prachin Buri has 7 districts, 64 subdistricts, 708 villages and 171,228 households.

Prachin Buri provides education at every level, from pre-school to higher education, including non-formal education. The institutions responsible for the different types of education are as follows:

- The Office of Primary Education Service Area
 - The Office of Prachin Buri Primary Education ‘Service Area I’ covers 129 schools
 - The Office of Prachin Buri Primary Education ‘Service Area II’ covers 121 schools
- The Secondary Educational Service Area covers only one area; namely, the Secondary Educational Service Area VII (covering Prachin Buri Province, Sa Kaeo Province and Nakhon Nayok Province), which has 19 schools
- Private Educational Institutes (school system) are divided into two main types: elementary education and vocational education. There are 27 schools operating from elementary level to higher vocational certificate level, 23 elementary schools, and 4 vocational schools
- Private Educational Institutes (non-school system) cover 11 schools

- Local education organisation has 8 schools
- There is one university

Based on national testing scores, namely the O-NET, in Grade 9 in the lower secondary level in the academic year 2012/13, Prachin Buri was ranked 50th out of 76 provinces in Thai Language, 47th in Social Studies, and Culture and Religion, 55th in English Language, 60th in Mathematics, 54th in Science, 45th in Health and Physical Education, 59th in Arts and 47th in Occupation and Technology (See Figure 6-2-Figure 6-9).

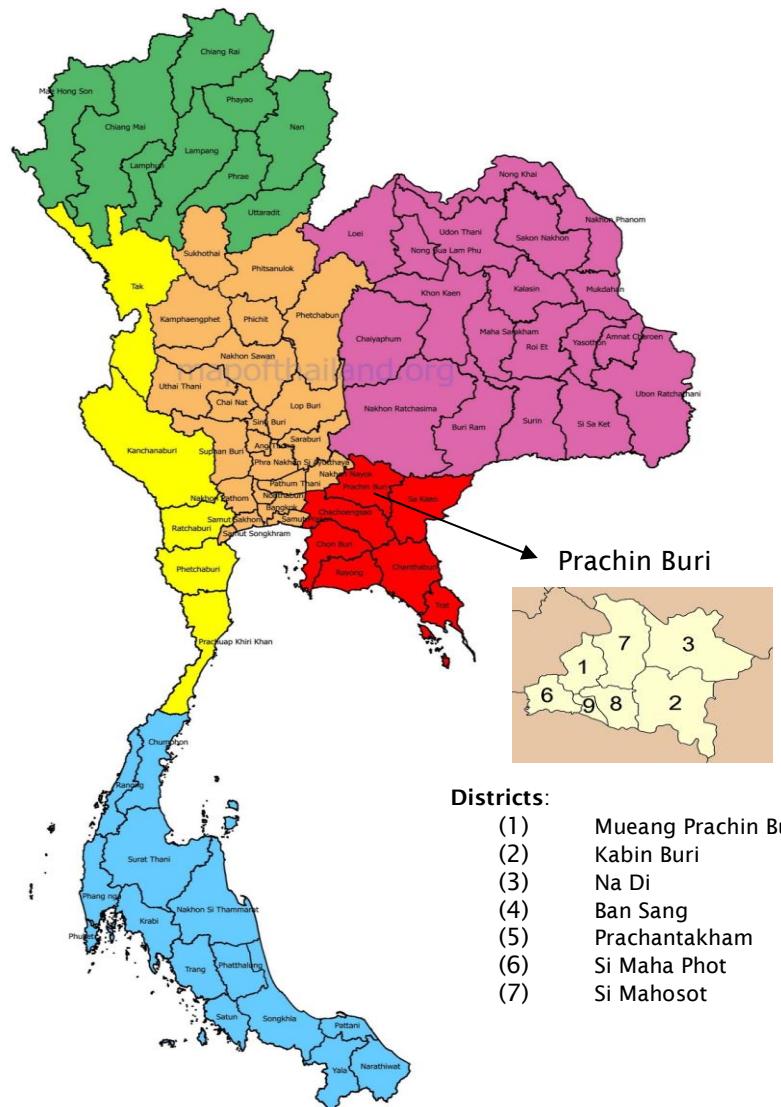


Figure 6-1 Map of Thailand and Prachin Buri Province

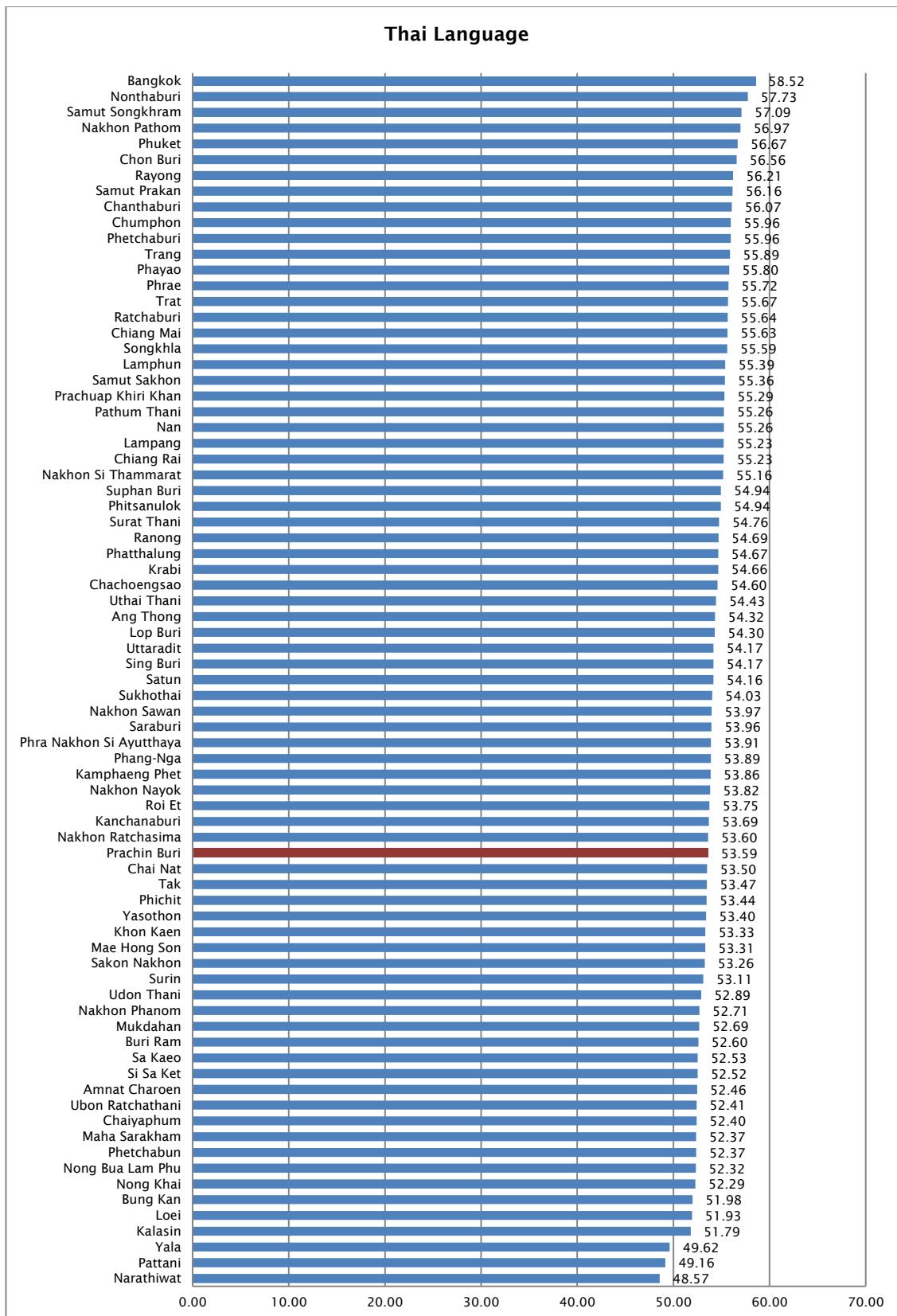


Figure 6-2 O-NET scores in Thai language in the academic year 2012/13

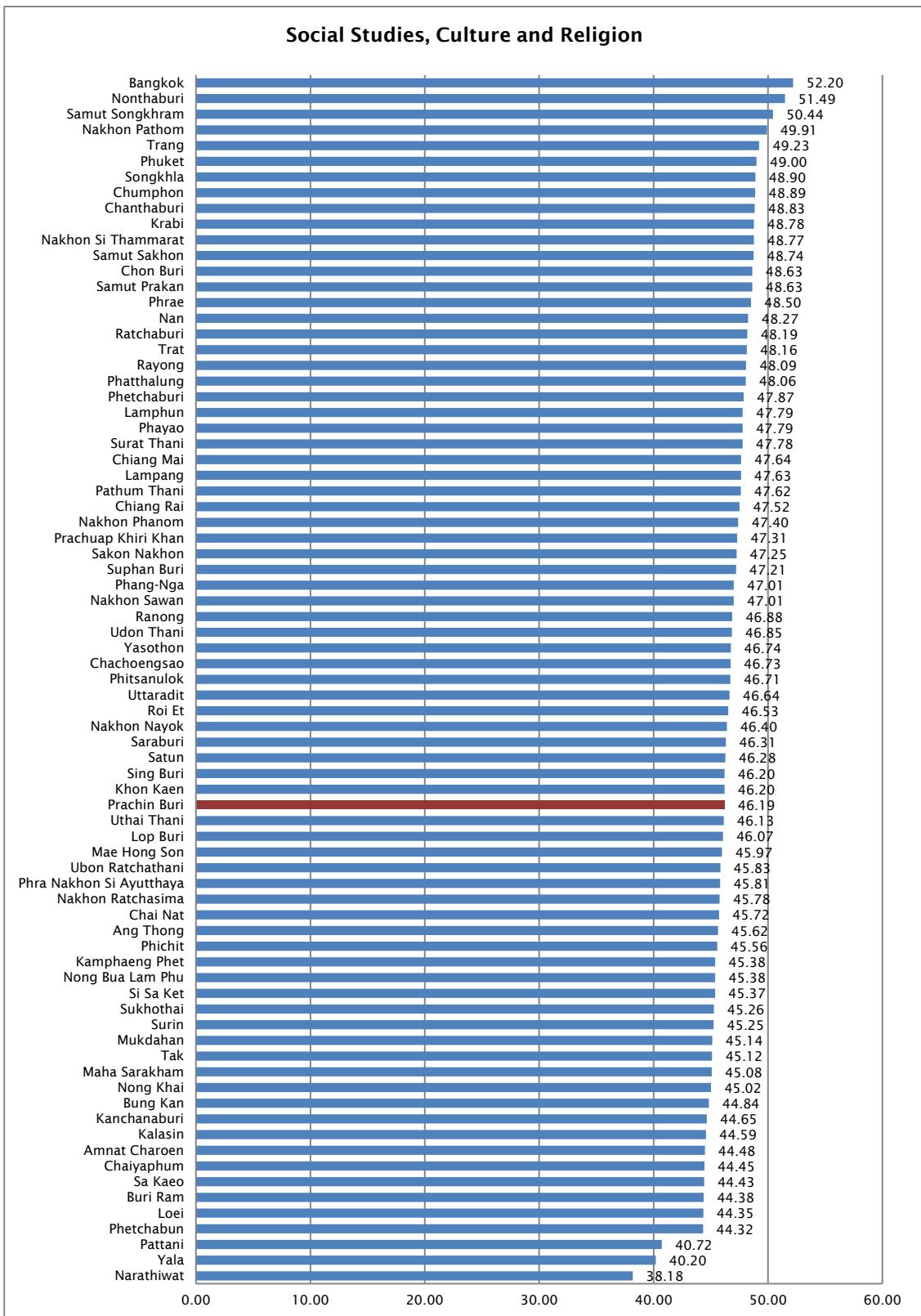


Figure 6-3 O-NET scores in Social Studies, Culture and Religion in the academic year 2012/13

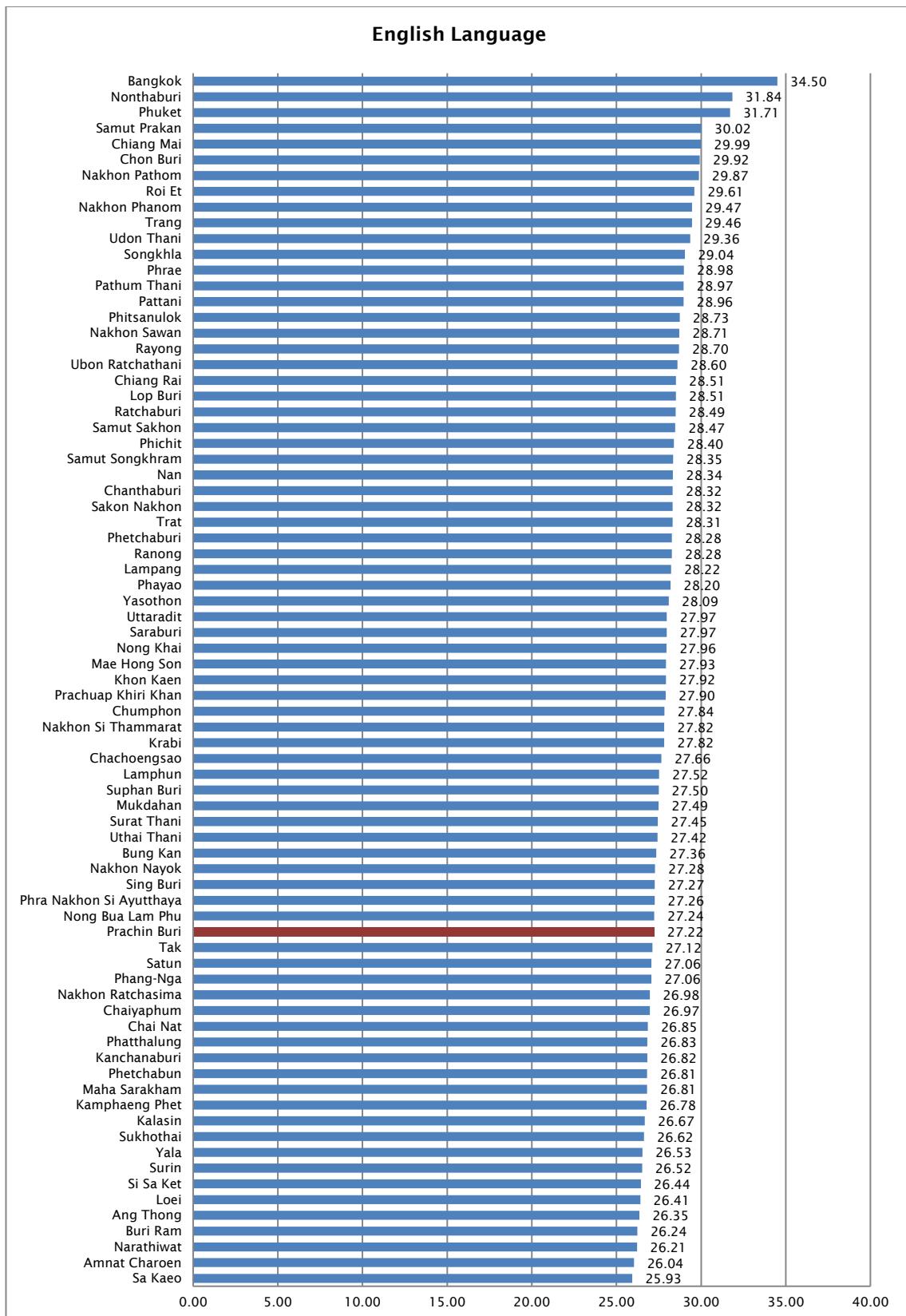


Figure 6-4 O-NET scores in English Language in the academic year 2012/13

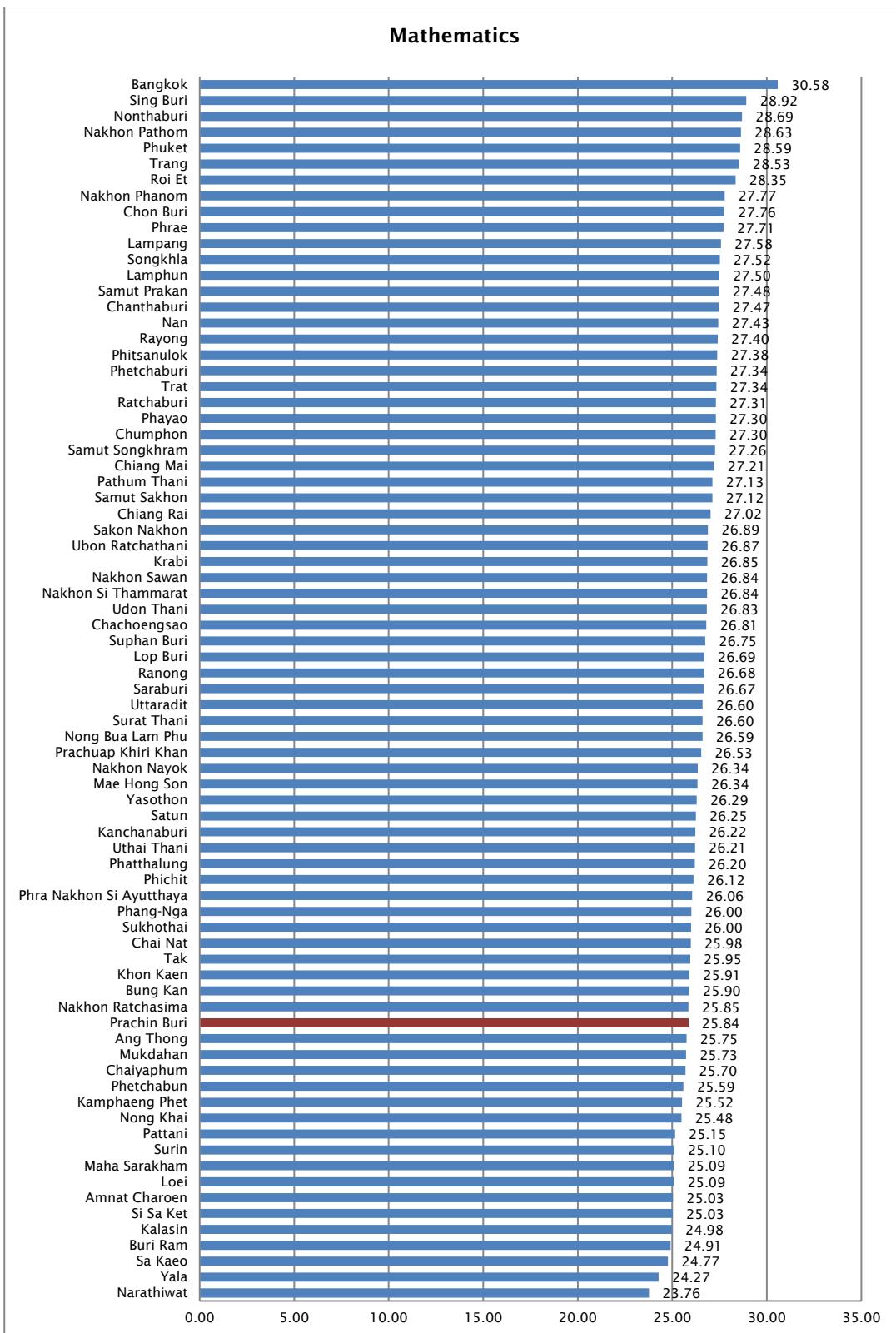


Figure 6-5 O-NET scores in Mathematics in the academic year 2012/13

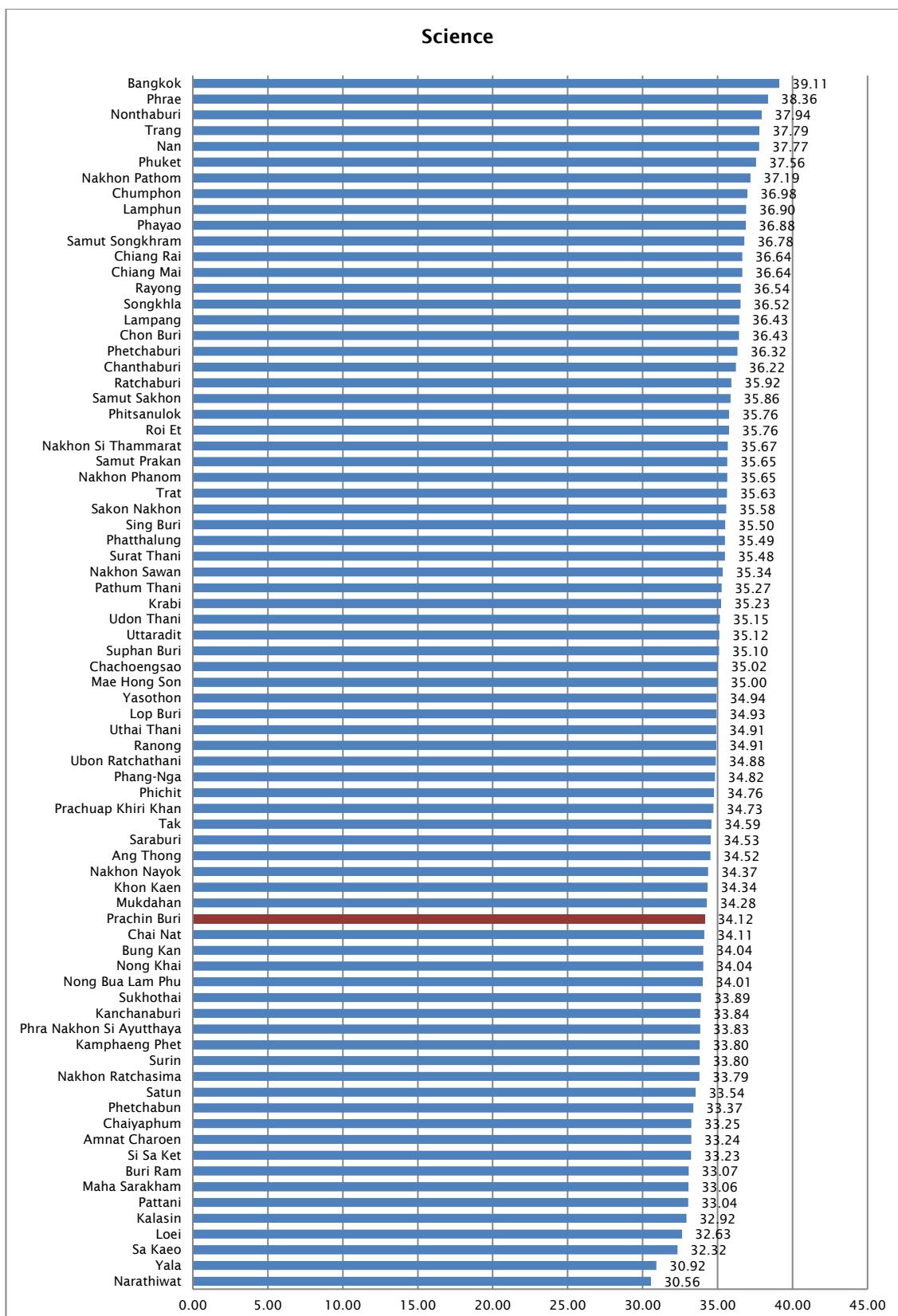


Figure 6-6 O-NET scores in Science in the academic year 2012/13

Health and Physical Education

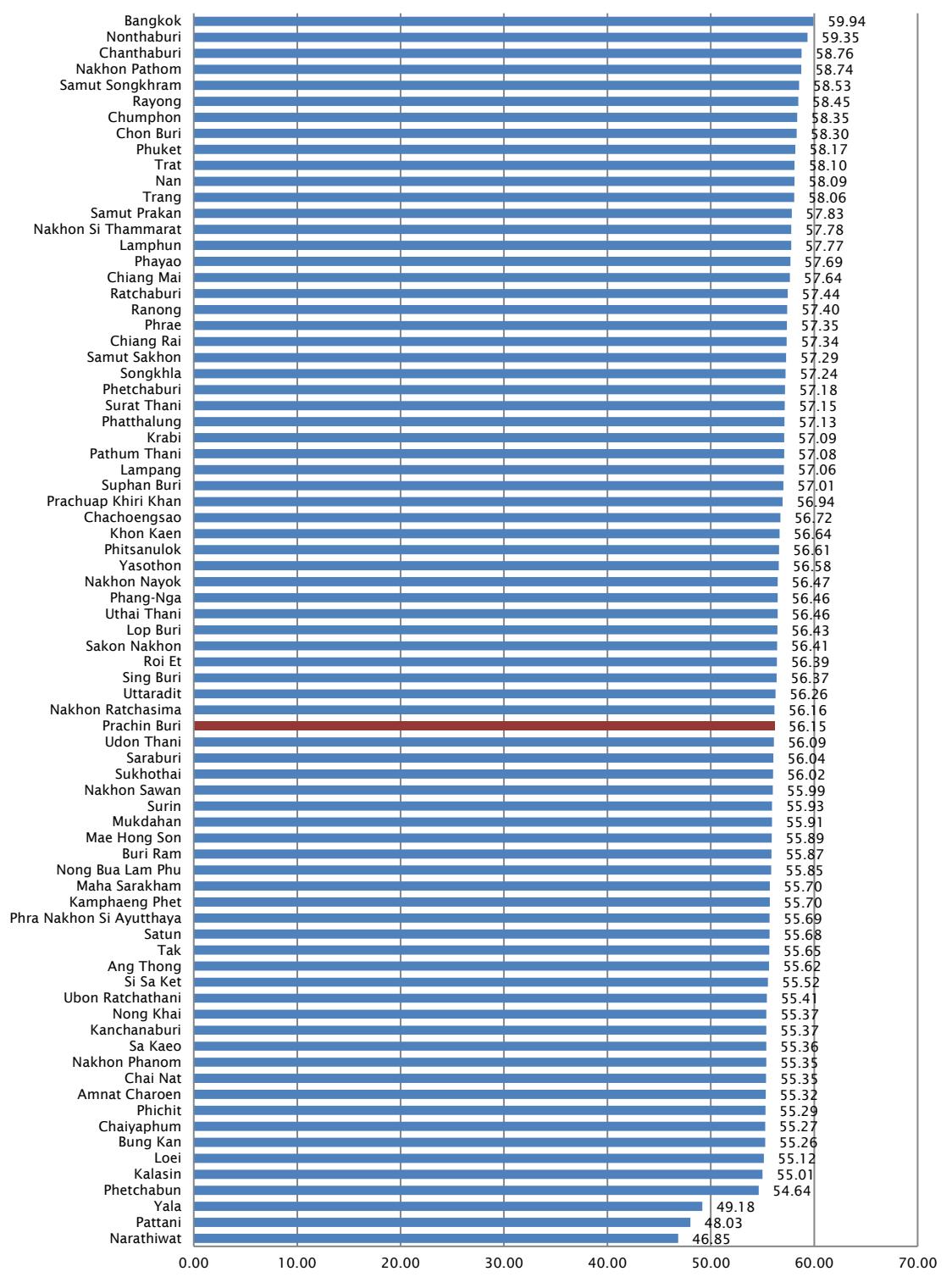


Figure 6-7 O-NET scores in Health and Physical Education in the academic year
2012/13

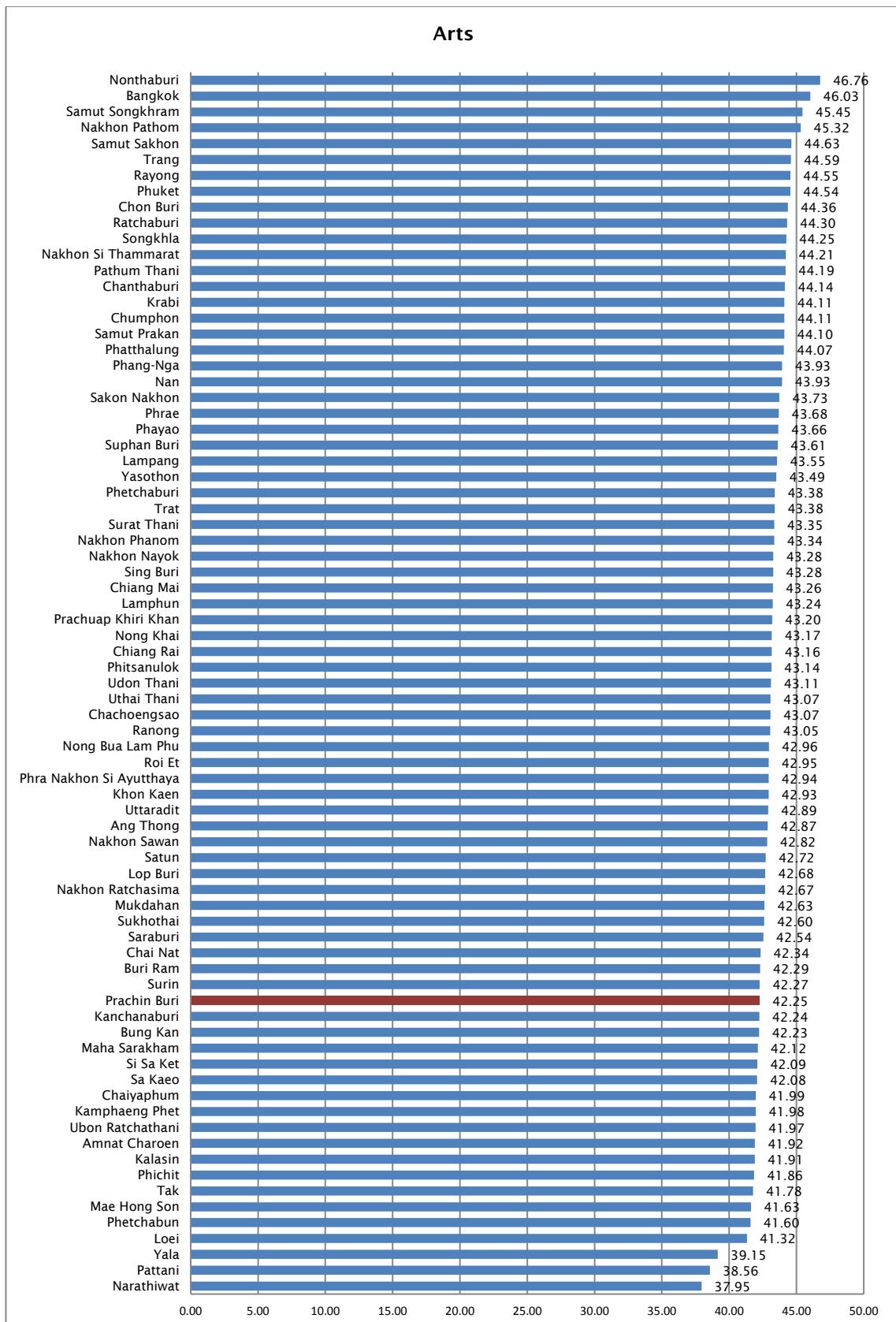


Figure 6-8O-NET scores in Arts in the academic year 2012/13

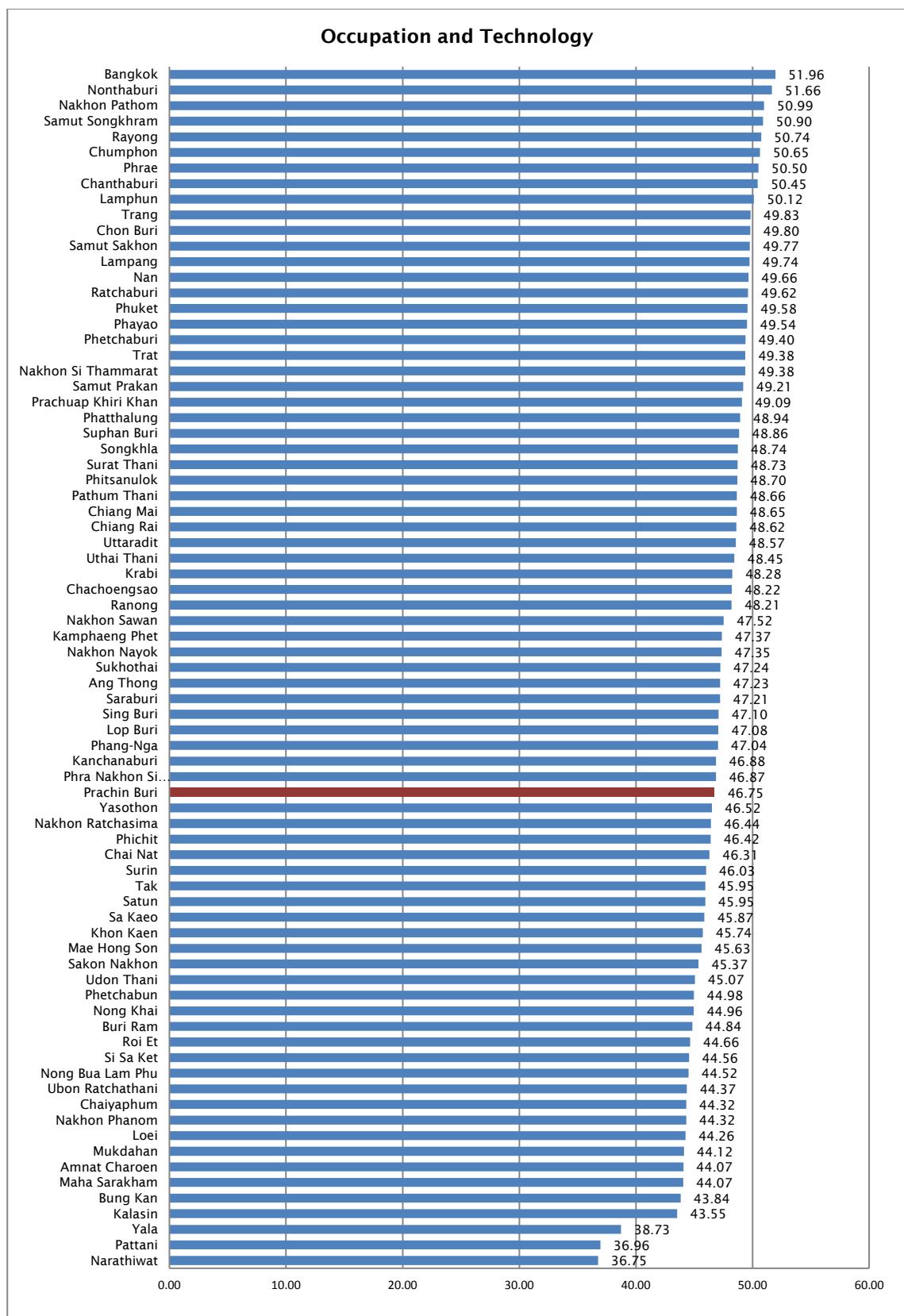


Figure 6-9 O-NET scores in Occupation and Technology in the academic year
2012/13

In economic terms, using Gross Provincial Products (GPP), Prachin Buri was ranked fourth most prosperous in the East region and eleventh overall in Thailand. Its major economic sectors are industrial production at 76.6% of GPP, followed by wholesale and retail trade, repair of motor vehicles, motorcycles and personal and household goods at 9.61% in 2011 (see Figure 6-10).

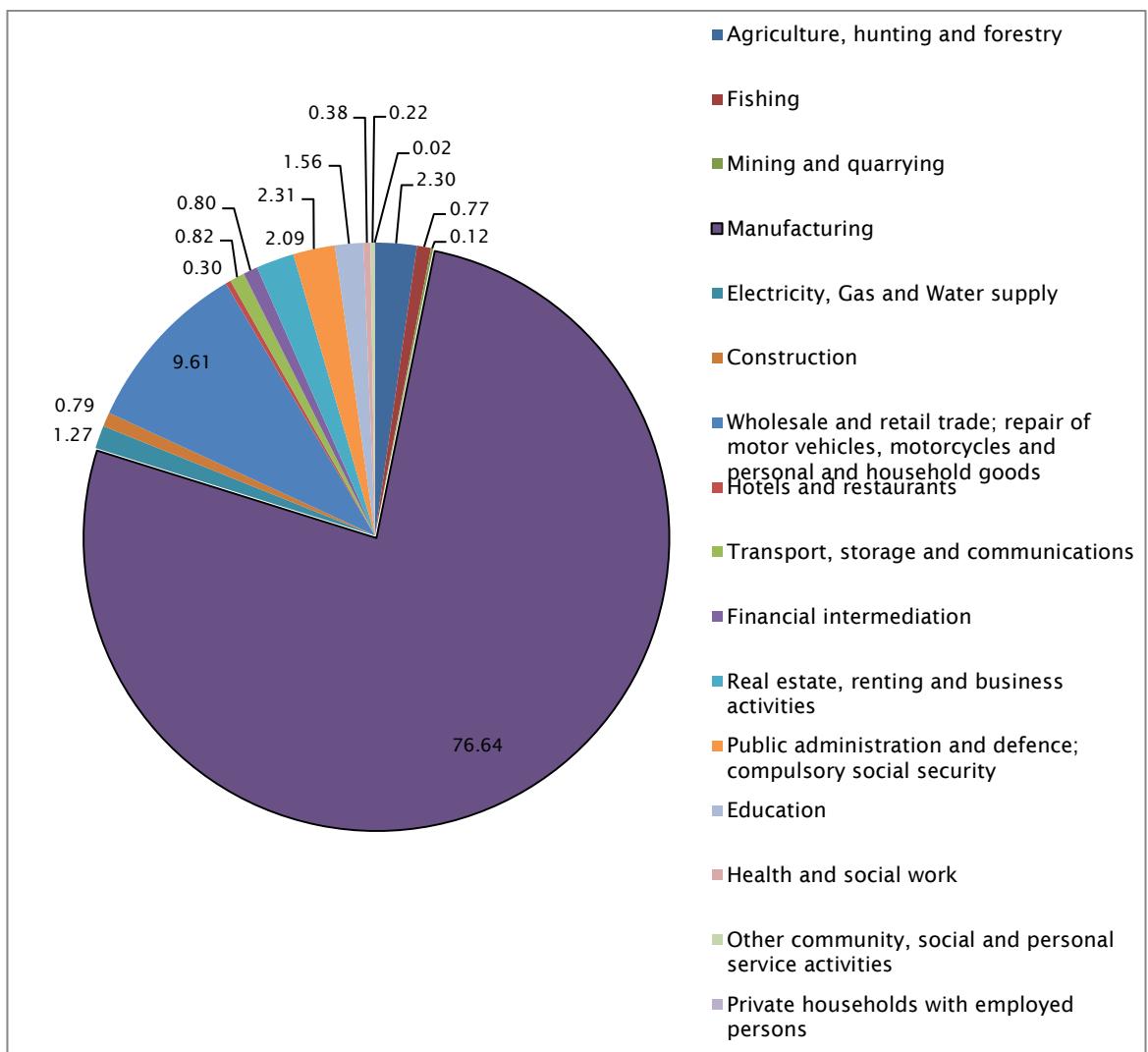


Figure 6-10 Percentage of GPP of Prachin Buri Province in 2011 classified by economic sector (at constant price in 2002)

[Source: The Office of the National Economic and Social Development Board, Thailand]

6.2 Scope of the study

The scope of this research involved the study of ‘nested’ or ‘hierarchical’ data within the Thai educational system, consisting of three main levels: student, classroom, and school (see Figure 6-11).

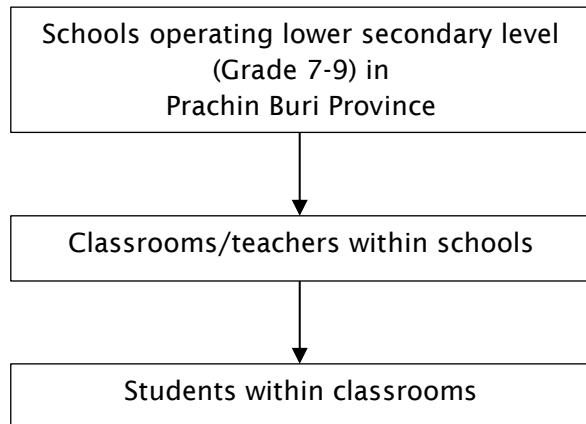


Figure 6-11 Multilevel data collection in the study

The selection criteria for schools in the study were as follows:

Inclusion criteria:

- Located in Prachin Buri
- Operating at the lower secondary level (Grade 7-9)
- Part of the *formal* education system
- Providing general education according to the Basic Education Core Curriculum of Thailand

Figure 6-12 shows the target schools included in the study. They included both public and private schools operating at the lower secondary level (Grade 7-9) in the formal education system in Prachin Buri Province, and totaled 106 schools. Special schools, which have certain characteristics in terms of teaching and learning processes (e.g. schools with disabled pupils or monk schools), were excluded from the study. Three schools were not willing to participate in the study due to the ethical dilemmas concerning the privacy of their students and these were also excluded. Therefore, the remaining total number of schools available for study was 101.

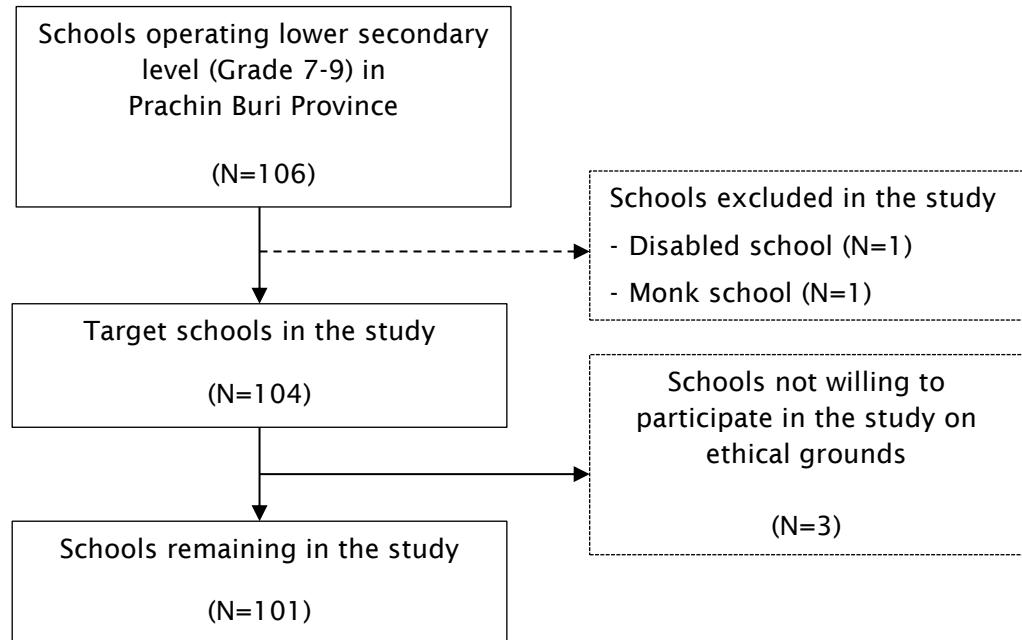


Figure 6-12 Scope of target schools in Prachin Buri Province

6.3 Population and respondents in the study

This research focused on schools operating at the ‘lower secondary level’ (i.e. with students aged 12 to 14) in Prachin Buri. The target population of the study covered four groups of people: students, parents/guardians, teachers, and headteachers. To eliminate sampling bias that might affect the internal and external validity of the study, the researcher collected data from a census of the *entire* population.

Table 6-1 illustrates the target population and questionnaires returned to the researcher. As mentioned earlier, 101 schools (from a possible 106) were willing to participate in the research project. Although the researcher planned to collect the data of the whole population, three schools were not willing to participate in the study due to ethical concerns about using the students’ national identification (ID) as a link for merging the survey data with the O-NET testing scores. Consequently, the researcher received 101 returned questionnaires from headteachers, amounting to a 97% return rate. To scale down the population of teachers, the researcher purposively selected only lower secondary level (Grade 7-9) teachers. As indicated already, the guidelines and criteria for assessing educational outcomes and school management are applied differentially across elementary, primary and secondary levels even within the same school (school policy and school evaluation within the Thai education system is specifically formulated at particular levels) so

the teachers targeted for this project were confined to the lower secondary level. In total, 1291 teacher questionnaires were returned to the researcher, but it is impossible to put a response rate on this return because it is almost impossible to isolate and assign individual teachers solely to an individual level (e.g. Grades 7-9) within schools that span different levels. For the parents/guardians questionnaire, which was distributed via the students, 4,811 were returned, which represents an (almost) 80% return.

Level	Target Population (persons)	Respondent (persons)	Response rate (%)
Students	6,025*	5,135	85
Sets of parents/guardians	6,025**	4,811	80
Teacher	-	1,291	-
Headteacher	104	101	97

Note: * based on the number of students enrolled by schools for taking O-NET examination in the academic year 2012/13 from the NIETS database.

**The number of parents/guardians was estimated according to student number.

Table 6-1 Number of population and response rate in data collection

Data about the students was obtained from the applicants for the O-NET testing in the academic year 2012/13. The student applications were sent directly by schools to NIETS, and this figure was updated to reflect the number of Grade 9 students in Prachin Buri. According to the NIETS database, there were 6,025 examinees and 5,135 student questionnaires (85%) were returned to the researcher. This survey data was merged with the individual student O-NET scores in the NIETS database using the examinees' ID (given by the Ministry of Interior). However, 15 students from the NIETS database did not match the ID lists that the researcher obtained from schools, 28 students did not take the test and 45 questionnaires were returned with incomplete data, so 88 returns were unusable and therefore only the individual O-NET scores of 5,047 students were obtained. Furthermore, 245 of these 5,047 students did not take the Grade 6 O-NET Examinations in the academic year 2009/10, so that eventually only the data of 4,802 students was used in the multilevel analysis, a return of 80%. The details are shown in Figure 6-13.

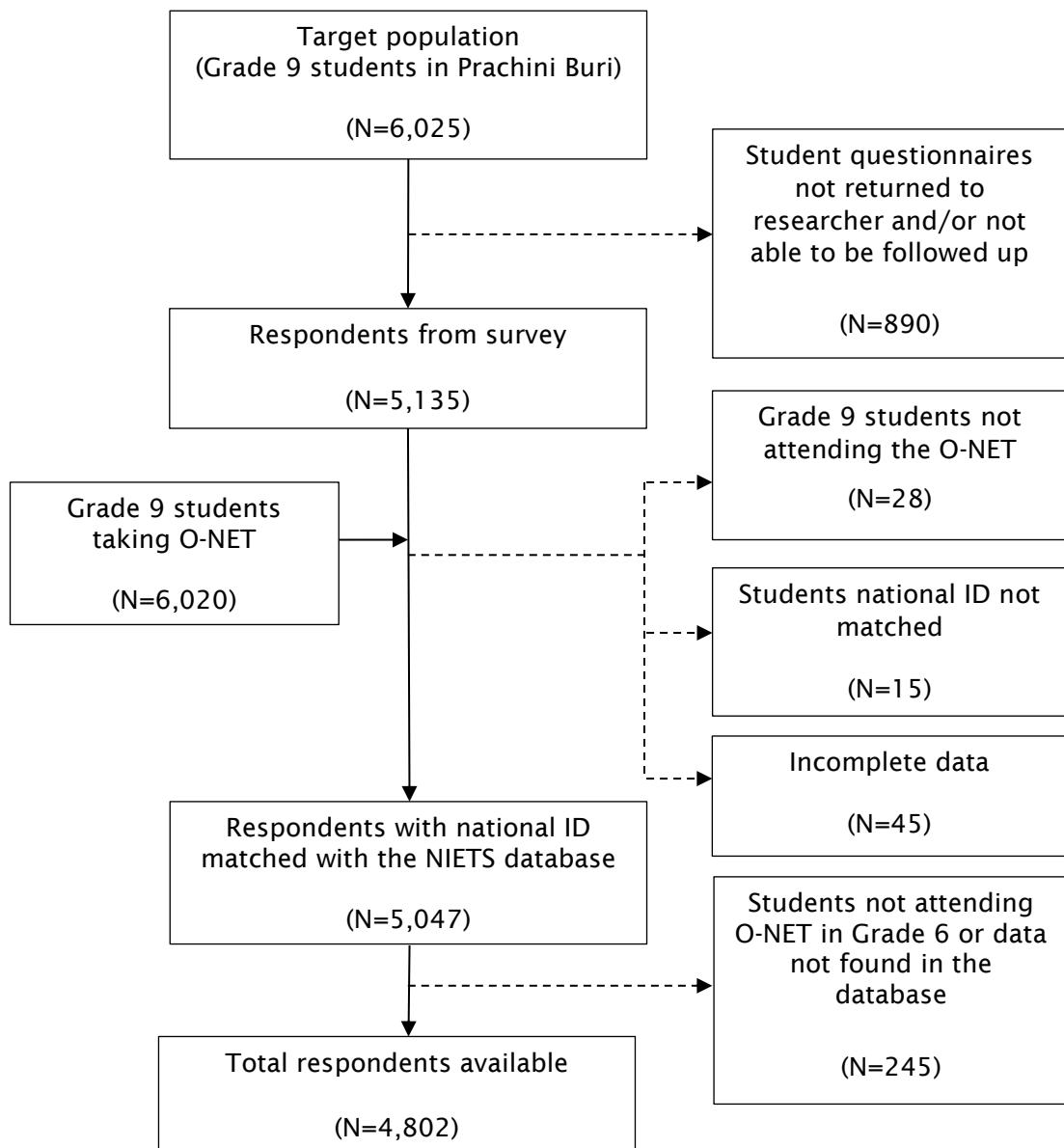


Figure 6-13 Number of available respondents at student level in the study

In terms of the unit of analysis in the multilevel model, Table 6-2 illustrates that of the 104 schools approached, 101 schools responded, representing a 97% return as mentioned earlier. Consequently, the number of classrooms used was 202 out of 207, amounting to a 98% return.

Level	Total	Available number used	Percentage
Student	6025	4,802	80
Classroom	207	202	98
School	104	101	97

Table 6-2 Number of units of analysis at a hierarchical level used in the multilevel models in the study

6.4 Research Instrument

Good research depends not only on the selection of the best research design, but also on selecting the best research instruments that fit the research scenario or context. The purpose obviously is to gain valid, reliable and accurate data. In the quantitative part in this project, the dominant research instrument used was the questionnaire with closed questions. Based on the group of people involved, four questionnaires were used, as follows.

6.4.1 The student questionnaire

The student questionnaire was administered to students in the second semester of the academic year 2012/13. It took approximately fifteen minutes to complete. It covered nine main parts, as shown in Table 6-3.

Questionnaire	Topics
Student	Part 1: General information about student
	Part 2: Student's perception about subjects
	Part 3: Reviewing lessons
	Part 4: Attending tutorials
	Part 5: Activities outside classroom
	Part 6: Parental involvement
	Part 7: Student's educational difficulties
	Part 8: Student's plan about future study
	Part 9: Possessions

Table 6-3 Structure of student questionnaire

6.4.2 The parent/guardian questionnaire

The parent/guardian questionnaires were given to students to pass on to their parents/guardians, although prior to passing them on, the first part of the questionnaire was completed by the students themselves as it was used to link to student information. This questionnaire took approximately ten minutes to complete and consisted of six main parts, as shown in Table 6-4.

Questionnaire	Topics
Parents/ guardian	Part 1: Student's ID
	Part 2: General information about male parents/guardian
	Part 3: General information about female parents/guardian
	Part 4: Perceptions about the school
	Part 5: School involvement
	Part 6: School choices

Table 6-4 Structure of parents/guardian questionnaire

6.4.3 The teacher questionnaire

The teacher questionnaires were prepared for teachers based on their specific subjects. Eight different questionnaires based on eight different subjects (Thai Language, Social Studies, Culture and Religion, English Language, Mathematics, Science, Health and Physical Education, Arts, and Occupation and Technology) were provided, since some questions were specific to the individual subjects. In addition, questions about school processes, policies and evaluation, which were developed from the original version of the dynamic model of educational effectiveness proposed by Creemers and Kyriakides (2012), as well as questions about school culture, were included in the questionnaire. This questionnaire took approximately twenty minutes to complete and it consisted of five main parts, as shown in Table 6-5.

Questionnaire	Topics
Teacher	Part 1: General information about teacher
	Part 2: School resource shortage
	Part 3: School policy
	Part 4: School evaluation

Table 6-5 Structure of teacher questionnaire

6.4.4 The headteacher questionnaire

The headteacher questionnaire was administered in the second semester of the academic year 2012/13. It included both personal and school information. It took approximately fifteen minutes to complete and covered four main parts, as shown in Table 6-6.

Questionnaire	Topics
Headteacher	Part 1: General information about headteacher
	Part 2: Information about school
	Part 3: School difficulties/shortages

Table 6-6 Structure of headteacher questionnaire

6.5 Variables and measurement in multilevel models

6.5.1 Dependent variables

Dependent variables used in the multilevel model consisted of student attainment in eight subjects. Individual students' raw scores in Grade 9 in the academic year 2012/13 were obtained from the comprehensive national testing scores, Ordinary National Educational Test (O-NET), conducted by the National Institute of Educational Testing Service (Public Organisation), Thailand (NIETS), which is an autonomous organisation dealing with measurement and evaluation at the national level. The O-NET test conducts and assesses students' academic proficiency in eight main strands:

- (i) Thai Language
- (ii) Social Studies, Culture and Religion
- (iii) English Language,
- (iv) Mathematics
- (v) Science
- (vi) Health and Physical Education

- (vii) Arts
- (viii) Occupation and Technology.

Examinations cover the academic content in Grade 7-9 according to the Basic Education Core Curriculum B.E.2551 (A.D. 2008) (Ministry of Education, 2008a) as shown in Table 6-7. The paper-based format employed included various multiple-choice questions, as shown in Table 6-8.

Thai Language	Social Studies, Culture and Religion	Foreign language	Mathematics	Science	Health and Physical Education	Arts	Occupation and Technology
Reading	Religion, morality and ethics	Language for communication	Numbers and operation	Living things and life processes	Human growth and development	Visual arts	Living and family
Writing	Civic, culture and living in society	Language and culture	Measurement	Life and environment	Life and family	Music	Design and technology
Listening, viewing and speaking	Economics	Language and relationship with other learning areas	Geometry	Substances and properties of substances	Safety in life	Dramatic arts	Information and communication technology
Principles of Thai language usage	History	Language and relationship with community and the world	Algebra	Forces and motion	Health-strengthening capacities and disease prevention		Occupations
Literature and literary work	Geography		Data analysis and probability	Energy	Movement, physical exercise, games, Thai and international sports		
			Mathematical skills and processes	Change processes of the earth			
				Astronomy and space			
				Nature of science and technology			

Table 6-7 Learning strands of the Basic Education Core Curriculum B.E. 2551 (A.D. 2008), Thailand

[Source: Ministry of Education, Thailand, 2008]

Strand	Items	Score (percent)	Testing time (minutes)	Multiple choice				Various choices selected from associated parts	Answering exact figure or numbers
				Four choices with one answer	Four choices with two answers	Various choices with one answer	Various choices with more than one answer		
Thai Language	52	100	90	✓			✓		
Social Studies, Culture and Religion	50	100	90	✓		✓			
English Language	50	100	90	✓					
Mathematics	30	100	90	✓					✓
Science	45	100	90	✓			✓		
Health and Physical Education	38	100	120	✓			✓		
Arts	38	100		✓	✓				
Occupation and Technology	44	100		✓				✓	

Note: ✓ = test formats available in the examination paper

Table 6-8 Testing formats used in the O-NET test in Grade 9 in the academic year 2012/13

However, one of the major concerns about measurement of educational outcomes (e.g. testing scores) involves the so-called ceiling and floor effects. The ceiling effect happens when individual scoring is at or near the upper limit that a test can provide, whereas floor effects occur at or near the lower limit. Therefore, information obtained pertaining to differences between actual scores and upper or lower limits provided in the research instrument will be lost or inaccurate (Joint Committee on Standard for Education and Psychological Testing, 1999). McBee (2010) states that available information at the upper or lower bounds is partial scoring, called censoring points or outcomes. As shown in Figure 6-14, in the ceiling effect, for example, if using analysis of variance, regression model and multilevel model, the censored outcomes can produce biased parameter estimates.

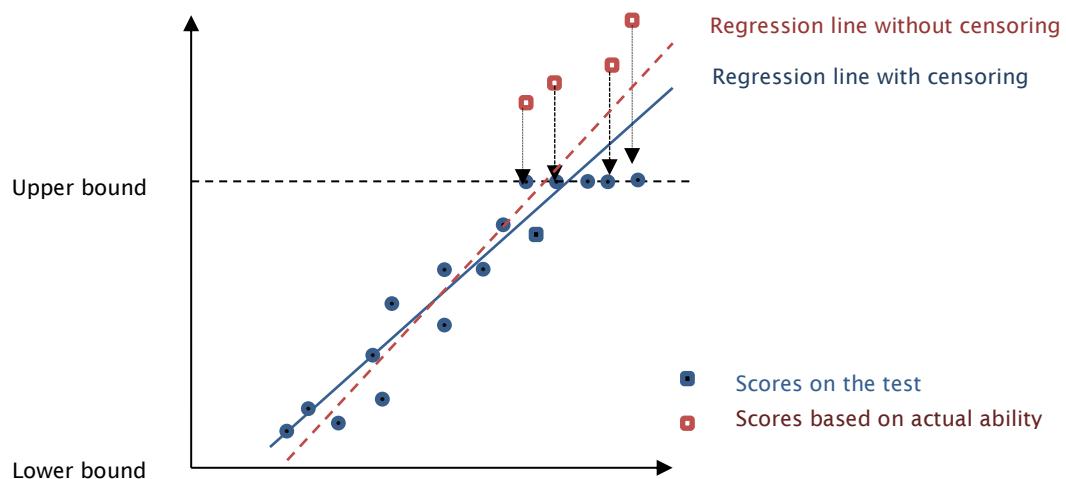


Figure 6-14 Ceiling floor effects on the regression line

[Source: McBee, 2010]

As shown in Table 6-9, none of the students in this dataset achieved full-rank performance (100%) in any of the national testing tests. Likewise, no students gained a score of zero in any subjects – except for Arts, and Occupation and Technology (however, only one student scored zero performance in these subjects). In addition, it is important to note that less than 1% and 5% of students gained higher than 80% and 75% of total scores in every subject, respectively. Less than 1% and 5% achieved lower than 9% and 12% in each subject, respectively. The ceiling effects, therefore, do not exist because no students showed full-rank performance in the tests. Likewise, incidents of floor effect were not an issue in most tests although, as stated, one student showed zero-performance in two tests.

Subjects	Scores		Score percentile			
	Max	Min	1 st	5 th	95 th	99 th
Thai Language	26.40	82.40	34.40	37.60	68.00	74.40
Social Studies, Religious and Culture	8.00	90.00	18.00	24.00	68.00	78.00
English Language	6.00	88.00	12.00	16.00	42.00	61.60
Mathematics	3.20	92.80	9.60	12.80	42.40	54.40
Science	6.00	94.00	16.00	20.00	54.00	68.00
Health and Physical Education	10.00	87.50	22.50	35.00	72.50	77.50
Arts	0.00	75.00	17.50	25.00	57.50	62.50
Occupation and Technology	0.00	84.00	16.24	24.00	66.00	74.00

Table 6-9 Statistic summary for diagnosing ceiling and floor effects in O-NET test of Grade 9 students

However, although the response rate at the student level was high, at 84% in the first stage and at 80% at the final step as mentioned earlier (see Table 6-1 and Table 6-2), the issue of whether the data was representative was still a concern. Consequently, based on population (census) data available, comparing the mean and variance of individual students' O-NET scores in all subjects was used to ascertain the similarity between target population and respondents: the first-hand survey (N=5,047) and the last step data (after merging files and cleaning the data for build multilevel models). As presented in Table 6-10 and Table 6-11, findings according to the independent sample t-test revealed that there were not statistically significant differences in terms of variances and means in all subjects between population and respondents in the study ($t>1.96$; $p>.05$). Therefore, it can be concluded that the respondents used in the study were representative of the target population.

Subjects	Group	N	Mean	SD	Levene's test		t-test	
					F	p-value	t	p-value
Thai language	Population	6,020	53.416	9.312	1.000	0.317	-1.637	0.102
	Respondents*	4,800	53.710	9.219				
Social Studies, Culture and Religion	Population	6,012	45.938	13.347	1.400	0.237	-1.464	0.143
	Respondents*	4,798	46.314	13.119				
English Language	Population	6,019	27.203	8.961	0.581	0.446	-0.183	0.855
	Respondents*	4,802	27.235	8.781				
Mathematics	Population	6,016	25.762	9.292	0.822	0.365	0.251	0.802
	Respondents*	4,795	25.717	9.071				
Science	Population	6,011	34.015	10.619	0.203	0.652	-0.519	0.604
	Respondents*	4,798	34.121	10.441				
Health and Physical Education	Population	6,011	55.854	11.603	2.134	0.144	-1.627	0.104
	Respondents*	4,796	56.217	11.369				
Arts	Population	6,011	42.048	9.797	2.933	0.087	-1.555	0.120
	Respondents*	4,796	42.340	9.595				
Occupation and Technology	Population	6,011	46.458	13.505	1.281	0.258	-1.491	0.136
	Respondents*	4,796	46.846	13.364				

* based on the respondents used in the multilevel analysis

Table 6-10 Diagnosing representativeness based on the O-NET scores using the independent sample t-test

Subjects	Group	N	Mean	SD	Levene's test		t-test	
					F	p-value	t	p-value
Thai language	Population	6,020	53.416	9.312	1.135	0.287	-1.268	0.205
	Respondents*	5,047	53.641	9.211				
Social Studies, Culture and Religion	Population	6,012	45.938	13.347	1.324	0.250	-1.126	0.260
	Respondents*	5,041	46.223	13.135				
English Language	Population	6,019	27.203	8.961	0.459	0.498	0.225	0.822
	Respondents*	5,047	27.165	8.781				
Mathematics	Population	6,016	25.762	9.292	0.998	0.318	0.371	0.711
	Respondents*	5,042	25.697	9.071				
Science	Population	6,011	34.015	10.619	0.658	0.417	-0.133	0.894
	Respondents*	5,041	34.042	10.441				
Health and Physical Education	Population	6,011	55.854	11.603	1.759	0.185	-1.310	0.190
	Respondents*	5,041	56.142	11.369				
Arts	Population	6,011	42.048	9.797	1.518	0.218	-1.482	0.138
	Respondents*	5,041	42.323	9.665				
Occupation and Technology	Population	6,011	46.458	13.505	0.805	0.369	-1.088	0.276
	Respondents*	5,041	46.737	13.395				

* based on the respondents with the National ID matched with the NIETS database

Table 6-11 Diagnosing representativeness based on the O-NET scores using the independent sample t-test

Table 6-12 shows the scale range of student attainment used in this study, which ranges between 0% and 100%.

Variables	Measurement	Source of data
O-NET scores: - Thai Language - Social Studies, Culture and Religion - English Language - Mathematics - Science - Health and Physical Education - Arts - Occupation and Technology	0-100 percent	NIETS' database

Table 6-12 Dependent variables and their measurement in the multilevel models

6.5.2 Explanatory variables

Explanatory variables used in the study are divided into three main groups according to the level of data structure: student, classroom, and school level, based on information gathered from students, parents/guardians, teachers and schools questionnaires and the individual students' O-NET scores. Some variables designed in the study and used in the data analysis are obtained from a single question (e.g. sex, age). In addition, some variables were designed to be constructed in some approaches, so as to measure latent constructs that cannot be asked or observed directly or obtained with a single questions (e.g. SES, study motivation, parental involvement). Thus, the following section describes how the exploratory variables were constructed and validated.

❖ Student-level variables

The student-level explanatory variables used in the multilevel models consist of nine variables as follows:

(1) Prior attainment

Prior attainment used in the study was obtained from the O-NET test, which Grade 9 students took in the academic year 2012/13. Survey data with national identification number on Grade 9 students was used to track their Grade 6 O-NET scores and was then merged with the survey data.

(2) Sex

Data on student sex was obtained from the student questionnaires. However, in cases of missing data, the researcher checked with the school databases.

(3) Age

In the study, the age of the student is measured in months. It is computed as a difference between the month and year of the O-NET testing, February 2013, and the month and the year of students' birth. The formula for computing students' age is shown below:

$$Age = 12 * (YT - YS) + (MT - MS)$$

where YT and YS are the year of O-NET testing, 2013, and the year of student's birth, respectively, and MT and MS are the month of O-NET testing, February, that is 2, and the month of students' birth, respectively.

(4) Socio-economic status (SES)

The computation of SES score used in the study is more or less an adaptation of the concepts of constructing an economic, social and cultural status index (ESCS) or socio-economic status (SES) developed in data analysis in the PISA (2000; 2003; 2006; 2009) (OECD, 2012b) and PIRLS (2006) studied by (Caro & Cortes, 2012) and the survey of Australian youth (2003) by Lim and Gemici (2011). Table 6-14 compares the items used for calculating the ESCS or SES. Components used for constructing the ESCS/SES consist of three main parts: parents' highest occupational status, parents' highest educational attainment in terms of years of schooling, and home possessions. Thus, this study also derived from such items.

Data on parental occupation for both father/male guardian and mother/female guardian was obtained from the parent/guardian questionnaires. According to the national survey (such as labour force survey) by the National Statistical Office of Thailand, categories of occupational status are adopted. Occupational data were then transformed into the Thai occupational status scores based on a study of Chantaravanich (1991) (see Table 6-14). The higher the level of occupational status in Thai society, the higher the occupational status scores. Two scores were obtained from indices: father/male guardian occupational score and mother/female guardian occupational score. The highest scores of occupational status of parents corresponding to the higher occupational status scores of either parent or to the only parent's occupational scores were used.

Parent/guardian education is the family background variable, which is frequently used as a predictor of student outcomes. In this study, based on OECD (2012b), data on highest educational qualifications were classified into eight categories according to Thai education systems. It was then transformed into the number of years of schooling, shown in Table 6-14.

Home possessions are also often used to predict student outcomes. Data on this was obtained by asking the student to identify what they did or did not have in their households. The obtained data on each item are then transformed to dummy variables. The home possession score was constructed by exploratory factor analysis (using scores from the first principal component) (Caro & Cortes, 2012; Lim & Gemici, 2011) and the one-parameter logistic model (1PL) (OECD, 2012b).

PISA 2000 (OECD, 2012)	PISA 2003 and 2006 (OECD, 2012)	PISA 2009 (OECD, 2012)	PIRLS (2006) (Caro & Cortes, 2012)	Survey of Australian Youth (2003) (Lim & Gemici, 2011)	This study
Highest educational level of parents					
Highest occupational status of parents					
Family wealth	Number of home possessions including books in home	Home possessions (which include items indicating the family wealth, cultural possessions, and home educational resources)	Home possessions	Household income and wealth	Home educational resources including books in home
Cultural possessions				Other dimensions (e.g. family structure, regionality, immigration and indigenous status)	
Home educational resources					

Table 6-13 Comparison of the components used for calculating the SES index

The SES scores are calculated as follows (OECD, 2012):

$$SES = \frac{F_1 HSP + F_2 YS' + F_3 HES}{E_{PC1}}$$

where F_1, F_2 and F_3 are the factor loadings of the first principle of comment, HSP is standardised value from the parent/guardian highest education, YS is standardised years of schooling, HES is standardised scores of home educational resources derived from the first principal component and/or one-parameter logistic model (1PL), and E_{PC1} is the eigenvalue of the first principal component.

Variables	Measurement for calculating SES scores
Father/male guardian's and Mother/female guardian's occupation	<p>According to the occupational status indices in Thailand, initially developed by Chantaravanich (1991), this study recalculated the occupational score (points) as follows:</p> <ul style="list-style-type: none"> ▪ Farmer = 32.90 ▪ General labor = 27.62 ▪ Service worker/shop or market sales worker = 35.80 ▪ Manufacturing = 38.60 ▪ Technicians = 42.08 ▪ Professionals = 60.00 ▪ Military/Police = 62.48 ▪ Business owner/manager = 62.10 ▪ Housework/house parents = 53.10 ▪ Unemployed = 0
Father/male guardian's and Mother/female guardian's highest education	<p>According to Thai education system, the number of schooling years can be determined as follows:</p> <ul style="list-style-type: none"> ▪ Non-educated = 0 ▪ Primary = 6 ▪ Lower secondary = 9 ▪ Upper secondary = 12 ▪ Vocational certificate = 12 ▪ Higher vocational certificate = 16 ▪ Undergraduate = 20 ▪ Postgraduate = 22
<p>Home educational resources</p> <ul style="list-style-type: none"> ▪ Desk to study ▪ Room of student's own ▪ Quiet place to study ▪ Computer for studying/doing homework ▪ Educational software ▪ Internet connection ▪ Dictionary ▪ Books related to studies ▪ General books 	<ul style="list-style-type: none"> ▪ Have = 1 ▪ Not have = 0

Table 6-14 Variables used for calculating the SES in the study

(5) Study motivation

Two items measuring study motivation were included in the student questionnaire. The scale provides information in each subject regarding the level of abilities evaluated by students themselves and the level of importance to their future study using the Likert scale. The IRT scaling was used for scoring this index.

(6) Parental involvement

Questions concerning parent involvement, which measured the interactions between students and parents/guardians with regard to their child's study, were asked in the student questionnaire. The scale provides information in all eight subjects on parents/guardians' interests and expectations as perceived by students. To construct this index, the IRT scaling was applied.

(7) Time spent on reviewing lessons

Questions on time spent on reviewing lessons after class were included in the student questionnaire. It was measured as an approximation of how many hours per week students spent revising or studying outside the classroom and was classified into four categories: none, less than 1 hour, 1-2 hours, 3-4 hours and more than 4 hours.

(8) Attending tutorials

The topic of attending tutorials outside classrooms or school has received much attention in Thai educational circles, since it is widely believed that attending tutorials raises student attainment and enhances students' knowledge at class, school, and national level. The value of tutorials influenced by students themselves, peers and parents seem to spread in Thai society. Information on this was included in the student questionnaire by asking whether they attended tutorials and, if yes, how many hours they spent in such tutorials. However, as there was a large amount of missing data regarding the numbers of hours, this variable was adapted to provide purely dichotomous variables, specifically: did they either 'attend' or 'not attend'.

Student-level Variables	Item(s) in the questionnaire/ Source of data	Measurement	Source of data
Prior attainment	O-Net scores in Grade 6: - Thai Language - Social Studies, Culture and Religion - English Language - Mathematics - Science - Health and Physical Education - Arts - Occupation and Technology	0-100 percent	NIETS databases
Sex	Sex (whether the respondent is boy or girl)	Dummy variable - $D_{SEX}=1$ if girl - $D_{SEX}=0$ if boy	Student questionnaire
Age	Date of birth	Age (months)	Student questionnaire
SES	- Parents/guardian's education - Parents/guardian's occupation	Scores based on author's calculation	Parent/guardian questionnaire
	- Things you have in your home	IRT Scaling score (1PL and/or 2PL)/Principal component analysis (PCA)	Student questionnaire

Table 6-15 Student-level exploratory variables used and their measurement in the multilevel models

Student-level Variables	Item(s) in the questionnaire/ Source of data	Measurement	Source of data
Study motivation	<ul style="list-style-type: none"> - Level of abilities perceived by students (each subject) - Level of importance of subjects to student's future study (each subject) 	IRT Scaling score (Graded response model)	Student questionnaire
Parental involvement	<ul style="list-style-type: none"> - Level of parents/guardians' expectations as perceived by students (each subject) - Time student discusses his/her classes/homework with his/her parents weekly (each subject) 	IRT Scaling score (Graded response model)	Student questionnaire
Time spent on reviewing lessons	Time students spent reviewing lesson every week (each subject)	<p>Number of hours a week</p> <ul style="list-style-type: none"> - None - less than 1 hour - 1-2 hours - 3-4 hours - more than 4 hours <p>Then, these categories were transformed into two dummy variables as follows:</p> <ul style="list-style-type: none"> - $D_{TIME1}=1$ if 1-2 hours $D_{TIME1}=0$ if others - $D_{TIME2}=1$ if 3 hours and more $D_{TIME2}=0$ if others 	Student questionnaire
Attending tutorials	Tutorial classes students attend outside their schools (each subject)	<p>Dummy variable</p> <ul style="list-style-type: none"> - $D_{TUTORIAL}=1$ if attend $D_{TUTORIAL}=0$ if not attend 	Student questionnaire

Table 6-15 Student-level exploratory variables used and their measurement in the multilevel models (*continued*)

❖ Classroom-level variables

With regard to the context of every classroom in the study, five variables consisting of average prior attainment, dispersion of prior attainment, average class SES, average class educational difficulties, and percentage of girls were used in the multilevel models. These contextual variables were aggregated from data at the student level. Table 6-16 briefly illustrates the calculation methods and their measurement.

Classroom-level variables	Description	Measurement	Source of data
Average prior attainment	Mean of the O-Net scores in Grade 6 among students within the class	0-100 percent	Calculation from the NIETS database
Dispersion of prior attainment	Standard deviation (SD) of O-Net scores in Grade 6 among students within the class	Continuous data	Calculation from the NIETS database
Average class SES	Mean of the SES scores among students within the class	0-100 percent	Calculation from student level
Percentage of girls	Proportion of girls studying in the classroom	0-100 percent	Calculation from student level
Class size	The number of students in the class	Continuous data	School database

Table 6-16 Classroom-level variables used and their measurement in the multilevel models

❖ School-level variables

In order to examine the school factors influencing student attainment, school-level variables can be divided into two main groups: the global variables (school types, school size and school educational difficulties) and school factors based on the dynamic model of educational effectiveness.

(1) School size

School size refers to the total enrolment of boys and girls in schools provided by the NIETS' database and headteacher's questionnaire. Based on criteria of the Ministry of Education, it is classified into four main categories: small (less than 500

students), medium (500-1,499 students), large (1,500-2,499) and extra-large (2,500 and more).

(2) School type

Types of schools in this study are classified as either public or private schools. The public schools in this particular context were those directly managed and controlled by public education authority. Therefore, 'public schools' refers to schools authorised by seven organisations:

- The Office of Prachin Buri Primary Education Service Area I
- The Office of Prachin Buri Primary Education Service Area II
- The Secondary Educational Services Office Area VII
- The Provincial Administration Organisation
- The Mayor of Mueng Prachin Buri
- The Mayor of Kabinburi Subdistrict.

'Private schools' refers to institutions that have their own authority in terms of school management and administration by the public sector or independence from the state, but are monitored and assessed in educational quality and standards by the state.

(3) School SES

School SES is calculated from the average of the individual students' SES scores as shown in the student-level variables.

(4) School educational difficulties

Educational difficulties at school level were divided into two main parts: by subject and at school overall. These questions were included in the headteacher questionnaire. For individual subjects, three items provided information on the level of shortage or inadequacy in terms of qualified teachers, textbooks and instructional technologies or equipment. Ten items measured overall educational difficulties in school facilities: classrooms, science laboratory, library, gymnasium, assembly area/theatre, social space, playing field and buildings. To construct the indices, items are scored for IRT scaling.

(5) School effectiveness factors

The exploratory variables based on the dynamic model of education effectiveness were measured via four main factors with five dimensions (frequency, focus, stage,

quality, and differentiation). To measure these factors, a research instrument referring to school factors was used that was initially developed by Creemers and Kyriakides (2012) and then adapted by the researcher in order to ensure suitability for the Thai educational context. The questionnaires were given to teachers who had taught at the secondary level in schools. It is believed that these groups of teachers can provide information regarding school situations, in terms of school policies and school evaluations related to the secondary level, as they have been directly involved in many ways in school practice and policy formulations. Data on teachers' perceptions about their school were obtained using the Likert scale. Additionally, data was scored for IRT scaling and then aggregated into school level. Their contents cover four main factors in five dimensions as follows:

- ❖ School policy for teaching and actions taken for improving teaching practices
 - Quantity of teaching
 - Provision of learning opportunity
 - Quality of teaching
- ❖ School policy for creating the school learning environment (SLE) and actions taken for improving SLE
 - Student behaviour outside classroom
 - Collaboration and interaction among teachers
 - Partnership policy
 - Provision of sufficient learning resource to students and teachers
 - Value in favour of learning
- ❖ Evaluation of school policy for teaching and actions taken for improving teaching practices
- ❖ Evaluation of school policy for creating SLE and actions taken for improving SLE.

Table 6-18 summarises variables and their measures used in the multilevel analysis in the study.

Factors	Dimensions				
	Frequency	Stage	Focus	Quality	Differentiation
(1) School policy teaching and actions taken for improving teaching [Question 8 in Appendix F]					
▪ Quantity of teaching	#1a, #2a, #3a	#7a, #7b, #8a, #9a	#10a, #12a	#26, #27a, #27c	#41a, #41d
▪ Provision of learning opportunity	#1b, #2b, #3b	#7c, #7d, #7e, #8b	#10b, #12b	#27b, #27d, #27e, #27f	#41b, #37
▪ Quality of teaching	#2c, #3c, #3c	#8c, #9b	#10c, #11, #12c	#27g, ##27h, #27i	#39, #40
(2) School policy for creating school learning environment (SLE) and actions taken for improving the SLE [Question 8 in Appendix F]					
▪ Student behaviours outside classroom	#1d, #1e, #1h	#7f, #8d, #9c	#10d, #15, #19	#27j, #28, #29	#41c, #43
▪ Collaboration and interaction among teachers	#1f, #1g	#8e, #9d	#16, #17, #18	#30a, #31	#44, #38
▪ Partnership policy	#4a, #4b, #4c, #4d	#8f, #9e	#10e, #20	#30b, #32, #33, #34	#24, #45
▪ Provision of sufficient learning resources	#1i, #1j	#7g, #8g, #9f	#10f, #21	#27f, #30c	#25, #30d
▪ Value in favour of learning	#1k, #1l	#8h, #9g	#22, #23	#35, #36	#42, #46
(3) Evaluation of the school policy teaching and actions taken for improving teaching [Question 9 in Appendix F]					
	#1a, #1b, #1c	#3, #4	#5, #6	#7, #8, #9	#10, #11
(4) Evaluation of School policy for creating school learning environment (SLE) and actions taken for improving the SLE [Question 10 in Appendix F]					
	#1, #2, #3	#4, #5	#6, #7, #8	#9, #10, #11	#12, #13

Items in the part of school policy and evaluation in the teacher questionnaire shown in Appendix F.

Table 6-17 School-level exploratory variables used and their measurement in the dynamic model of educational effectiveness

School-level variables	Description	Measurement	Source of data
School size	The number of students enrolled in school <ul style="list-style-type: none"> ▪ less than 500 (small) ▪ 500-1,499 (medium) 1,500 and above (large or extra-large) 	Dummy variables: $D_{SIZE1} = 1$ if medium $D_{SIZE1} = 0$ if others $D_{SIZE2} = 1$ if large or extra large $D_{SIZE2} = 0$ if others	Headteacher questionnaire/ NIETS' database
School type	Characteristics of school classified by powers to make school decisions in terms of management and controlling regarding its affairs	Dummy variable: $D_{TYPE}=0$ if public $D_{TYPE}=1$ if private	Headteacher questionnaire/ NIETS' database
School SES	The average of the individual students' SES scores at the student level	Continuous data	Student questionnaire
School educational difficulties (in each subject)	Level of shortage or inadequacy in the following items: <ul style="list-style-type: none"> ▪ Qualified teachers ▪ Textbooks ▪ Instructional technologies or equipment 	Scaling score based on the IRT	Headteacher questionnaire

Table 6-18 School-level variables used and their measurement in the multilevel models

School-level variables	Description	Measurement	Source of data
School policy in teaching and actions taken for improving teaching ▪ Quantity of teaching ▪ Provision of learning opportunity ▪ Quality of teaching	Five main dimensions are measured: ▪ Frequency ▪ Focus ▪ Stage ▪ Quality ▪ Differentiation	Scaling score using the IRT (Graded response model)	Calculation from teacher questionnaire
School policy for creating school learning environment (SLE) and actions taken for improving the SLE ▪ Student behaviours outside classroom ▪ Collaboration and interaction among teachers ▪ Partnership policy ▪ Provision of sufficient learning resources ▪ Value in favour of learning	Five main dimensions are measured: ▪ Frequency ▪ Focus ▪ Stage ▪ Quality ▪ Differentiation	Scaling score using the IRT (Graded response model)	Calculation from teacher questionnaire
Evaluation of school policy in teaching and actions taken for improving teaching	Five main dimensions are measured: ▪ Frequency ▪ Focus ▪ Stage ▪ Quality ▪ Differentiation	Scaling score using the IRT (Graded response model)	Calculation from teacher questionnaire
Evaluation of school policy for creating SLE and actions taken for improving the SLE	Five main dimensions are measured: ▪ Frequency ▪ Focus ▪ Stage ▪ Quality ▪ Differentiation	Scaling score using the IRT (Graded response model)	Calculation from teacher questionnaire

Table 6-18 School-level variables used and their measurement in the multilevel models (*continued*)

6.6 Pilot study and instrumentation

A pilot study is defined as a small-scale study of a project, carried out under identical conditions before implementing the main research project (Basit, 2010; Gillham, 2008). As claimed by Oppenheim (1996), almost anything in the social survey could be piloted, since it helps to enhance the validity, reliability and usability of the research instruments. Furthermore, it is a guideline for researchers to help design and conduct a logical and realistic research project within a limited period (Basit, 2010).

Gillham (2008) describes three important pieces of information that researchers gain from conducting a pilot study: whether the contents in research instrument need to be adjusted or modified, whether it works as planned or aimed, and whether the process of analysis could face difficulties. Particularly, the returned questionnaires in the pilot study should be checked for misunderstandings in terms of omitted responses, incomplete responses and comments like 'do not know/not sure'. Taking this into consideration, the feedback from the pilot will be used to improve and modify the research instrument.

The criteria for selecting respondents employed in the pilot study should be as similar to the main research project as possible (Oppenheim, 1996). In terms of sample size of the piloting stage, Gillham (2008) suggested that respondents should number approximately 20-30 in total. This pilot study was conducted with 20 Grade 9 students, 20 parent/guardians, 20 teachers and 15 headteachers from schools in Prachin Buri.

Figure 6-15 illustrates the procedure for questionnaire construction and development in the study.

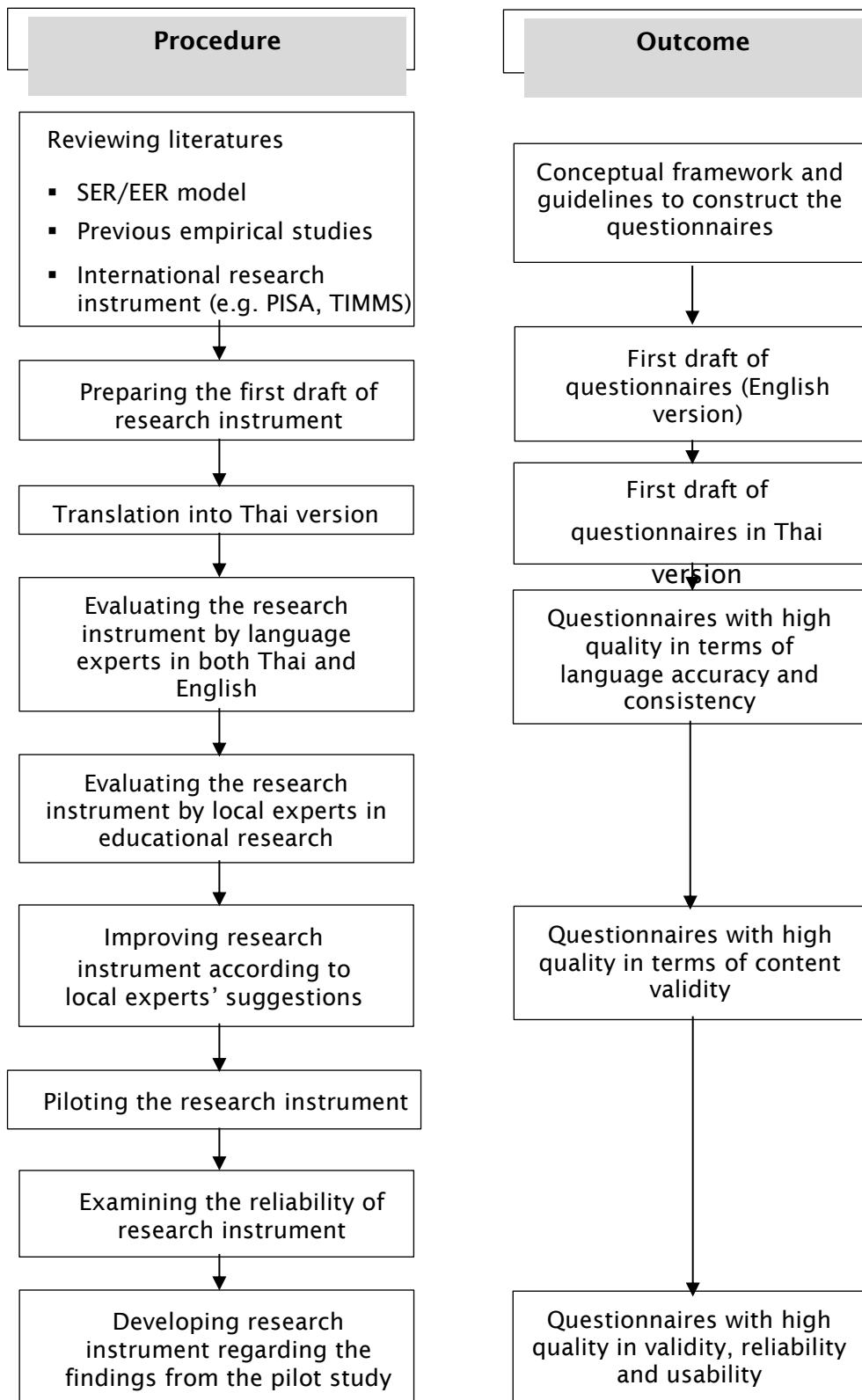


Figure 6-15 Research instrument development process in the quantitative phase

6.6.1 Validity

The quality of the research instrument is important, especially in quantitative social research, since it is used for quantifying and measuring human behaviours, feeling, thinking and experience (Drost, 2011; Muijs, 2011). Consequently, the researcher needs to ensure that the data gathered is valid and reliable, allowing the researcher to draw accurate research findings and conclusions.

In instrumentation, validity is defined as a focus on the extent to which the research instrument illustrates proof of fair and comprehensive coverage of the items that it is intended to cover (Oluwatayo, 2012). Cohen, Manion, and Morrison (2007) point out the component of the main points must be covered by the research instrument and fairly presented in terms of the broad and deep elements under investigated and interested phenomena. It can be said that the features of the qualified research instrument, in terms of content validity, are highly concerned with the completeness of content review of what it is proposed to measure. To identify this, it is typically judged by experts.

With regard to content validity as discussed above, as some parts of the questionnaire had been developed and modified from the international standard questionnaires such as PISA and TIMMS, widely used for international educational comparisons, the content of questionnaires needed to be modified to relate to Thai educational contexts. Particularly, this study employed school-process variables based on the dynamic model of educational effectiveness by Creemers and Kyriakides (2012) and adopted their questions on school policy and evaluation. Such research instruments have been developed to conduct research in European contexts (widely studied and tested in the Netherlands and Cyprus), which, naturally, is considerably different from the context of education in Thailand. Thus, it is necessary for the researcher to modify such questions. For this reason, all questionnaires used in the study were examined by Thai educational experts and revised according to their suggestions and comments.

6.6.2 Reliability

Reliability is synonymous with dependability and consistency and is primarily concerned with issues of accuracy and precision (Cohen et al., 2007). For the research to be considered reliable, the research needs to have the potential to be repeated at a different points of time and the results of the study would be consistent (Basit, 2010; Cohen et al., 2007).

In the study, some parts of the research involved specifying the level of agreement or disagreement for a series of items/statements using the Likert scale. A focus on the homogeneity of items constructed in the research instrument as internal consistency is crucial (Muijs, 2011). To identify the extent of reliability of such items, Cronbach's alpha coefficient has been widely used to measure internal consistency and reliability of the research instrument with multi-item indices (Groves et al., 2009; Muijs, 2011). A higher Cronbach's alpha coefficient indicates higher reliability or level of internal consistency, as shown in Table 6-19.

Cronbach's alpha coefficient	Level of internal consistency
$\alpha \geq 0.9$	Excellent
$0.8 \leq \alpha < 0.9$	Good
$0.7 \leq \alpha < 0.8$	Acceptable
$0.6 \leq \alpha < 0.7$	Questionable
$0.5 \leq \alpha < 0.6$	Poor
$\alpha < 0.5$	Unacceptable

Table 6-19 Cronbach's alpha coefficient and its interpretation

The results from the pilot studies in terms of internal consistency reliability are shown as follows:

Factors	Dimensions				
	Frequency	Stage	Focus	Quality	Differentiation
(1) School policy on teaching and actions taken for improving teaching					
▪ Quantity of teaching	0.874	0.716	0.837	0.901	0.707
▪ Provision of learning opportunity	0.917	0.867	0.812	0.933	0.854
▪ Quality of teaching	0.855	0.871	0.737	0.921	0.765
(2) School policy for creating school learning environment (SLE) and actions taken for improving the SLE					
▪ Student behaviours outside classroom	0.946	0.846	0.702	0.750	0.789
▪ Collaboration and interaction among teachers	0.810	0.923	0.921	0.866	0.982
▪ Partnership policy	0.777	0.719	0.899	0.825	0.764
▪ Provision of sufficient learning resources	0.937	0.876	0.922	0.870	0.796
▪ Value in favour of learning	0.847	0.912	0.753	0.830	0.843
(3) Evaluation of the school policy on teaching and actions taken for improving teaching					
	0.736	0.840	0.871	0.914	0.861
(4) Evaluation of School policy for creating school learning environment (SLE) and actions taken for improving the SLE					
	0.879	0.841	0.855	0.833	0.866

Table 6-20 Cronbach alpha's coefficient among school factors in the dynamic model of educational effectiveness in teacher questionnaires

6.7 Data collection and database construction procedure

Since Thailand lacks complete databases of the kind available in the UK, USA and European countries, data for previous studies on school effectiveness in Thailand was collected according to the researcher's own aims or personal interests (as explored in Chapter 2). In addition, analysing examination scores alone is not sufficient for understanding school effectiveness, which is complex by nature. Therefore, it can be said that an educational database is an important key for studying school effectiveness in Thailand. To overcome this limitation, the database was constructed by collecting data from related groups of people, that is, students, parents/guardians, teachers and headteachers. Therefore, the procedure for data collection in this study can be divided into three main phases: prior-surveying, surveying and post-surveying.

6.7.1 Prior-surveying

The prior-surveying stage mainly involves contacting, coordinating and asking permission. It consists of five main steps as follows:

Step I: The researcher submitted official letters from his supervisor to the provincial governor of Prachin Buri, asking permission to conduct research in public and private schools in Prachin Buri and to the Director of National Institute of Educational Testing Services (Public Organisation) (NIETS) for permission to use individual students' raw scores.

Step II: After obtaining the permission from the ethical clearance process from the University of Southampton, the researcher formally submitted the second letters from his supervisors together with the ethical clearance letter, research proposal, and questionnaires to the provincial governor of Prachin Buri.

Step III: The researcher passed the approved letters from the provincial governor to seven main educational organisations (see Figure 6-16). After obtaining permission, the researcher passed the formal letters provided by the directors to the headteachers in the next step.

Step IV: The researcher passed the documents from the directors to the school and asked permission from heads of school or school managers to collect data from students, parents/guardians, teachers and headteachers. However, since this study employs individual students' O-NET scores as student outcomes, individual

students' national identification numbers (national ID with 13 digits) provided by the Ministry of Interior, Thailand, were used as links between the survey data and the O-NET database provided by the NIETS. For this reason, the researcher needed to ask permission from headteachers and/or school managers to provide the lists of the National ID and students' names used as a link to the O-NET database. In addition, the researcher made an appointment with schools for data collection and asked for their coordination to inform students and teachers.

Step V: In order to preserve confidentiality and anonymity, the researcher coded the student questionnaires by number rather than name, in order to identify returned questionnaires. Teacher questionnaires and headteacher questionnaires were coded via the same process.

6.7.2 Surveying

The surveying stage involves the data collection process in the field. The process in this stage consists of four main steps:

Step I: The researcher went to schools on the appointed date and visited classrooms and explained the details of the research project, including the questionnaires, and asked for the participants' cooperation in completing the questionnaires. Student questionnaires were given to students to complete on the survey date.

Step II: After students finished completing the questionnaires, parents/guardians questionnaires with envelopes were distributed to students to pass on. In the first part of the questionnaire, the researcher asked students to fill in their student IDs, providing a link through student information prior to passing it to their parents/guardians. In addition, the researcher asked for their cooperation in returning the questionnaires to classroom teachers the next day.

Step III: In the case of students who did not attend school that day, student questionnaires and parents/guardians questionnaires were left with classroom teachers or classroom head along with stamped and addressed return envelope. However, in some schools, heads of schools or school managers distributed the questionnaires to their students themselves. The researcher then collected these questionnaires on an appointed date.

Step IV: Teachers and headteacher questionnaires, likewise, were handed out to be completed and collected on an appointed date.

6.7.3 Post-surveying

After obtaining data from the survey, the next stage involves data coding, data entry and data merging. There are five steps to this stage:

Step I: The researcher determined the codes and missing codes in each variable on questionnaires.

Step II: Data from questionnaires were entered into Microsoft EXCEL.

Step III: All were merged into the same file.

Step IV: The researcher explored the data to examine whether missing or irregular data was evident. If they were, the first approach was to replace such data with data found on the school database. If such data from schools were not available, statistical techniques developed to deal with missing data were applied.

Step V: The final step concerned merging the survey data with the O-NET scores. More importantly, according to the rules of data usage by NIETS, the researcher was required to sign a contract concerning data usage and data protection at the legal department first. Then, the survey data file was merged with the individual students' O-NET scores and any unmatched national IDs were also checked by the IT officers. According to the principle of data utilisation, NIETS were the party responsible for merging the files and deleting national IDs in order to act in compliance with ethical issues concerning confidentiality and anonymity.

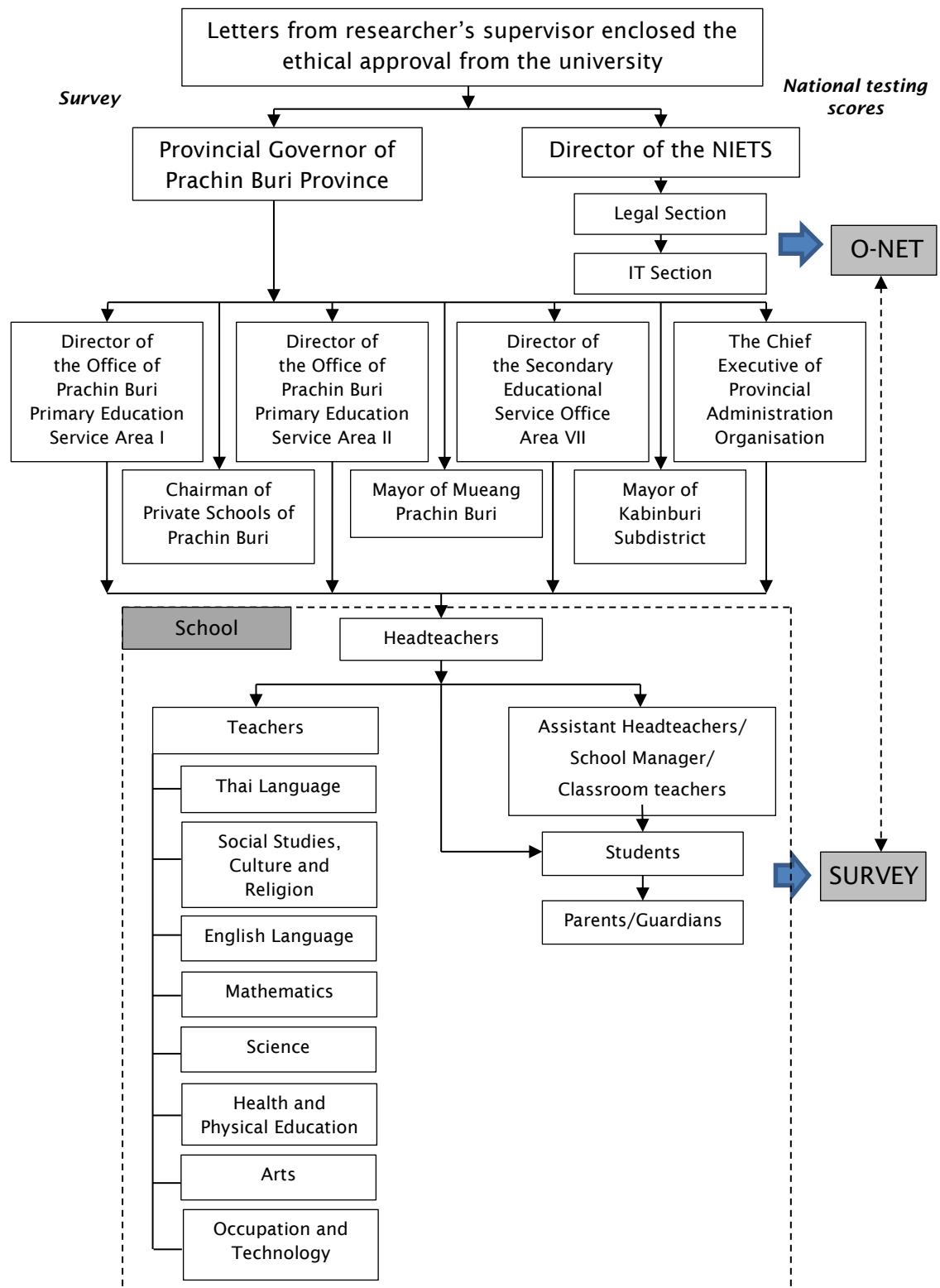


Figure 6-16 Access to respondents in the quantitative study

6.8 Data analysis

6.8.1 Item response theory and scaling methodology

Item response theory (IRT), also known as the modern test theory or latent trait theory, is an extension of the classical theory concerning the mathematical relationship between latent trait and item responses (Ostini & Nering, 2006; Thissen & Wainer, 2001). The idea of IRT relates to item calibration and scoring (Thissen, Nelson, & Rosa, 2001; Thissen & Wainer, 2001). Typically, the IRT is a function that involves the probability of a person responding to an item in a particular pattern reflecting that person on the trait measured by the item (Baker & Kim, 2004). In other words, its function identifies a person having more of a latent trait is likely to respond differently in a response category in the item from a person who has less of the latent trait. Mathematically, the function can normally be expressed in the form of a logistic ogive and also refer to an item response function (IRF), which reflects the probability of selecting a positive response to an item (Verhelst, 2010).

In order to deal with item calibration and score scaling, this study applies the one-parameter logistic (1PL) and two-parameter logistic (2PL) model for dichotomous items and the graded response model for polytomous items.

❖ One-parameter logistic model (1PL)

The one-parameter logistic model (1PL) is used for scaling in the case of dichotomous items, where the probability of choosing a certain category is '1' instead of '0'. The model can be mathematically written as (Verhelst, 2010):

$$P_i(X_i = 1|\theta) = \frac{\exp(\theta - \delta_i)}{1 + \exp(\theta - \delta_i)}$$

where P_i is the probability of respondent n choosing 1 on the item i , θ_n is the latent trait of respondent n and δ_i is the estimated location of item i on the dimension called an item difficulty parameter.

❖ Two-parameter logistic model

Extended from the 1PL model above, the two-parameter logistic model (2PL) has a similar model as 1PL, but adds the discrimination into the model. Thus, it can be modelled as (Verhelst, 2010):

$$P_i(X_i = 1|\theta) = \frac{\exp[\alpha_i(\theta - \delta_i)]}{1 + \exp[\alpha_i(\theta - \delta_i)]}$$

where α_i is the estimated slope of item i so called item discrimination parameter.

❖ **Graded response model**

In the case of items with more than two categories, called 'polytomous data', with the ordered categories, as for example with the Likert-types items, the categories can be labeled as $0, 1, 2, \dots, n$. With respect to the latent trait, the assumption is that gaining a '0' is an implication of a value lower than obtaining a '1'; likewise, '1' points to a value lower than '2', and so on.

To deal with the ordered categories, Samejima (1996) developed the graded response model, as per which the IRT model can be generalised to the graded response model as follows:

$$P_i(X_i \geq j | \theta) = \frac{\exp \sum_{k=0}^j (\theta - \beta_{ij})}{1 + \exp(\theta - \beta_{ij})}$$

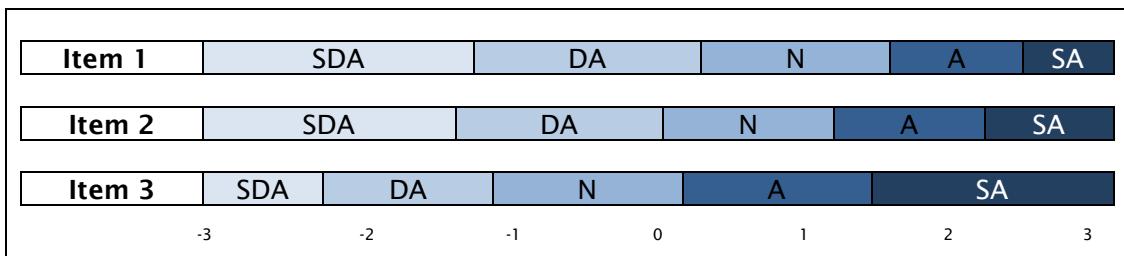
where P is the probability of respondent n selecting X on item i , θ_n is the latent trait of the respondent n . To calculate the parameter in the model with many thresholds, given a person's latent trait, the probability of response on the item i is expressed as follows:

$$P(X_i = 0) = 1 - P(X_i \geq 1)$$

$$P(X_i = j) = P(X_i \geq j) - P(X_i = j + 1)$$

$$P(X_i = m) = P(X_i \geq m)$$

Figure 6-17 illustrates the interpretation of the item map presenting the relationship between score and item responses in the Likert scale with five categories used in the study, namely, strongly disagree (SDA), disagree (DA), neutral (N), agree (A) and strongly agree (SA) in three sample items. For instance, respondents with the location of -1, 1 standard deviation below the mean, have more than 50 percent probability of disagreeing with the first and second items, but are likely to give a neutral response for the third item. Similarly, respondents with the location of 2, that is, 2 standard deviations above the mean, are expected to agree with the first and second item, but would tend to strongly agree with the third item.



Note: SDA = Strongly disagree; DA = Disagree; N = Neutral; A = Agree; SA = Strongly agree

Figure 6-17 Sample of the item map in the IRT in the study

[Source: OECD, 2012]

❖ Score scaling

Using the IRT score scaling, the basic concept, in general, is not based on the estimates of the person's ability or other attributes on summed scores. To distinguish the score scaling from the classical theory, the IRT uses a scale score whose properties can make comparisons when adding or deleting items, weigh the individual items based on discrimination powers, produce accurate standard errors and provide flexible adjustments for guessing, and it is present on the same continuum as item locations. The general idea of the estimate of the magnitude of the individual's latent trait is based on the item response function leading to a weighted score.

In this study, the Bayes estimation method is deployed, using expected *a posteriori* estimation for response patterns where the mean of the posterior distribution θ , given the pattern of the observed response x_i (Thissen, n.d.). Using the Gaussian quadrature theorem, θ can be approximated shown below (Thissen, n.d.):

$$\bar{\theta}_i \cong \frac{\sum_{k=1}^q X_k P(x_i / X_k) A(X_k)}{\sum_{k=1}^q P(x_i / X_k) A(X_k)}$$

where $A(X_k)$ is the weight determined by the assumed θ distribution assumed and x_i is the observed response pattern.

The function of the response pattern, x_i , is called the expected *a posteriori* and estimates (EAP), which is a precision measure that can be determined using the posterior standard deviation, $PSD(\bar{\theta}_i)$ estimated as shown below (Thissen, n.d.) :

$$PSD(\bar{\theta}_i) \cong \frac{\sum_{k=1}^q (X_k - \theta_i)^2 P(x_i / X_k) A(X_k)}{\sum_{k=1}^q P(x_i / X_k) A(X_k)}$$

Thissen (n.d.) notes that expected *a posteriori* estimates for response patterns:

- Produce lower average error in a population than other estimators (such as the maximum likelihood (ML))
- However, although this is generally biased in the population mean, the magnitude of biasness lies within ± 3 standard deviation of the mean in the case that the PSD is not large.
- The sample mean is an unbiased estimator of latent population mean values whereas the standard deviation of the sample is lower than that of latent population. This dilemma will be minimised if all respondents are measured within the same PSD.

6.8.2 Multilevel modelling

Multilevel modeling (MLM) is a method for dealing with hierarchical, nested or clustered data structures, which formulate the relationship between micro and macro aspects, or individuals and contexts (Hox, 2010; Muijs, 2011). The conditions required for MLM are that data be nested in different levels according to hierarchical structure and groups cannot be ignored. As Hox (2010) notes, ignoring the nature of the nested data structure by analysing data from different variables at one single level leads to two main problems. Firstly, it leads to a statistical dilemma where the information from the data is lost and power of statistical analyses is reduced. Secondly, it involves conceptual dilemmas, which may arise from interpretation of aggregated data at the individual level, widely known as the ecological fallacy, or from the formulation of the higher-level data based on lower-level data, best known as the atomistic fallacy. In addition, analysing grouped data drawn from the heterogeneous populations as if obtained from the homogeneous population may lead to misleading conclusions.

Education is a typical case of nested data structure, since students are situated within classrooms and classrooms are situated within schools (Muijs, 2011). Here, Figure 6-18 illustrates the nature of hierarchy data structure in the study, which consists of three main levels: student, classroom and school.

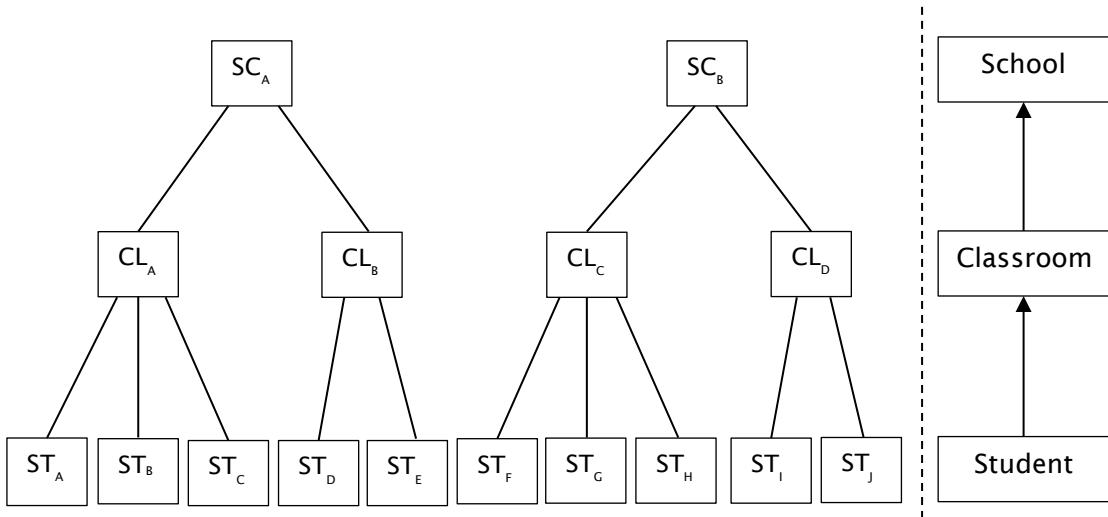


Figure 6-18 Diagram of data structure in the study

Suppose that Y is the outcome of the level 1-unit, here student (ST) is nested in the classroom (CL), which are clustered in the level 3-unit, school (SC), as shown in Figure 6-19.

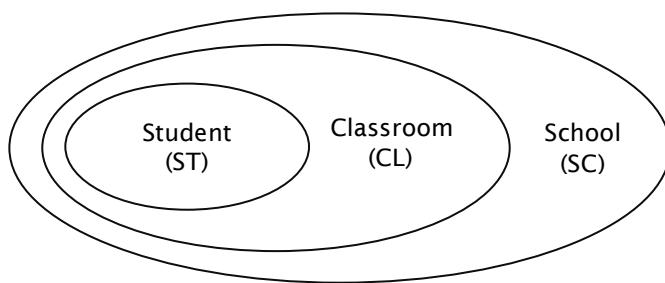


Figure 6-19 Nested data structure in the multilevel model in the study (student: classroom: school)

[Source: Kanchanawasee, 2011]

According to such a data structure, student attainment as the outcome of the model depends on three main effects (Kanjanawasee, 2011):

$$\begin{aligned}
 Y &= \mu && \text{(Grand Mean)} \\
 &+ (\mu_{SC} - \mu) && \text{(School effect)} \\
 &+ (\mu_{CL} - \mu_{SC}) && \text{(Classroom effect)} \\
 &+ (\mu_{ST} - \mu_{CL}) && \text{(Residual effect)}
 \end{aligned}$$

where μ is the mean of student attainment among students or the grand mean, $(\mu_{SC} - \mu)$ is the difference between the mean of student attainment at school level and the grand mean, *the school effect*, $(\mu_{CL} - \mu_{SC})$ is the difference between the mean of student attainment at classroom level and at the school level, *the classroom effect*, and $(\mu_{ST} - \mu_{CL})$ is the difference between the mean of student attainment at student level and at the classroom level, *the individual's difference or residual*, presenting any other effects excluding the school and classroom effects. Based on the model, the variance of student attainment can be written as follows (Kanjanawasee, 2011):

$$\sigma_Y^2 = \sigma_{SC}^2 + \sigma_{CL:SC}^2 + \sigma_{ST:CL:SC}^2$$

where σ_Y^2 is the variance of student attainment at the student level, $\sigma_{ST:CL:SC}^2$ is the variance among students within a classroom, $\sigma_{CL:SC}^2$ is the variance between classrooms within a school and σ_{SC}^2 is the variance between schools.

Notwithstanding the fact that the data structure is hierarchical, it does not guarantee that multilevel analysis is needed. This is because if the higher level of data structure does not account for significant variations of the dependent variable in the study, the single-level data analysis may be sufficient. Therefore, it is assumed that the MLM can also be used to estimate the intra-class correlation in order to indicate whether the higher-level data can significantly explain the dependent variable in the model (Hox, 2010; Leckie, 2013). The model used for this contains only the intercept, the so-called intercept model, which excluded any independent variable (Hox, 2010). With the three-level model, the intercept model can be expressed as:

$$Y_{ijk} = \beta_0 + v_k + u_{jk} + \epsilon_{ijk}$$

where Y_{ijk} is the observed student attainment for the student i in the classroom j in the school k and v_k , u_{jk} and ϵ_{ijk} are normally distributed: $v_k \sim N(0, \sigma_v^2)$, $u_{jk} \sim N(0, \sigma_u^2)$ and $\epsilon_{ijk} \sim N(0, \sigma_e^2)$. The notation used by Leckie (2013) is adopted here in the mathematical explanation. The notation defines the indices using $i = 1, \dots, N$, $j = 1, \dots, J$ and $k = 1, \dots, K$ where N denotes the total number of students, J denotes the total number of classrooms and K denotes the total number of schools in the study as shown in Figure 6-20.

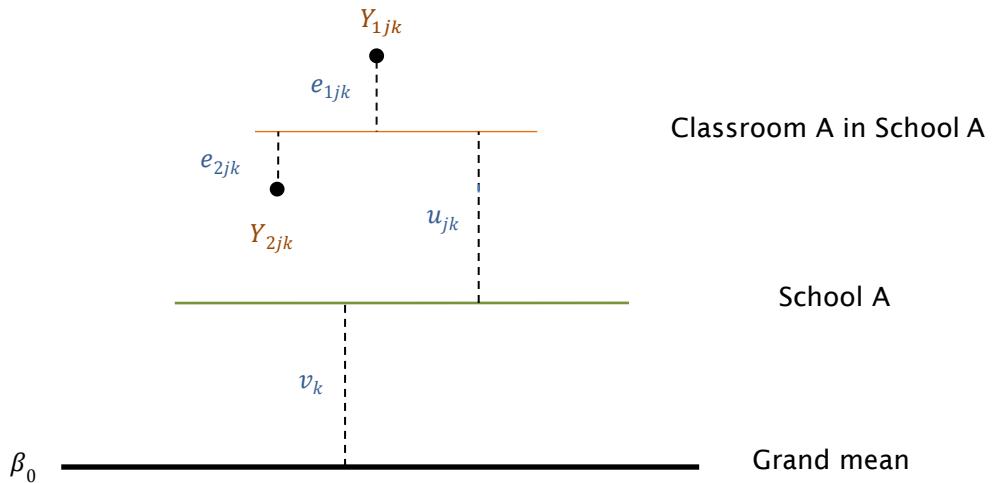


Figure 6-20 Graphical presentation of the three-level variance component model
 [Adapted from Leckie, 2013; Steele, 2008]

$$Var(Y_{ijk}) = Var(\beta_0 + v_k + u_{jk} + \varepsilon_{ijk})$$

Also, it can be written as follows:

$$\sigma_{Y_{ijk}}^2 = \sigma_{v_k}^2 + \sigma_{u_{ij}}^2 + \sigma_{\varepsilon_{ijk}}^2$$

Therefore, the total variance is constant and computed from the sum of the three variance parts: student, classroom and school. The VPC in separate parts can be computed as the ratio of the considered-level variance to total variance.

Level 1: Student-level VPC

$$VPC_{\varepsilon_{ijk}} = \frac{\sigma_{\varepsilon_{ijk}}^2}{\sigma_{v_k}^2 + \sigma_{u_{ij}}^2 + \sigma_{\varepsilon_{ijk}}^2}$$

Level 2: Classroom-level VPC

$$VPC_{u_{ij}} = \frac{\sigma_{u_{ij}}^2}{\sigma_{v_k}^2 + \sigma_{u_{ij}}^2 + \sigma_{\varepsilon_{ijk}}^2}$$

Level 3: School-level VPC

$$VPC_{v_k} = \frac{\sigma_{v_k}^2}{\sigma_{v_k}^2 + \sigma_{u_{ij}}^2 + \sigma_{\varepsilon_{ijk}}^2}$$

Besides, as Hox (2010) notes, another approach to define the interclass correlations at the classroom and school levels is to estimate the expected correlation between two randomly selected components within the same group. For example, the intraclass correlation at the classroom level indicates the expected correlation between students within the same classroom and such students must be in the same school. Thus, the variance components of both classroom and school are expressed in the numerator term. The intra-class correlation of the MLM can be expressed as:

Level 2: Classroom-level VPC

$$VPC_{u_{ij}} = \frac{\sigma_{u_{ij}}^2 + \sigma_{v_k}^2}{\sigma_{v_k}^2 + \sigma_{u_{ij}}^2 + \sigma_{\varepsilon_{ijk}}^2}$$

Level 3: School-level VPC

$$VPC_{v_k} = \frac{\sigma_{v_k}^2}{\sigma_{v_k}^2 + \sigma_{u_{ij}}^2 + \sigma_{\varepsilon_{ijk}}^2}$$

Generally, school effectiveness research investigates the effectiveness factors significantly affecting student outcomes at different levels: student, classroom and school level. Considering such effectiveness factors, the exploratory variables of each level can be added in the model which is written as:

$$Y_{ijk} = \beta_0 + \beta_{1i}X_{1ijk} + \dots + \beta_{1n}X_{nijk} + \beta_{2i}X_{2jk} + \dots + \beta_{2n}X_{njk} + \beta_{3i}X_{3k} + \dots + \beta_{3n}X_{nk} + v_k + u_{jk} + \varepsilon_{ijk}$$

where $X_{1ijk}, \dots, X_{nijk}$ are the student-level exploratory variables, X_{2jk}, \dots, X_{njk} are the classroom-level exploratory variables and X_{3k}, \dots, X_{nk} are the school-level exploratory variables and v_k , u_{jk} and ε_{ijk} are normally distributed: $v_k \sim N(0, \sigma_v^2)$, $u_{jk} \sim N(0, \sigma_u^2)$ and $\varepsilon_{ijk} \sim N(0, \sigma_e^2)$. In the model, there are two main components, namely, the fixed and random parts. The fixed part is $\beta_0 + \beta_{1i}X_{1ijk} + \dots + \beta_{1n}X_{nijk} + \beta_{2i}X_{2jk} + \dots + \beta_{2n}X_{njk} + \beta_{3i}X_{3k} + \dots + \beta_{3n}X_{nk}$ whereas $v_k + u_{jk} + \varepsilon_{ijk}$ is the random part of the model.

6.8.3 Calculating attainment equity indices

❖ Kelly's AE index

Kelly (2012) introduces the statistical equity measurement methodology of a GINI-type index for measuring the magnitude of attainment equity, the so-called Kelly's

AE index. The basic concept of Kelly's AE index is to identify 'how far a school (or group of schools) is from having a 'fair' proportion of its examination success attributable to a fair proportion of its student population' (Kelly, 2012, p. 977). Based on the original version, Kelly (2012) proposed the method based on the Lorenz curve employing the piecewise linear function as follows:

$$AE = 1 - \sum_{i=1}^n (X_i - X_{i-1})(Y_i + Y_{i-1})$$

where X_i is the cumulative percentage of student population and Y_i is the cumulative percentage of student attainment.

❖ Theil's T index

Besides the GINI-based measure, Kelly (2014) introduced Theil's T-type metric for measuring attainment equity, which can provide hierarchical data by considering two main elements: within-group and between-group. Theil's T index measuring the attainment equity can be given by:

$$T = \frac{1}{n} \sum_{i=1}^n \left[\left(\frac{V_i}{\mu} \right) \cdot \ln \left(\frac{V_i}{\mu} \right) \right]$$

where n is the number of students, V_i is the value of student attainment for student i , and μ is the average student attainment.

6.8.4 Contextual school value-added and attainment equity

School effectiveness research fundamentally focuses on the quality and equity of schooling (Kelly, 2012; Kyriakides & Creemers, 2011). As suggested by Kelly (2012), school effectiveness research should account for whether schools provide added value to students across a range of students in terms of attainment, the so-called attainment equity-contextual value added measure (AE-CVA measure). Based on this idea, schools can be classified into four school types: high equitability school (high quality and high equity), differentially effective school (high quality, but low equity), low equitability school (low quality and low equity), and uniformly ineffective school (low quality but high equity) (see Figure 6-21).

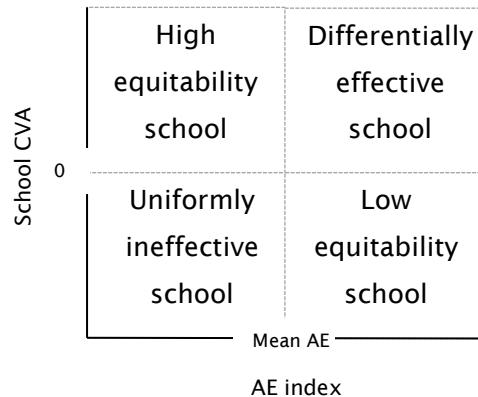


Figure 6-21 Combining Kelly's attainment equity index with school CVA

[Source: Kelly, 2012]

In practice, the residual at school level from the multilevel analysis regarding student, classroom and school characteristics, is used to indicate the school's contextual value-added (CVA). To classify the school quality in each subject, a residual at '0' represents 'average or acceptable growth' (an acceptably/typically effective school) (Kelly, 2012). A negative residual refers to negative value-added scores, meaning the school adds some values to their students lower than expected (low quality of schooling) whereas a positive residual indicates the school added values higher than expected (high quality of schooling) (Kelly, 2012).

Additionally, Kelly's AE index is used for measuring the attainment equity at school level. As proposed by Kelly (2012), an average score on Kelly's AE index is used as the cut off to identify the level of school equity. An above average score presents a low equity of attainment while a lower than average score indicates a high equity of student attainment. The products from both these two components gauge the extent of quality and equity of schooling in education (Kelly, 2012).

Topics	Objectives	Statistical methods	Statistical software
General information relating to data and respondents in the study	To describe the characteristics of variables used in the study	Descriptive statistic used consisted of: <ul style="list-style-type: none"> ▪ Frequency ▪ Percentage ▪ Mean ▪ Standard deviation ▪ Skewness ▪ Kurtosis ▪ Histogram ▪ Boxplot ▪ etc. 	IBM SPSS
Score scaling	To construct the score scaling with dichotomous and ordinal scales and to create score scale	Item response theory (IRT) <ul style="list-style-type: none"> ▪ 1-parameter logistic (1PL) ▪ 2-parameter logistic (2PL) ▪ Graded response model (GRM) Score scaling using the EAP technique	IRTPRO
Multilevel modelling	To calculate the variations of student attainment at student, classroom and school levels	Variance component analysis	MLWIN/STATA
	To study student, classroom and school factors affecting student attainment	Multilevel analysis (three-level model)	MLWIN/STATA
	To calculate the residuals indicating the contextual value-added	Residual analysis	MLWIN/STATA
Attainment equity	To calculate the level of attainment equity indices at the school level	Calculating indices: <ul style="list-style-type: none"> ▪ Kelly's AE index 	Free online statistical computation: http://www.wessa.net/co.wasp
		▪ Theil's T index	Excel
	To study factors affecting the attainment equity at the school level	Multiple liner regression	STATA/SPSS

Table 6-21 Summary of statistical techniques used in the study

6.9 Conceptual Framework

The conceptual framework is a research tool which reflects or demonstrates the research and its contexts and also identifies the existence of actions and behaviours through the framework (Smyth, 2004). As a function of conducting research, conceptual frameworks are useful for manifesting how the study promotes knowledge, conceptualising the study, presenting the research design, and clarifying the viewpoints for interpreting the results (Oppong, 2013). In particular, in empirical and scientific research, the conceptual framework facilitates the research to be carried out in an orderly and cohesive manner (Taylor, 2005), in order to generate a scheme to be viewed, tested, reviewed and reformed as a consequence of investigation (Lincoln & Guba, 1985).

Figure 6-22 presents the quantitative conceptual framework in the study. In detail, it consists of three main parts:

Part A: Study of factors affecting student attainment – this part of conceptual framework originates from the most-up-to-date educational/school effectiveness model: the dynamic model of educational effectiveness by Creemers and Kyriakides (2008). It investigates the factors affecting student attainment using multilevel analysis.

Part B: Study of factors affecting attainment equity at the school level – this part investigates the relationship between school factors and attainment equity using multiple regression analysis.

Part C: Investigating quality and equity dimensions – this part focuses on combining the results from Part A and B. Based on such results, schools are classified on the basis of quality and equity across eight main subjects. Thereafter, an investigation of such patterns across eight main subjects existing within the schools is identified and the schools are categorised on the basis of these patterns.

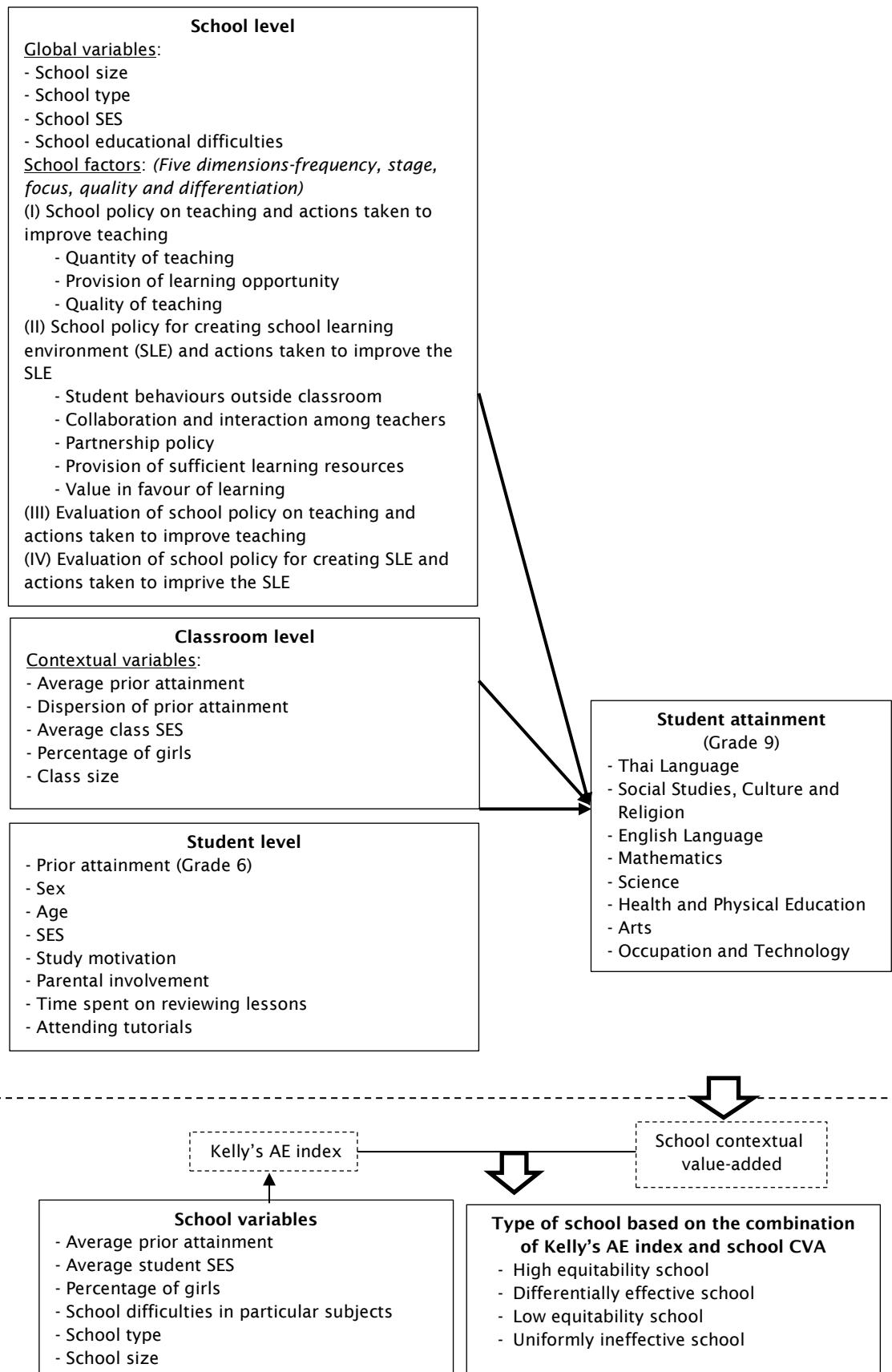


Figure 6-22 Conceptual framework in the quantitative research

6.10 Limitations deriving from the quantitative research in the study

All research studies have limitations. Thus, the identification of limitations is a useful caveat for understanding research content and findings. Limitations can also signify issues that require consideration and further study in order to reduce those limitations and acquire more extensive knowledge. In light of this, the present study identifies five limitations.

Firstly, the data was collected from two main sources, i.e. a survey with questionnaires and O-NET scores from the national-level examinations conducted by NIETS, for the following reasons: there was a lack of central educational databases; schools did not systematically collect data; and local schools were also governed by different educational organisations. As a result, different methods were used for collecting data from the students, teachers, and headteachers in different classrooms and schools. With time-constraints and a limited budget, the present study used the data from the questionnaire survey as its primary source of data. Thus, further quantitative studies should use various sources of data, such as school document analysis and classroom observation, in order to improve the accuracy and completeness of data.

Secondly, to access the sources of data, as previously mentioned regarding the merging of data from the survey and individual students' O-NET scores, it is required that the students' national identification numbers (13 digits) are authorised by the Ministry of Interior. Hence, some schools were unwilling to participate in this study. Additionally, some schools did not allow the researcher to collect data from their pupils. Rather, the schools voluntarily collected the data for the researcher, and this practice might have affected the response rates.

Thirdly, regarding problems in collecting the administered questionnaires, some students and their parents/guardians were absent on the days that the questionnaires were administered. For practical reasons, the researcher gave the questionnaires to classmates and/or their homeroom teachers and then collected them on appointed days. In some cases, there were difficulties with remote schools regarding returning the document. Therefore, the researcher provided envelopes with stamps in order to have the answered questionnaires returned to the researcher's address. Nonetheless, the response rates of this group were difficult to identify.

Fourthly, although the language used in the questionnaires was simplified to be accessible to Grade 9 students and to facilitate data collection, some students had literacy-related issues and the researcher found that they asked their friends about the meanings of questions. Accordingly, the researcher tried to solve these issues by communicating with these students and explaining the questions to them, in order to obtain the most accurate and complete data possible. In some cases, the researcher had to read each question aloud. There was, nevertheless, some difficulties in solving these issues, depending on different situations.

Fifthly, due to the fact that the O-NET test is a national-level test that measures the qualities of schools in teaching students, it was not one of the compulsory graduation tests that schools and NIETS try to encourage the students to take; some students might not have taken the test. Hence, the value-added model required the O-NET tests in Grade 6 and Grade 9 as prior attainments and post attainments. Some students in certain cases were excluded from the analysis.

6.11 Chapter summary

This quantitative study aims to build models of school effectiveness and equity attainment in the Prachin Buri Province, Thailand. Adopting a conceptual framework based on the most up-to-date model, the dynamic model of educational effectiveness by Creemers and Kyriakides (2008), the multilevel structure focused on three main levels: student, teacher, and school. Data obtained in the study was from a survey and national testing scores of eight subjects from the 2012/13 academic year. Furthermore, the data was analysed using a multilevel data analysis. For equity attainment, as Kelly (2012) introduced, Kelly's AE index and Theil's T index were calculated to indicate the magnitude of inequity in student outcomes within schools. As a consequence, the final outcomes obtained from both the multilevel models, in terms of residuals, and the attainment equity indices in eight subjects within the school were combined. Based on these outcomes, schools were classified based on similarities in patterns across eight main subjects, which were used to define cases according to school typology in the qualitative phase.

7. Chapter 7: Methodology and methods: Qualitative Phase

This chapter describes the qualitative research methodology adopted in the study. Specifically, the research question derived from the quantitative data was: how and why do Thai schools perform differently in terms of quality and equity? The chapter begins with a justification for selecting a qualitative multiple case study approach, and the selection of cases and study participants. It continues with an explanation of the research processes used for the data collection and analysis, and the final section discusses the strategies used for establishing trustworthiness of the findings.

7.1 Case study

There are a great variety of research designs in the field of qualitative research. These include narrative research, grounded theory, ethnography, phenomenology and case study (Creswell & Maietta, 2002). Each type has its own features and purpose. Narrative research is most appropriate for studying stories of lived experience; grounded theory best enables the development of theory in relation to social phenomenon (Creswell & Maietta, 2002); ethnography focuses on the study of human nature in social and cultural groups; phenomenology relates to understanding the essence of lived experiences surrounding a phenomenon (Cohen et al., 2007); and the case study approach is most appropriately used for building a rich picture or gaining in-depth insights into a particular context (Cresswell & Maietta, 2002; Hamilton, 20101).

There are many definitions of the term “*case study research*”. The general notion of case study, as defined by Thomas (2012, p. 1), is that it is ‘about the particular, rather than the general’. According to Yin (2009, p. 18),

‘A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident.’

Based on several academic works relating to case studies, Gerring (2007) summarised the approach as a method that: (i) that involves a qualitative approach with a small sample size; (ii) uses an holistic approach; (iii) employs a certain type

of evidence; (iv) uses naturalistic methods of data collection with a focus on real-life context; (v) is applied where the case and the context are difficult to separate explicitly; (vi) employs triangulation by using multiple sources of data; (vii) explores the properties of a single observation; and (viii) investigates a single phenomenon or example. However, it can be argued that case study research is about both the subject of the study (Cresswell & Maietta, 2002; Stake, 1995) and also the research methodology and method (Cresswell & Maietta, 2002; Yin, 2009). In either situation, case study research is an investigation of a bounded system, which can have either single or multiple sites, through an in-depth data collection process from several sources of data in order to gain rich information leading (it is hoped) to an insightful understanding of a social phenomenon in a particular context (Cresswell & Maietta, 2002; Stake, 1995; Yin, 2009).

Regarding the typology of the case study research, Yin (2009) notes that a case study approach is typically appropriate when a researcher needs to find out answers to why and/or how research questions are posed, and when the research focuses on a contemporary phenomenon of real-life contexts and where the researcher has little or no control over events. It is most appropriate for investigating a unique and particularly complex phenomenon in-context, particularly when the boundaries between context and phenomenon are not explicitly identified or identifiable.

Case studies can be classified into three main types, according to purpose: intrinsic, instrumental and collective (Stake, 1995). An intrinsic case study provides understanding in a particular case; an instrumental study is designed for insights into something else, rather, the particular issue in question; and collective study is for sorting various cases (Stake, 1995). In the same way, Yin (2009) identifies cases based on their applications: explanatory, descriptive, and exploratory.

The multiple case study research strategy is the strategy adopted in this study, conceptualising each type of school as a unique case in the investigation. Selecting such a strategy is driven by the small existing knowledge base in relation to the typology of schools in Thailand and on a combination of quality and equity dimensions within schools. Moreover, related empirical studies and literature in the area of school effectiveness research are rare and imperfect, so that multiple case studies can provide in-depth understanding in terms of how and why Thai schools perform differently across subjects; comparing different school types also generates rich data to provide the researcher with insights into these phenomena

in schools in Thailand. The rationale is that this leads to a new knowledge base in school effectiveness research in the region.

7.2 Defining cases

Fundamentally, case study research focuses on the notion of a boundary, which is investigated and analysed to capture the main elements of the case (Hamilton, 2010). In this study, seventy-four schools [in which the number of Grade 9 students was more than 20] were classified based on a combination of school CVA and Kelly's AE index across eight main subjects. The process of school classification is shown below:

Type I: Schools that showed a *high* level of equitability in the subject

Type II: Schools that were *differentially effective* in the subject

Type III: Schools that showed a *low* level of equitability in the subject

Type IV: Schools that were *uniformly ineffective* in the subject

In the next step, schools were classified based on the similarities of the overall characteristics of equity-contextual value-added measure (AE-CVA measure) across eight main subjects. Based on this idea, schools were classified into four main types:

Type I: Schools that showed a *high level of equitability* across subjects

Type II: Schools that were *differentially effective* across subjects

Type III: Schools that showed a *low level of equitability* across subjects

Type IV: Schools that were *consistently ineffective* type across subjects

Figure 7-1 presents the process of school classification in the multiple case study research.

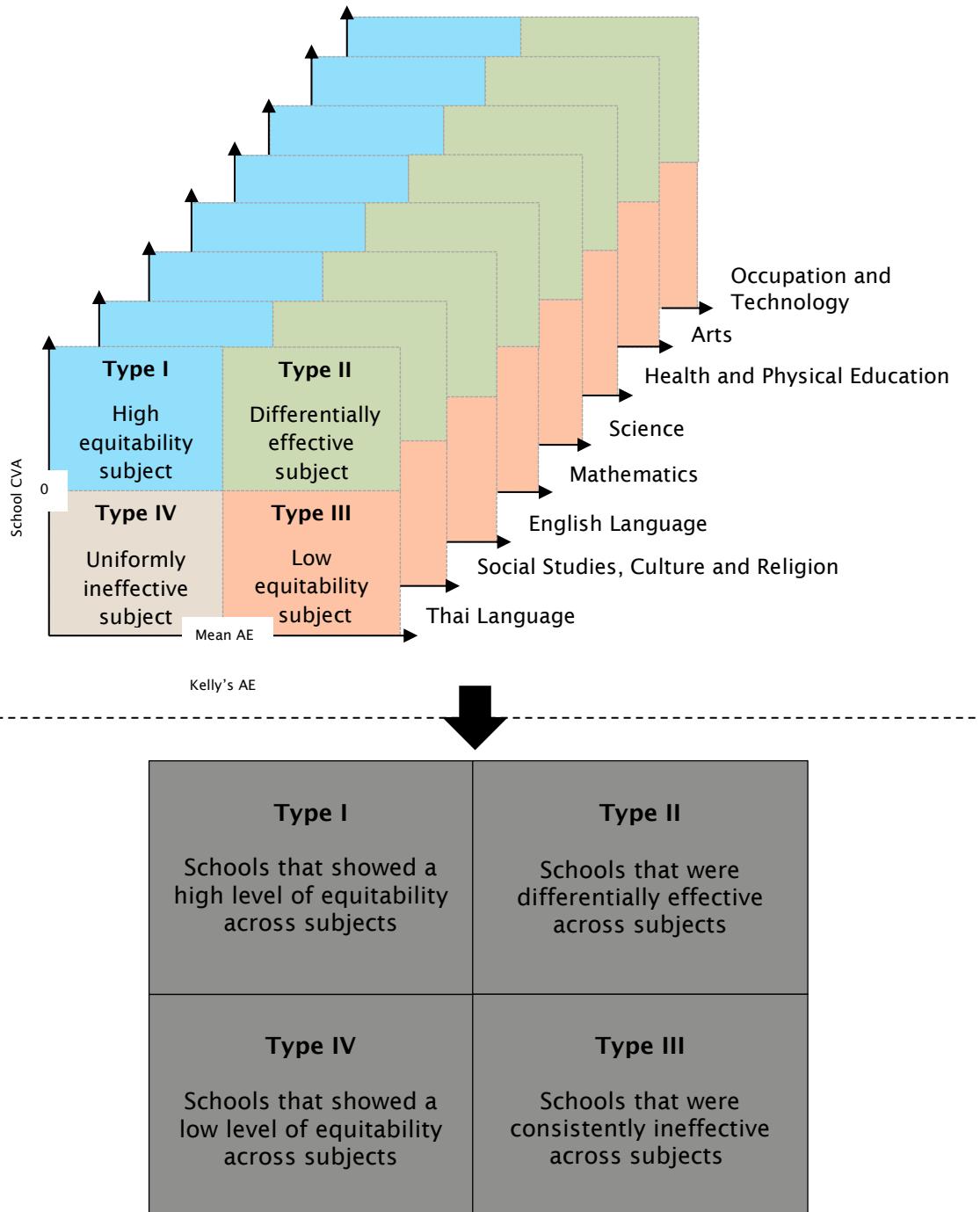


Figure 7-1 Classification process of school types

7.3 Case selection

When a multiple case study method was adopted to provide in-depth insight into quality and equity within schools in Thailand, it was important to ensure that the benefits of the multiple case study method were realised. Stake (2006) suggests the number of cases should not be less than four or more than ten, since a smaller number of cases may not be sufficient for clarifying the interactivities between programmes and situations, and a large number of cases (more than ten) could cause 'over uniqueness of interactivities'. In this study, one school was selected from each group of schools as being representative of that school type (as shown in Figure 7-1 above) in order to illustrate the most insightful characteristics of the school type.

As Flyvbjerg (2011) notes, various forms of sampling techniques can be used for case selection, to suit different points of view and different circumstances. Random selection (e.g. random and stratified sampling) puts emphasis on avoiding systematic bias, thus allowing for generalisation for the whole population, but despite these benefits, it is argued that this approach may not be appropriate since the *average* case might not provide the richest information. Information-oriented selection (e.g. extreme/deviant, maximum-variation, critical and paradigmatic orientation), on the other hand, helps to maximise information utility and cases are typically selected on the basis of expected information content.

Regarding the contribution of multiple case studies to this research, both in terms of practical considerations and the theoretical development of school effectiveness research in Thailand, the information-oriented selection strategy for selecting schools that provide the specifically distinguished characteristics across eight main subjects, in each school type (see Figure 7-1), was adopted in this study. Since empirical studies on school typologies are limited, it is thought that an analysis of multiple cases based on information-oriented selection would provide an opportunity to gain the richest possible insights and present an overall picture of school effectiveness in the Thai education system. Considering that the majority of schools in this research setting are small public schools, only small-sized schools were selected for this study. Figure 7-2 gives an overview of the multiple cases in the study.

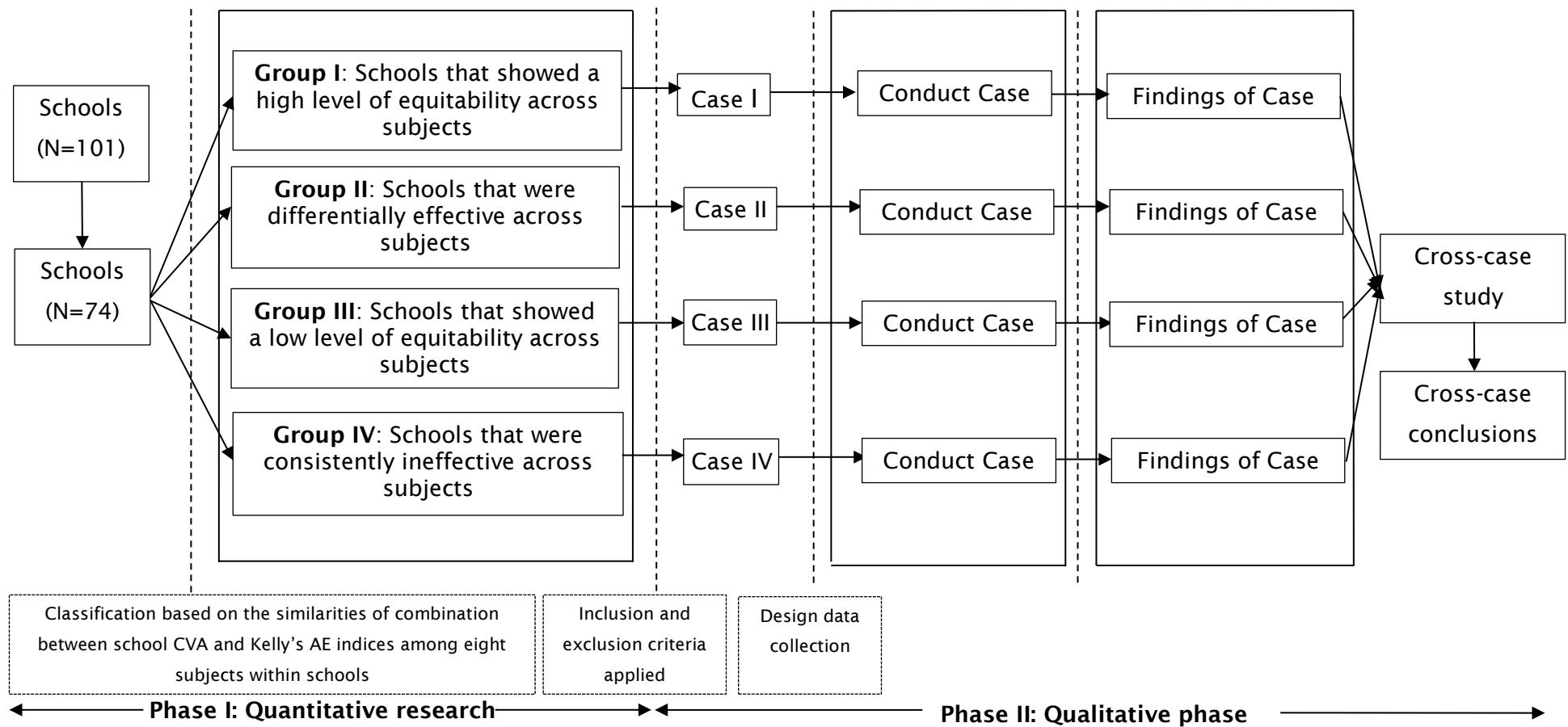


Figure 7-2 Overview of study in Phase II

7.4 Participants

In schools, headteachers and teachers are the key persons who are closely involved with their students. Listening to their voices and including their opinions and perceptions can help provide a greater understanding of the processes of ensuring quality and attainment equity within schools.

However, qualitative research has no particular rule regarding sample size (Bryman, 2008a); in general, it depends on information and research purposes. Therefore, participation in this study used purposive sampling, as opposed to probability sampling. In purposive sampling, the sample size can be increased if not enough information is acquired (Bryman, 2008a), so it was decided that the proposed sample size for each school should be the headteacher and eight teachers from different academic strands (see Table 7-1). For teacher participants, the selection/inclusion criterion was to choose appropriate informants who had an understanding of the phenomenon and contexts of their schools, and:

- (i) Had teaching experience in the relevant subject(s) for at least three years
- (ii) Worked in the school for at least three years
- (iii) Had no sabbatical leave in the previous three years

Participants	Rationale
Headteachers (N=1)	A school leader who is in direct and indirect charge of school in various aspects (e.g. school policy, evaluation, atmosphere, quality and equity). His/her responsibilities and duties closely involve school quality and equity.
Teachers who have taught in the following subjects: <ul style="list-style-type: none">▪ Thai Language (N=1)▪ Social Studies, Culture and Religion (N=1)▪ English Language (N=1)▪ Mathematics (N=1)▪ Science (N=1)▪ Health and Physical Education (N=1)▪ Arts (N=1)▪ Occupation and Technology (N=1)	He/she is directly and/or indirectly involved in formulating, supporting and implementing school policies. Particularly, he/she plays an important role in teaching.

Table 7-1 Participants in each school case

7.5 Data collection

Data collection involves gathering information for research projects and differs according to the type of research being conducted. In case study research, data can be obtained from single or multiple sources. Multiple sources of data are expected to provide rich and complementary information, contributing to a better understanding and more scientifically rigorous research.

Credibility is achieved by triangulation – using multiple sources of evidence is beneficial and contributes to the overall picture – so for this research, semi-structured interviews with headteachers and teachers in eight strands were used and secondary data was additionally collected from (internal and external) school documents.

7.5.1 Semi-structured interview

The interview is frequently considered the gold standard of qualitative research. It is ‘a conversation with a purpose’ (Bryman, 2008a) and is the most common data collection method. It provides in-depth interaction between the participant and the researcher (Barbour, 2008) and allows the researcher to gather opinions, perspective and thoughts from the participant. Interviews should be more than verbal exchanges, but in any case they aim to collect data to answer the research questions under consideration.

There are different kinds of interview and the different forms depend on the amount of control that the researcher attempts to exercise over participants’ responses (Bernard, 2000). It depends largely on the priorities of the researcher. The continuum of interviews stretches from structured, through semi-structured, to unstructured interviews. According to Bernard (2000), in the fully semi-structured interviews, predefined fixed questions are set and all respondents are asked to respond to the same set of questions, though the prepared questions can be modified based on what the interviewer perceives as most appropriate aspects of the interview. In this study, the semi-structured interview was chosen as an appropriate approach and they were conducted face-to-face, which allowed the researcher to gather subjective information that sometimes cannot be explicitly and directly obtained through other approaches.

7.5.2 Documents and related information

The term ‘documents’ pertains to impressive traces of the thoughts and actions of human beings that are left as evidence of former times (Scott, 2006), including the implication of chains of actions (Bryman, 2008a). According to Bryman (2008a), documents include a range of different source types, such as personal documents, official documents, mass-media outputs and virtual outputs.

In this study, the documents used are mainly based on official internal and external school documents. Internal school documents cover annual/monthly school meetings, documents related to school philosophy, mission and vision statements, policies and regulations and other related material. The external documents are from the executive summary of educational quality assessment in round I (2001-2005), round II (2006-2010) and round III (2011-2015), reported and summarised by the Office for National Educational Standards and Quality Assessment (Public Organisation), Thailand (ONESQA) and the national testing scores provided by the National Institute of Educational Testing Services (Public Organisation), Thailand. Both of these organisations will provide information useful for considering the effectiveness of schools in dealing with quality and equity; they will also enable the researcher to understand the school contexts.

Both interviews and documentation have their own strengths and weaknesses, as shown in Table 7-2. As discussed by Yin (2009), using both sources provides some strengths to overcome individual drawbacks and enhances trustworthiness of the study.

Sources of data	Strengths	Weaknesses
Semi-structured interview	<ul style="list-style-type: none"> ▪ Directly targeted on case study topics ▪ Insight provides perceived causal inferences and explanations 	<ul style="list-style-type: none"> ▪ Bias due to question wording ▪ Response bias ▪ Inaccuracies due to poor recall ▪ Reflexivity – interviewee gives what interviewer wants to hear
Documentation	<ul style="list-style-type: none"> ▪ Stable and can be reviewed repeatedly ▪ Unobtrusive, because not created as a result of the case study ▪ Exactness due to containing exact name, references and details of phenomenon ▪ Broad coverage over a long span of time, many events and many settings 	<ul style="list-style-type: none"> ▪ Retrievability can be an issue; can be difficult to find ▪ Bias selectivity if collection is incomplete ▪ Reporting bias because it reflects influence of author ▪ Access may be deliberately withheld

Table 7-2 Strengths and weaknesses of sources of data used in the case study

[Source: Yin, 2009]

7.6 Data collection timeline

Qualitative data was collected after obtaining quantitative findings, which were used as a guideline for classifying school type – based on the pattern of quality and equity across eight main subjects existing within schools. Thus, data collection took place from October 2014 to March 2015, mainly in the second semester of the academic year 2014/15. Table 7-3 presents the data collection process in the qualitative phase.

Activities	School break	Second semester of academic year 2014/15					School break
	Oct	Nov	Dec	Jan	Feb	Mar	
Preparing and applying for ethical clearance	↔						
Contacting the educational organisations for permission to conduct research in schools	↔	→					
Contacting schools to ask permission to conduct research	↔	→					
Collecting data at schools (fieldwork)		↔			→		
Collecting the school assessment report by ONESQA						↔	

Table 7-3 Gantt chart of qualitative data collection process

7.7 Field notes and reflective diary

Field notes play an important role in the research project: they help the researcher recall information such as behaviours, activities, events and other characteristics and surroundings of the research settings. In addition, the important issues that need to be extensively monitored and dealt with are specified in the notes. In a reflective diary, the researcher recorded the details of the respondents, such as opinions and unexpected and unusual circumstances or interactions that occurred during the fieldwork. Importantly, these notes directly and indirectly assisted the researcher in comprehending the phenomenon in question.

7.8 Data analysis

Qualitative data analysis is a process whereby the qualitative data is established or transformed into a form of examination, categorisation, tabulation and combination of data leading to conclusions (Yin, 2009). However, its underlying roles may differ according to the research questions addressed: defining concepts to comprehend internal structures, mapping the range, the nature and phenomena dynamic, creating typologies, investigating associations, searching for explanations, and building theories or concepts (Ritchie & Spencer, 1994). The

method of data analysis used in this study is the *framework approach*, initially introduced by the National Centre for Social Research, UK (Green, 2008; Ritchie & Spencer, 1994). This method employs the matrix-based system for ordering and synthesising data, leading to theoretical depiction of cases (Ritchie & Spencer, 1994). In addition, this approach is highly suitable when the study focuses on policy outcome orientation and the research aims have been explicitly determined from the outset (Green, 2008).

Having adopted the framework analysis as the method of qualitative data analysis, there are seven main steps (Ritchie & Spencer, 1994; Srimuang, 2013):

- **Data preparation:** preparing transcription for data analysis
- **Familiarisation:** gaining the overview of the whole data collected in its richness, depth and diversity
- **Identifying the thematic framework:** developing coding scheme in the thematic framework
- **Indexing:** applied systematic thematic framework or index to data in its textual form
- **Charting:** contriving the headings (themes) and subheadings (sub-themes) in the matrix chart/table
- **Mapping and interpretation:** drawing together features of data and mapping and interpreting data set as a whole. This stage relates to some activities according to the aims of researcher at the outset such as defining concepts, mapping the range and nature of phenomenon, building typologies, seeking associations and providing explanations
- **Cross-case analysis:** comparing the findings among cases

To proceed with the data analysis, the process adopted in the study can be divided into seven main steps as shown in Figure 7-3.

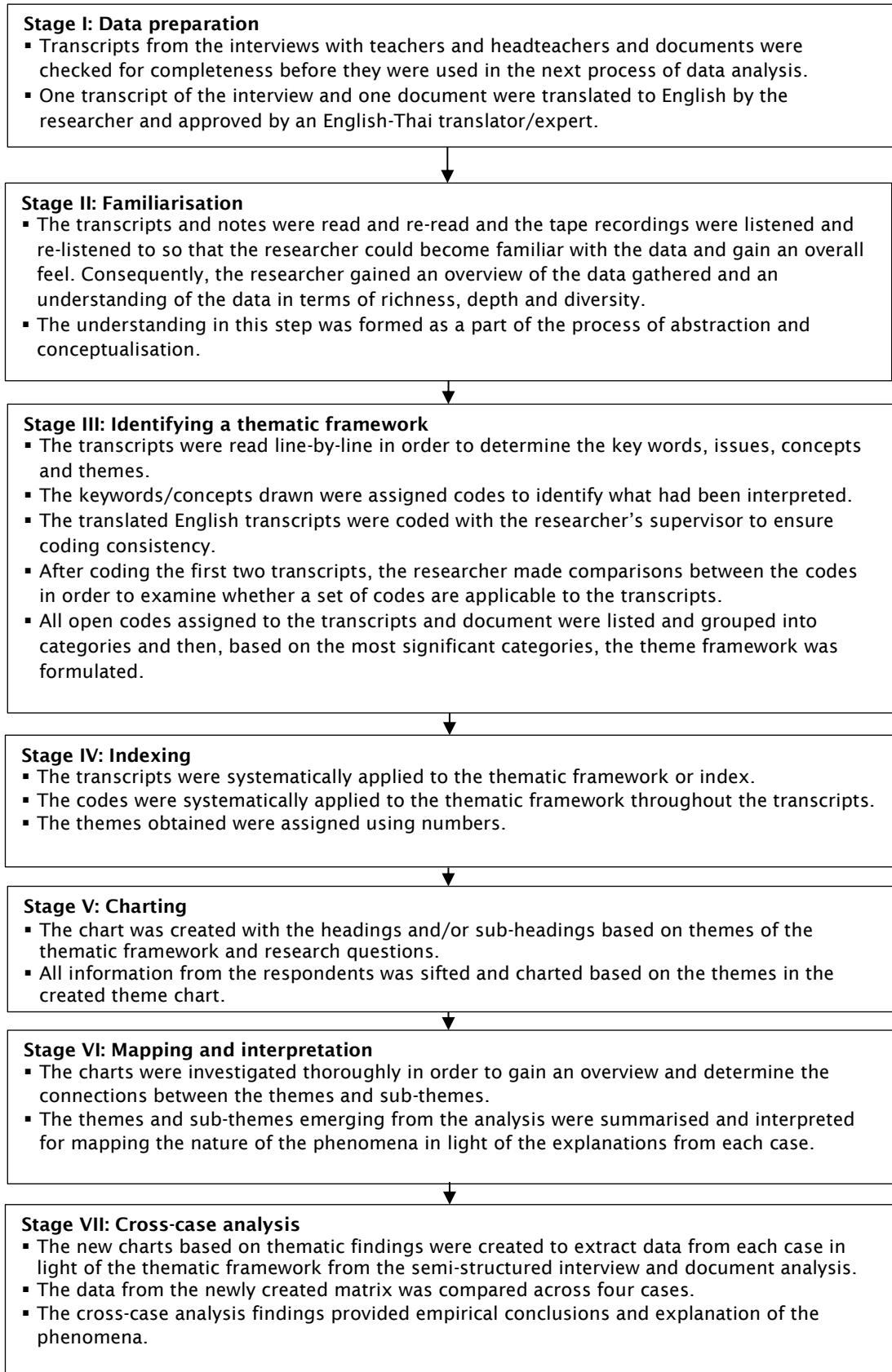


Figure 7-3 Process of data analysis in the qualitative study

[Adapted from Srimuang, 2013]

7.9 Strategies used to establish trustworthiness

To ensure high trustworthiness or value of any particular research, it is important to ensure that the research is subjected to rigor (Morse, Barrett, Mayan, Olson, & Spiers, 2002); in other words, a great deal of exactitude must be established in every research undertaking. However, post-positivists frequently claim that, compared to the quantitative approach, the qualitative approach – as a naturalistic work – may always lack validity, reliability and objectivity, despite of that natures and aims, in fact, differs to be applied the same criteria and sometimes are not comparable themselves. As Lincoln and Guba (1985) note, an identification process addressing research quality and posing questions that can be applied to both quantitative and qualitative approaches includes four main criteria: truth value, applicability, consistency and neutrality (See Table 7-4).

Criteria	Questions posed by Lincoln and Guba (1985, p. 290)	Quantitative approach	Qualitative approach
Truth value	<i>'How can one establish confidence in the truth of findings of a particular inquiry for the subjects (respondents) with which and the context in which the inquiry was carried out?'</i>	Internal validity	Creditability
Applicability	<i>'How can one determine the extent to which the findings of a particular inquiry have applicability in other contexts or with other subjects (respondents)?'</i>	External validity	Transferability
Consistency	<i>'How can one determine whether the findings of an inquiry would be repeated if the inquiry were replicated with the same (or similar) subjects (respondents) in the same (or similar) context?'</i>	Reliability	Dependability
Neutrality	<i>'How can one establish the degree to which the findings of an inquiry are determined by the subjects (respondents) and conditions of the inquiry and not by the biases, motivations, interests, or perspectives of the inquirer?'</i>	Objectivity	Confirmability

Table 7-4 Comparison of the criteria and questions as per the research approach

[Source: Kreft, 1991; Lincoln & Guba, 1985]

In qualitative research, the quality or appropriateness of an inquiry can be established in terms of *trustworthiness*. Lincoln and Guba (1985) identify four main criteria to establish the trustworthiness of a qualitative study:

- **Creditability:** the believability of the findings based on the 'fact' or 'truth' of the phenomenon under deliberation.
- **Transferability:** the ability for generalisation of the findings to similar contexts.
- **Dependability:** the consistency of the findings, i.e. the same or similar findings should be achieved if the study is repeated.
- **Confirmability:** demonstrating the research findings emerging from data or controlling the researcher's bias emerging from the interpretations.

As trustworthiness plays an important role in ensuring that the research quality and findings adhere to high standards, various strategies, according to four main criteria, were applied – as shown in Table 7-5.

Criteria	Strategies	Descriptions
Creditability	Prolonged engagement (Krefting, 1991; Lincoln & Guba, 1985; Shenton, 2004)	The researcher personally contacted the selected schools and introduced himself as a PhD candidate at the University of Southampton with a scholarship from Burapha University, in order to further build a positive personal relationship with school staff; the school staff and the researcher had already been familiar with each other since he had collected survey data in the earlier quantitative phase. The researcher explained the importance of the research project clearly and assured the participants that the data obtained through interviews and school documents would be anonymous and not shared with any third party. Furthermore, a positive relationship was prioritised and the participants were verbally informed of their right to refuse to participate and withdraw from the project at any time (also specified in the consent form), to ensure that the interviews involved only those who were willing to participate and the quality of data reflected the facts related to the phenomenon.
	Triangulation (Krefting, 1991; Lincoln & Guba, 1985; Shenton, 2004)	For the purposes of triangulation, this study applied two main sources of data from both internal and external schools across all cases. The researcher collected data from interviews, school documents (e.g. school meeting reports, school website) and reports relating to school quality and assurance assessed and reported by the Office for National Education Standards and Quality Assessment (Public Organisation) (ONESQA). For the interviews, one headteacher and teachers across eight main strands/subjects were chosen for each school included in the study. Data gained from various internal and external sources enabled the investigation to be carried out from multiple perspectives and allowed the researcher to cross-check the phenomenon. Therefore, the derived outcomes added to existing findings, interpretations and conclusions
	Peer examination (Krefting, 1991)	Before collecting the qualitative data, the research project must be approved by the researcher's supervisor, an ethical committee of the University of Southampton and the head of the local educational office. Furthermore, all processes, including the questions, needed to be discussed and examined by the researcher's supervisor in order to ensure that all processes meet the high quality standard and are appropriate in terms of being on track, precise, in agreement with research objectives and without bias. This step also ensured that the methodology and research instruments used are ethical and practical.

Table 7-5 Techniques used to establish trustworthiness in the study

Criteria	Strategies	Descriptions
Creditability (continued)	Iterative questioning (Shenton, 2004)	To gain in-depth information from the interview respondents, iterative questioning, or rephased questions, was used for probing or to return to interesting matters raised.
	Negative case analysis (Lincoln & Guba, 1985; Shenton, 2004)	The researcher refined the hypotheses with hindsight, until it accounted for all known cases without any exceptions and revised the data in order to ensure that the constructs account for all cases.
	Reflexivity (Krefting, 1991)	The researcher used the field notes and a reflective diary for monitoring the phenomenon throughout the research project, to avoid missing key information gained from the interviews and to be aware of the researcher's personal influence or biases on data.
Transferability	Dense description (Lincoln & Guba, 1985)	To simplify and allow comparisons with the same or similar cases; detailed information related to school background, context and participants of cases was clearly identified in the thesis. Moreover, strategies adopted to select the 'right persons' as key informants were explicitly discussed.
Dependability	Audit trial of research process (Krefting, 1991; Lincoln & Guba, 1985)	The detailed description of the qualitative research design, methodology and methods was explained. Furthermore, the unexpected circumstances and limitations which might affect the research findings were reported.
	Code-recode check procedure (Krefting, 1991)	After finishing the coding, the researcher returned to recode the data and determine whether the two sets of coding are similar.
	Triangulation (Krefting, 1991; Lincoln & Guba, 1985)	Same as shown earlier.

Table 7-5 Techniques used to establish trustworthiness in the study (continued)

Criteria	Strategies	Descriptions
Confirmability	Audit trial and process (Krefting, 1991; Lincoln & Guba, 1985; Shenton, 2004)	The audit process was ongoing throughout the research project for the raw data, data analysis, data reconstruction/synthesis, process notes, material used, and instrument development. Also, the shortcomings observed during data collection which might affect the study were clearly reported in the thesis. This helped the researcher trace the research step-by-step through the research plan and process.
	Triangulation (Krefting, 1991; Lincoln & Guba, 1985)	Same as shown earlier
	Reflexivity (Krefting, 1991; Lincoln & Guba, 1985)	Same as shown earlier

Table 7-5 Techniques used to establish trustworthiness in the study *(continued)*

7.10 Chapter summary

A qualitative research design, adopting multiple-cases, was applied to answer the question of why and how schools perform differently in terms of quality and equity. Four schools, with different characteristics in terms of the pattern of school CVA and the AE index across eight main subjects, were purposively selected as cases. Primary data was obtained from various sources: semi-structured interviews with the headteachers and teachers in eight main strands, and secondary data such as school documents and school quality assurance. Data was analysed using the framework approach and findings from each case were then compared by cross-case analysis. To ensure the rigor and quality of the multiple-case study findings, several techniques based on the Lincoln and Guba (1985)'s model of trustworthiness were applied to the research project.

8. Chapter 8: Findings from the quantitative phase: Modelling school effectiveness and attainment equity

This chapter presents the research findings from the quantitative Phase I of the study. It focuses on the general question: *what makes schools effective in Thailand in terms of quality of education and equity of attainment?* The chapter begins with an investigation of the variation in student attainment at student, classroom and school level, and then focuses on building the multilevel models to test school factors as proposed in the dynamic model of educational effectiveness (Creemers & Kyriakides, 2008). In addition, the residuals at school level from the multilevel model across eight subjects are estimated to indicate 'the school CVA'. The second part of the chapter involves quantifying the magnitude of 'attainment equity' at the school level using both Kelly's AE index and Theil's T index. The chapter then continues with an investigation of the school contextual factors affecting attainment equity. The final section discusses the outcomes from both the school CVA and Kelly's AE index across eight subjects which are used to classify schools based on the similarities across eight subjects.

8.1 Research question 1

To what extent does student attainment vary at the student, classroom and school level in Thailand? Which school factors significantly affect student attainment in Thailand?

To answer Research Question 1, the three-level model was adopted as the data was hierarchical/nested/clustered. The data hierarchy proposed in this study consists of three main levels; namely, students nested in classrooms and classrooms nested in schools. Before we proceed, it is essential to test whether the three-level model fits data performance more accurately than the two- or single-level model. To do this, the likelihood ratio test was used.

Table 8-1 presents the cluster effect testing for all eight (main) subjects, comparing the three- and single-level model, and three- and two-level model in turn. The null hypothesis is that there is *no* school effect or variation, whereas the alternative hypothesis shows that the school effect/variation exists. The findings indicate that the null hypotheses for all eight main subjects were rejected in all

subjects ($p < .001$). This means the three-level models performed better than two- and single-level models.

Subjects	Likelihood ratio test			
	Three-level vs single-level		Two-level vs single-level	
	χ^2	p	χ^2	p
Thai Language	1690.05	<.001	899.58	<.001
Social Studies, Culture and Religion	2004.66	<.001	1189.19	<.001
English Language	1269.73	<.001	586.64	<.001
Mathematics	735.87	<.001	470.20	<.001
Science	2092.08	<.001	1122.90	<.001
Health and Physical Education	1010.58	<.001	596.40	<.001
Arts	710.29	<.001	351.10	<.001
Occupation and Technology	1431.74	<.001	748.57	<.001

Table 8-1 Testing clusters using likelihood ratio test among eight main subjects

8.1.1 Variations of student attainment at student, classroom and school level

To investigate the magnitude of student attainment variation in each level of model hierarchy, a three-multilevel variance component excluding any explanatory factors in the model or the null/naïve model was utilised to decompose the variation of student achievement into student, class, and school level as shown in ‘*Model 0*’.

Figure 8-1 illustrates the percentage of variation in student attainment at student, classroom and school level. A comparison of the null models of the eight subjects shows that the highest variation in student attainment lies at student level, followed in turn by classroom and school level.

Overall the variations at the classroom level among the eight subjects accounts for around 10-20%, except for Mathematics which is only 8.4%, and at the school level in all subjects at approximately 8%.

Among the eight subjects, the highest variations in student attainment at school level were in Social Studies, Culture and Religion, at nearly 10%, followed by Science, Thai Language, Health and Physical Education, and Occupation &

Technology, which were all similar at around 6%. The rest of the subjects (Arts, Mathematics, and English) had variations at school which were all less than 5%.

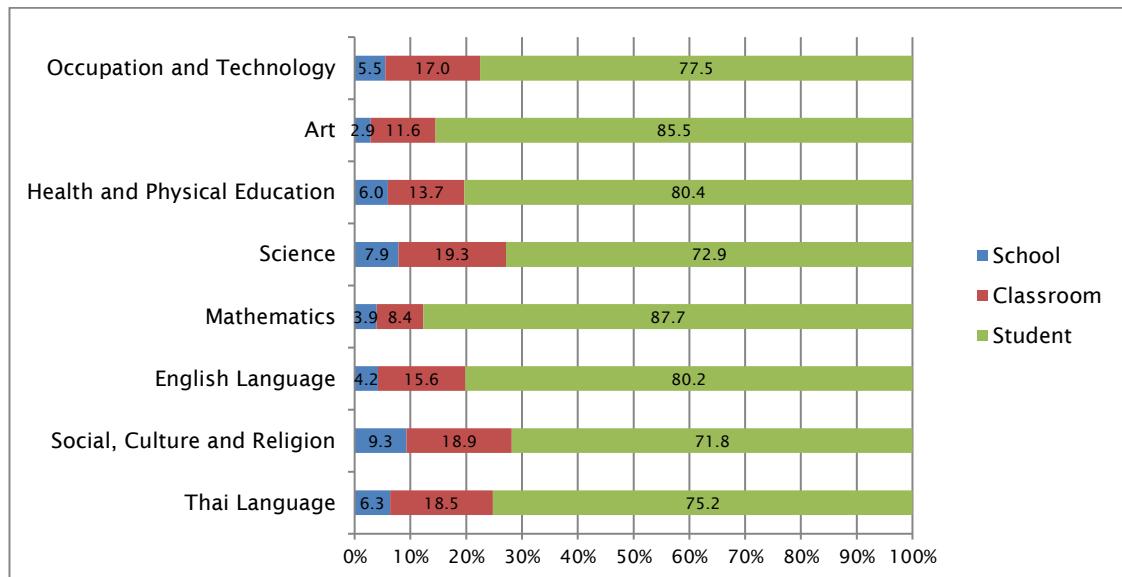


Figure 8-1 Percentage of variations of student attainment in student, classroom and school level

8.1.2 Factors affecting student attainment in Thailand: Multilevel models

In this section, we will investigate the student, classroom, and school effects on student attainment by adding these independent variables in the multilevel model. However, as suggested by many statisticians and/or researchers (Hox, 2010; Kyriakides & Creemers, 2012; Leckie, 2013), in the procedure of multilevel modelling, the sets of independent variables should be incrementally and sequentially added to the model, and then compared with the previous simpler model in order to obtain the most parsimonious model. In addition, to establish this parsimony, non-statistically significant independent variables at .05 level (p -value>.05) are removed from the model before the subsequent estimated model is conducted. In this study, the sequence of independent variables incrementally added in the model is shown in Table 8-2.

Model	Independent variables added in the model
(0)	Null or naïve model
(1)	Prior attainment
(2)	(1) + Sex + Age + SES
(3)	(2) + Study motivation + Parental involvement + Time spent on reviewing lessons + Attending tutorial
(4)	(3) + Average prior attainment + Dispersion of prior attainment + Average SES + Percentage of girls + Class size
(5)	(4) + School size, School type, School SES, School difficulties
(6)	(5) + Quantity of teaching (FR) + Provision of learning (FR) + Quality of teaching (FR)
(7)	(5) + Quantity of teaching (FO) + Provision of learning (FO) + Quality of teaching (FO)
(8)	(5) + Quantity of teaching (ST) + Provision of learning (ST) + Quality of teaching (ST)
(9)	(5) + Quantity of teaching (QU) + Provision of learning (QU) + Quality of teaching (QU)
(10)	(5) + Quantity of teaching (DI) + Provision of learning (DI) + Quality of teaching (DI)
(11)	(5) + Dealing with student behaviors outside classroom (FR) + Collaboration and interactions among teachers (FR) + Partnership policy (FR) + Provision of sufficient learning resources (FR) + Value on favour of learning (FR)
(12)	(5) + Dealing with student behaviors outside classroom (FO) + Collaboration and interactions among teachers (FO) + Partnership policy (FO) + Provision of sufficient learning resources (FO) + Value on favour of learning (FO)
(13)	(5) + Dealing with student behaviors outside classroom (ST) + Collaboration and interactions among teachers (ST) + Partnership policy (ST) + Provision of sufficient learning resources (ST) + Value on favour of learning (ST)
(14)	(5) + Dealing with student behaviors outside classroom (QU) + Collaboration and interactions among teachers (QU) + Partnership policy (QU) + Provision of sufficient learning resources (QU) + Value on favour of learning (QU)
(15)	(5) + Dealing with student behaviors outside classroom (DI) + Collaboration and interactions among teachers (DI) + Partnership policy (DI) + Provision of sufficient learning resources (DI) + Value on favour of learning (DI)
(16)	(5) + Evaluation in school policy for teaching (FR) + Evaluation in school policy for learning environment (FR)
(17)	(5) + Evaluation in school policy for teaching (FO) + Evaluation in school policy for learning environment (FO)
(18)	(5) + Evaluation in school policy for teaching (ST) + Evaluation in school policy for learning environment (ST)
(19)	(5) + Evaluation in school policy for teaching (QU) + Evaluation in school policy for learning environment (QU)
(20)	(5) + Evaluation in school policy for teaching (DI) + Evaluation in school policy for learning environment (DI)

Table 8-2 The sequence of sets of independent variables incrementally added into the multilevel models

Interpreting the findings presented in the models was undertaken in each independent variable and effectiveness dimension (frequency, stage, focus, quality and differentiation) by comparing across the eight subjects. This leads to more meaningful theoretical and practical implications in the final step. According to Table 8-3 to Table 8-10, the findings are the following:

Model 0: Null/naive model

The findings reveal that most of variation lies within student level, followed in turn by classroom and school level (see Figure 8-1). This means that the values for school effects were modest in student attainment in all subjects, whereas the moderate effects were found at classroom level.

Model 1: Adding prior attainment

In Model 1, the null model was extended by adding prior attainment in each of the eight subjects. The findings revealed that prior attainment has a significant effect on predicting student attainment in Grade 9. In addition, the log likelihood test (χ^2) indicated that there were statistically significant changes in going from the null model (Model 0) to Model 1 (p-value<.05).

Model 2: Adding student backgrounds

In the next modelling step, three student backgrounds – sex, age, and socio-economic status (SES) – were added into Model 1. The findings indicate that:

- Sex has a significant effect on student attainment in Thai Language (THA), Social Studies, Culture & Religion (SOC), Health and Physical Education (HEA), Art (ART) and Occupation & Technology (OCC) (p<.05), but does not in Science (SCI), English (ENG) and Mathematics (MAT) (p>.05). This implies that girls perform better than boys in THA, SOC, HEA, ART and OCC while there are *no* difference in student attainment between boys and girls in SCI, ENG and MAT.
- Age negatively affects student attainment in THA, HEA and OCC (p<.05), but not in SOC, SCI, ENG, MAT, ART (p>.05). This means older students are likely to perform less well than younger students in THA, HEA and OCC.
- SES positively affects student attainment in THA, SOC, HEA and OCC (p<.05), but not in SCI, ENG, MAT and ART (p>.05). This means that students with a higher SES were found to have better student attainment in THA, SOC, HEA and OCC than those having lower SES.

The log likelihood test (χ^2) was used to compare Model 2 with Model 1. The findings revealed that there are significant changes in going from Model 2 to Model 1, except for SCI, ENG and MAT, where Model 2 remains unchanged from Model 1 because sex, age, and SES all had significant effects on student attainment in these subjects.

Model 3: Adding student factors relating to study behaviours and parental involvement

After controlling for student backgrounds in the models, we then proceeded to include the following four factors into Model 2: motivation to study; parental involvement; time spent on reviewing lessons; and tutorial attendance. The findings are as follows:

- ‘Motivation to study’ has a positive effect on student attainment in all subjects ($p<.05$), except for ENG and ART ($p>.05$). This means that students with a higher motivation to study are likely to perform better in student attainment than those who have lower motivation, except for students in ENG and ART.
- ‘Parental involvement’ has a positive effect on student attainment in all subjects ($p<.05$), which means that students with a higher level of interaction (concerning their studies) with their parents/guardians tend to perform better than students who have less interaction.
- The amount of ‘time spent reviewing lessons’ has a positive effect on student attainment only in SCI and ENG ($p<.05$). This means that, in SCI, students who spend more than 4 hours a week reviewing lessons perform better than those who spend 1-4 hours a week, who in turn perform better than those who spend less than 1 hour a week. In the case of ENG, students who spend more than 4 hours per week reviewing lessons are likely to have higher student attainment than those who spend less than 4 hours. However, there is a significant difference between students spending their time between 1-4 and less than 1 hour per week.
- ‘Attending tutorials’ has a positive effect on student attainment in ENG, MAT and SCI ($p<.05$) only. This means that students who attend tutorials for ENG, MAT and SCI perform better than those who do not.

The log likelihood statistic indicated then that there are statistically significant changes in going from Model 2 to Model 3 in student achievement in every subject ($p <.05$), which justifies a selection of Model 3.

Model 4: Adding the *classroom* contextual effect

After incrementally adding student variables into Models 2 and 3, the next procedure was to include the classroom contextual variables in Model 4. (The findings of Models 4 and 5 are similar in many respects.) The classroom contextual effects are the following:

- The average prior attainment (Grade 6) at classroom level has a positive effect on student attainment in Grade 9 ($p<.05$), and these findings were consistent across the eight subjects. This means that students who were in the higher average prior attainment class tended to have better student attainment than those who had lower average prior attainment.
- The dispersion of prior attainment (Grade 6) at classroom level negatively affects student attainment in Grade 9 in THA, SOC, ENG, MAT and OCC ($p<.05$). This means that students who study in the higher dispersion of prior attainment in the class are likely to have a lower attainment than those in the lower dispersion in THA, SOC, ENG, MAT and OCC
- The average SES of students within the class has a positive effect on student attainment in SOC and ENG ($p<.05$) only. This implies that students who study in the higher average SES in the class are likely to have higher attainment than those in the lower average SES in only SOC and ENG.
- The percentage of girls within the class positively affects student attainment in every subject ($p<.05$) except ENG ($p>.05$). This means that students who study in classes that have a higher percentage of girls are more likely to have higher attainment than those with a lower percentage of girls in the class in all subjects except ENG.
- Class size does not significantly affect student attainment in any subject ($p>.05$).

Model 5: Adding the *school* contextual effects

After controlling for the *classroom* contextual effects in Model 4, the *school* contextual effects were added into Model 5. The findings are the following:

- ‘School size’, ‘type of school’, and ‘average SES at school level’ have no significant effect on student attainment in any subject ($p>.05$).
- School educational difficulties have a negative effect on student attainment ($p<.05$) in THA, SOC, MAT, SCI, ART and OCC, but not in ENG and HEA. This means that students who face a higher level of difficulties in THA, SOC,

MAT, SCI, ART and OCC tend to perform worse than those who study at a lower level.

In the data analysis, to investigate the school effects on student attainment, five core dimensions in the dynamic model of educational effectiveness were extended in Model 5: (i) frequency, (ii) quality, (iii) stage, (iv) focus and (v) differentiation – in (a) school policy on teaching, (b) school policy on the school learning environment, and (c) school evaluation. However, because the five dimensions of the same school factors are interrelated, this may cause multicollinearity, leading to biased estimation. In addition, as suggested by Creemers and Kyriakides (2012), adding all the dimensions of all the factors together in the same model may lead to dilemmas of justifying whether or not such factors are significantly associated with student achievement. For this reason, in this study, each dimension of the school factors was added separately into Model 5.

For MAT and ENG, after controlling for student background, classroom and school contextual effects, Model 5 showed that the variations in student attainment at the school level was not significant ($\sigma_{sc}^2 = 0.948$, $p>.05$ and $\sigma_{sc}^2 = 0.869$, $p>.05$, respectively). As the variations in both subjects at the school level were very weak, developing the MLMs for these two subjects was terminated at this Model 5 stage.

Model 6-10: Adding five dimensions of school policy for teaching

After controlling student variables, classroom and school contextual effects in Model 5, we proceeded by adding the five dimensions (frequency, quality, stage, focus and differentiation) of *school policy on teaching* (quantity of teaching, provision of learning opportunity, and quality of teaching). The findings are as follows:

- Frequency:
 - Quantity of teaching has a positive effect on student attainment only in THA ($p<.05$).
 - Provision of learning opportunities has a positive effect on student attainment in THA and OCC ($p<.05$) only.
 - Quality of teaching positively affects student attainment in THA, SCI, HEA, ART and OCC ($p<.05$).
- Focus:
 - Quantity of teaching has a positive effect on student attainment in SOC and ART ($p<.05$) only.

- Provision of learning opportunities has a positive effect on student attainment in THA ($p<.05$) only.
- Quality of teaching positively affects student attainment in *all* six subjects ($p<.05$).
- Stage
 - Quantity of teaching has a positive effect on student attainment in THA ($p<.05$) only.
 - Provision of learning opportunities has a positive effect on student attainment in THA and OCC ($p<.05$) only.
 - Quality of teaching positively affects student attainment in *all* six subjects ($p<.05$).
- Quality
 - Quantity of teaching does not have a positive effect on student attainment in all subjects ($p>.05$).
 - Provision of learning opportunities has a positive effect on student attainment in THA and OCC ($p<.05$) only.
 - Quality of teaching positively affects student attainment in *all* six subjects ($p<.05$).
- Differentiation
 - Quantity of teaching does not have a positive effect on student attainment in SCI ($p>.05$) only.
 - Provision of learning opportunities has *no* effect on student attainment in all subjects ($p>.05$).
 - Quality of teaching positively affects student attainment in *all* six subjects ($p<.05$) *except for* HEA.

 **Model 11-15: Adding five dimensions of school policy for school learning environment**

In the next step, a similar procedure of investigating the school effects used for ***school policy on school learning environment*** was adopted in Models 11-15. The findings are the following:

- Frequency:
 - School behaviours outside classroom have *no* significant effect on student attainment in *all* subjects ($p>.05$).
 - Collaboration among teachers has *no* significant effect on student attainment in *all* subjects ($p>.05$).

- Partnership policy positively affects student attainment in only TH ($p<.05$).
- Provision on sufficient learning resources positively affects student attainment in only THA and SOC ($p<.05$).
- Value on favour of learning has a significant effect on student attainment in THA, SOC, HEA and ART ($p<.05$).
- Focus:
 - School behaviours outside the classroom have *no* effect on student attainment in any subject ($p>.05$).
 - Collaboration among teachers has *no* effect on student attainment in any subject ($p>.05$).
 - Partnership policy does *not* significantly affect student attainment in any subject ($p<.05$).
 - Provisions of sufficient learning resources positively affect student attainment in THA, HEA and ART ($p<.05$).
 - Value on favour of learning has a positive effect on student attainment only in THA and HEA ($p<.05$).
- Stage:
 - School behaviours outside the classroom have no effect on student attainment in *all* subjects ($p>.05$).
 - Collaboration among teachers has a positive effect on student attainment only in THA ($p<.05$).
 - Partnership policy does *not* significantly affect student attainment in any subject ($p>.05$).
 - Provisions of sufficient learning resources positively affect student attainment in SOC, SCI, ART and OCC ($p<.05$).
 - Value on favour of learning has a positive effect on student attainment in *all* subjects ($p>.05$).
- Quality:
 - School behaviour outside the classroom does *not* significantly affect student attainment in *all* subjects ($p>.05$).
 - Collaboration among teachers has a positive effect on student attainment only in THA ($p<.05$).
 - Partnership policy does *not* significantly affect student attainment in any subjects ($p>.05$).
 - Provisions of sufficient learning resources positively affects student attainment in all subjects ($p<.05$), *except for* HEA.

- Value on favour of learning has a positive effect on student attainment in *all* subjects ($p<.05$).
- Differentiation:
 - School behaviours outside the classroom do *not* significantly affect student attainment in any subject ($p>.05$).
 - Collaboration among teachers has *no* significant effect on student attainment in any subject ($p>.05$).
 - Partnership policy does *not* significantly affect student attainment in any subject ($p>.05$).
 - Provisions of sufficient learning resources positively affect student attainment in all subjects ($p<.05$) *except for* HEA.
 - Value on favour of learning has a positive effect on student attainment in all subjects ($p<.05$) *except for* HEA.

Model 16-20: Adding five dimensions of school evaluation

In the final step of multilevel modelling, we again employed an incremental procedure similar to the earlier models. Model 5 is extended by adding five dimensions of two *school evaluation* factors (school evaluation of teaching and school evaluation of the learning environment). The findings reveal that *all* dimensions of school evaluation of teaching positively affect student attainment in THA and ART ($p<.05$), *except for* the *frequency* of school evaluation of teaching in ART, which has no significant effect on student attainment. In addition, only *differentiation* of school evaluation of teaching has a positive effect on student attainment in HEA and OCC. For school evaluation of learning environment, *only* differentiation dimension significantly affects student attainment in OCC.

❖ Thai Language

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
Constant	51.842 (0.392)	41.912 (0.538)	50.400 (3.464)	49.489 (3.428)	34.855 (3.923)	28.205 (1.945)	30.911 (1.804)	30.186 (1.814)	30.778 (1.805)	30.778 (1.813)	30.853 (1.875)
Student level:											
Prior attainment in Thai language		0.272 (0.011)	0.227 (0.012)	0.218 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)
Sex (Ref=boy)			4.495 (0.214)	4.160 (0.214)	4.046 (0.215)	4.066 (0.215)	4.075 (0.215)	4.069 (0.215)	4.074 (0.215)	4.070 (0.215)	4.071 (0.215)
Age			-0.047 (0.018)	-0.039 (0.018)	-0.036 (0.018)	-0.036 (0.018)	NS	NS	NS	NS	NS
SES			0.789 (0.114)	0.745 (0.113)	0.663 (0.114)	0.665 (0.115)	0.699 (0.111)	0.714 (0.111)	0.695 (0.111)	0.667 (0.115)	0.667 (0.114)
Motivation in Thai Language				0.839 (0.151)	0.823 (0.149)	0.829 (0.149)	0.818 (0.149)	0.828 (0.149)	0.822 (0.149)	0.822 (0.149)	0.819 (0.150)
Parental Involvement in Thai Language				0.609 (0.117)	0.626 (0.117)	0.625 (0.117)	0.627 (0.117)	0.625 (0.117)	0.631 (0.117)	0.637 (0.117)	0.637 (0.117)
Time spent on reviewing lessons in Thai Language (Ref = None)					NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
▪ Medium											
▪ High											
Attending tutorial in Thai Language (Ref = not attend)				NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:											
Average prior attainment in Thai Language					0.386 (0.064)	0.398 (0.064)	0.307 (0.060)	0.323 (0.060)	0.312 (0.060)	0.323 (0.060)	0.329 (0.062)
Dispersion of prior attainment in Thai language					-0.387 (0.131)	-0.379 (0.130)	-0.281 (0.120)	-0.258 (0.121)	-0.268 (0.120)	-0.315 (0.120)	-0.340 (0.123)
Average SES					NS	NS	NS	NS	NS	NS	NS
Percentage of girls					0.068 (0.016)	0.070 (0.016)	0.058 (0.015)	0.056 (0.015)	0.056 (0.015)	0.057 (0.015)	0.056 (0.015)
Class size					NS	NS	NS	NS	NS	NS	NS

Table 8-3 Factors affecting student attainment in Thai Language

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
School level:											
School size (Ref = Small)							NS NS	NS NS	NS NS	NS NS	NS NS
▪ Medium											
▪ Large and extra large											
School type (Ref = Public)							NS	NS	NS	NS	NS
School SES							NS	NS	NS	NS	NS
School difficulties in Thai Language							-0.549 (0.273)	-0.548 (0.273)	-0.549 (0.273)	-0.547 (0.273)	-0.546 (0.273)
School policy for teaching											
Quantity of teaching							0.702 (0.285)	NS	0.971 (0.317)	NS	NS
Provision of learning							2.210 (0.270)	0.715 (0.291)	1.130 (0.481)	1.340 (0.599)	NS
Quality of teaching							0.991 (0.492)	0.176 (0.234)	2.168 (0.247)	1.379 (0.284)	1.444 (0.270)
Variance components:											
School	5.132 (1.450)	3.951 (1.120)	2.948 (0.888)	2.943 (0.870)	1.365 (0.595)	1.342 (0.578)	0.046 (0.249)	0.100 (0.278)	1.110 (0.542)	0.129 (0.252)	0.510 (0.350)
Classroom	14.947 (1.896)	10.264 (1.391)	8.186 (1.173)	7.963 (1.140)	4.100 (0.745)	3.984 (0.727)	3.396 (0.668)	3.914 (0.670)	3.957 (1.006)	3.838 (0.652)	3.905 (0.676)
Student	60.874 (1.126)	55.553 (1.060)	49.428 (1.032)	48.331 (1.010)	48.357 (1.011)	48.391 (1.011)	48.399 (1.011)	48.407 (1.012)	48.395 (2.493)	48.390 (1.011)	48.392 (1.011)
Log likelihood	-21224.638	-21169.762	-16264.789	-16211.167	-16161.276	-16161.122	-16145.834	-16146.42	-16144.959	-16144.288	-16151.097

Table 8-3 Factors affecting student attainment in Thai Language (*Continued*)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
Constant	29.871 (1.825)	30.146 (1.823)	30.518 (1.795)	29.717 (1.936)	30.071 (1.838)	29.244 (1.886)	28.974 (1.863)	30.364 (1.898)	30.060 (1.935)	29.899 (1.853)
Student level:										
Prior attainment in Thai language	0.204 (0.012)	0.203 (0.012)	0.204 (0.012)	0.205 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)	0.204 (0.012)
Sex (Ref=boy)	4.069 (0.215)	4.065 (0.215)	4.068 (0.215)	4.073 (0.215)	4.074 (0.215)	4.062 (0.215)	4.064 (0.215)	4.072 (0.215)	4.070 (0.215)	4.074 (0.215)
Age	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SES	0.718 (0.111)	0.718 (0.111)	0.719 (0.111)	0.666 (0.115)	0.666 (0.115)	0.665 (0.115)	0.664 (0.115)	0.667 (0.115)	0.665 (0.115)	0.716 (0.112)
Motivation in Thai Language	0.818 (0.149)	0.825 (0.149)	0.824 (0.149)	0.813 (0.150)	0.821 (0.150)	0.831 (0.150)	0.834 (0.150)	0.819 (0.150)	0.822 (0.150)	0.814 (0.150)
Parental Involvement in Thai Language	0.643 (0.117)	0.637 (0.117)	0.630 (0.117)	0.634 (0.117)	0.631 (0.117)	0.639 (0.117)	0.631 (0.117)	0.630 (0.117)	0.631 (0.117)	0.622 (0.117)
Time spent on reviewing lessons in Thai Language (Ref = None)										
▪ Medium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
▪ High	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Attending tutorial in Thai Language (Ref = not attend)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:										
Average prior attainment in Thai Language	0.354 (0.060)	0.339 (0.061)	0.321 (0.060)	0.367 (0.063)	0.342 (0.061)	0.376 (0.062)	0.373 (0.061)	0.335 (0.062)	0.348 (0.063)	0.337 (0.061)
Dispersion of prior attainment in Thai language	-0.340 (0.120)	-0.321 (0.121)	-0.273 (0.122)	-0.384 (0.122)	-0.325 (0.123)	-0.385 (0.126)	-0.371 (0.123)	-0.328 (0.123)	-0.365 (0.125)	-0.315 (0.122)
Average SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Percentage of girls	0.055 (0.015)	0.057 (0.015)	0.055 (0.015)	0.058 (0.015)	0.060 (0.015)	0.066 (0.016)	0.069 (0.015)	0.068 (0.014)	0.067 (0.013)	0.059 (0.015)
Class size	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 8-3 Factors affecting student attainment in Thai Language (Continued)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
School level:										
School size (Ref = Small) Medium Large and extra large	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
School type (Ref = Public)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School difficulties in Thai Language	-0.490 (0.241)	-0.486 (0.244)	-0.488 (0.242)	-0.500 (0.250)	-0.491 (0.242)	-0.492 (0.247)	-0.484 (0.242)	-0.483 (0.241)	-0.484 (0.240)	-0.485 (0.240)
School policy for school learning environment:										
Dealing with student behaviours outside classroom	NS	NS	NS	NS	NS					
Collaboration and interactions among teachers	NS	NS	1.854 (0.226)	9.363 (3.186)	NS					
Partnership policy	1.492 (0.554)	NS	NS	NS	NS					
Provision of sufficient learning resources	1.082 (0.541)	1.464 (0.282)	NS	9.663 (3.209)	NS					
Value on favour of learning	1.795 (0.262)	1.567 (0.614)	0.596 (0.292)	1.314 (0.300)	1.578 (0.277)					
School evaluation:										
School policy for teaching						2.363 (0.600)	3.176 (0.628)	1.386 (0.276)	1.579 (0.395)	1.822 (0.247)
School policy for school learning environment						NS	NS	NS	NS	NS
Variance components:										
School	0.191 (0.293)	0.250 (0.302)	0.113 (0.271)	0.542 (0.372)	0.354 (0.319)	0.676 (0.459)	0.437 (0.383)	0.590 (0.371)	0.800 (0.433)	0.405 (0.343)
Classroom	3.864 (0.668)	3.970 (0.680)	3.970 (0.675)	3.819 (0.675)	3.953 (0.680)	4.115 (0.729)	3.972 (0.697)	3.811 (0.668)	3.889 (0.690)	3.872 (0.673)
Student	48.407 (1.102)	48.401 (1.011)	48.414 (1.012)	48.388 (1.011)	48.404 (1.012)	48.398 (1.012)	48.387 (1.011)	48.384 (1.011)	48.384 (1.011)	48.412 (1.011)
Log likelihood	-16146.945	-16147.880	-16147.823	-16149.989	-16150.430	-16153.856	-16150.976	-16150.249	-16153.856	-16150.254

Table 8-3 Factors affecting student attainment in Thai Language (*Continued*)

❖ Social Studies, Culture and Religion

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
Constant	43.529 (0.609)	27.481 (0.614)	27.429 (0.649)	27.961 (0.641)	13.978 (1.737)	13.882 (1.728)	13.882 (1.728)	14.031 (1.715)	14.291 (1.738)	14.325 (1.734)	14.341 (1.734)
Student level:											
Prior attainment in Social Studies, Culture and Religion		0.510 (0.013)	0.495 (0.014)	0.481 (0.014)	0.455 (0.014)	0.455 (0.015)	0.455 (0.015)	0.456 (0.015)	0.455 (0.015)	0.455 (0.014)	0.455 (0.015)
Sex (Ref=boy)			2.072 (0.290)	1.821 (0.289)	1.696 (0.291)	1.699 (0.291)	1.699 (0.291)	1.696 (0.291)	1.700 (0.291)	1.700 (0.291)	1.700 (0.291)
Age			NS	NS	NS	NS	NS	NS	NS	NS	NS
SES			0.476 (0.156)	0.417 (0.154)	0.309 (0.157)	0.308 (0.157)	0.308 (0.157)	0.309 (0.156)	0.309 (0.157)	0.309 (0.157)	0.309 (0.157)
Motivation in Social Studies, Culture and Religion				1.426 (0.218)	1.421 (0.215)	1.417 (0.216)	1.417 (0.216)	1.415 (0.216)	1.415 (0.216)	1.415 (0.216)	1.415 (0.216)
Parental Involvement in Social Studies, Culture and Religion				0.563 (0.162)	0.593 (0.161)	0.587 (0.160)	0.587 (0.160)	0.588 (0.160)	0.588 (0.160)	0.588 (0.160)	0.600 (0.160)
Time spent on reviewing lessons in Social Studies, Culture and Religion (Ref = None) - Medium - High				NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
Attending tutorial in Social Studies, Culture and Religion (Ref = not attend)				NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:											
Average prior attainment in Social Studies, Culture and Religion					0.511 (0.057)	0.601 (0.047)	0.601 (0.047)	0.499 (0.056)	0.489 (0.057)	0.487 (0.057)	0.489 (0.057)
Dispersion of prior attainment in Social Studies, Culture and Religion					-0.379 (0.136)	-0.381 (0.138)	-0.381 (0.138)	-0.367 (0.134)	-0.352 (0.135)	-0.362 (0.137)	-0.353 (0.135)
Average SES					2.014 (0.753)	1.858 (0.765)	1.858 (0.765)	1.550 (0.760)	1.557 (0.774)	1.537 (0.769)	1.523 (0.770)
Percentage of girls					0.055 (0.019)	0.057 (0.020)	0.057 (0.020)	0.058 (0.020)	0.056 (0.019)	0.056 (0.020)	0.055 (0.020)
Class size					NS	NS	NS	NS	NS	NS	NS

Table 8-4 Factors affecting student attainment in Social Studies, Culture and Religion

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
School level:											
School size (Ref = Small)							NS NS	NS NS	NS NS	NS NS	NS NS
▪ Medium											
▪ Large and extra large											
School type (Ref = Public)							NS	NS	NS	NS	NS
School SES							NS	NS	NS	NS	NS
School difficulties in Social Studies, Culture and Religion							-1.077 (0.502)	-1.077 (0.502)	-0.953 (0.483)	-1.028 (0.492)	-1.002 (0.489)
School policy for teaching											
▪ Quantity of teaching								NS	2.630 (0.984)	NS	NS
▪ Provision of learning								NS	NS	NS	NS
▪ Quality of teaching								NS	1.290 (0.509)	0.821 (0.405)	0.861 (0.457)
School	15.303 (4.066)	9.496 (2.552)	9.049 (2.555)	8.536 (2.408)	1.937 (0.795)	1.948 (0.797)	1.948 (0.797)	1.927 (0.788)	2.823 (0.823)	2.039 (0.826)	2.041 (0.827)
Classroom	31.010 (4.107)	13.545 (2.110)	12.022 (2.032)	11.534 (1.950)	12.297 (2.774)	11.451 (2.640)	11.451 (2.640)	10.220 (2.399)	10.746 (2.588)	10.546 (2.567)	10.516 (2.564)
Student	118.001 (2.185)	94.494 (1.806)	92.034 (1.925)	90.385 (1.891)	90.371 (1.890)	90.375 (1.890)	90.375 (1.890)	90.357 (1.889)	90.370 (1.900)	90.376 (1.890)	90.376 (1.890)
Log likelihood	-23207.916	-21169.762	-11736.825	-17691.322	-17633.468	-17631.215	-17631.215	-17626.649	-17635.641	-17629.502	-17629.421

Table 8-4 Factors affecting student attainment in Social Studies, Culture and Religion (*Continued*)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
Constant	14.183 (1.727)	13.882 (1.728)	14.320 (1.717)	13.838 (1.723)	14.223 (1.714)	13.882 (1.728)	13.882 (1.728)	13.882 (1.728)	13.882 (1.728)	13.882 (1.728)
Student level:										
Prior attainment in Social Studies, Culture and Religion	0.456 (0.015)	0.455 (0.015)	0.456 (0.015)	0.455 (0.015)	0.456 (0.015)	0.455 (0.015)	0.455 (0.015)	0.455 (0.015)	0.455 (0.015)	0.455 (0.015)
Sex (Ref=boy)	1.701 (0.288)	1.699 (0.291)	1.694 (0.290)	1.696 (0.291)	1.697 (0.291)	1.699 (0.291)	1.699 (0.291)	1.699 (0.291)	1.699 (0.291)	1.699 (0.291)
Age	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SES	0.309 (0.157)	0.308 (0.157)	0.310 (0.156)	0.308 (0.156)	0.309 (0.156)	0.308 (0.157)	0.308 (0.157)	0.308 (0.157)	0.308 (0.157)	0.308 (0.157)
Motivation in Social Studies, Culture and Religion	1.419 (0.216)	1.417 (0.216)	1.416 (0.216)	1.414 (0.216)	1.412 (0.216)	1.417 (0.216)	1.417 (0.216)	1.417 (0.216)	1.417 (0.216)	1.417 (0.216)
Parental Involvement in Social Studies, Culture and Religion	0.581 (0.160)	0.587 (0.160)	0.591 (0.160)	0.586 (0.160)	0.588 (0.160)	0.587 (0.160)	0.587 (0.160)	0.587 (0.160)	0.587 (0.160)	0.587 (0.160)
Time spent on reviewing lessons in Social Studies, Culture and Religion (Ref = None)										
▪ Medium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
▪ High	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Attending tutorial in Social Studies, Culture and Religion (Ref = not attend)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:										
Average prior attainment in Social Studies, Culture and Religion	0.492 (0.056)	0.601 (0.047)	0.497 (0.057)	0.501 (0.057)	0.511 (0.056)	0.601 (0.047)	0.601 (0.047)	0.601 (0.047)	0.601 (0.047)	0.601 (0.047)
Dispersion of prior attainment in Social Studies, Culture and Religion	-0.349 (0.134)	-0.381 (0.138)	-0.383 (0.134)	-0.360 (0.135)	-0.416 (0.134)	-0.381 (0.138)	-0.381 (0.138)	-0.381 (0.138)	-0.381 (0.138)	-0.381 (0.138)
Average SES	1.645 (0.768)	1.858 (0.765)	1.584 (0.760)	1.656 (0.766)	1.575 (0.766)	1.858 (0.765)	1.858 (0.765)	1.858 (0.765)	1.858 (0.765)	1.858 (0.765)
Percentage of girls	0.056 (0.020)	0.057 (0.020)	0.057 (0.020)	0.059 (0.020)	0.057 (0.020)	0.057 (0.020)	0.057 (0.020)	0.057 (0.020)	0.057 (0.020)	0.057 (0.020)
Class size	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 8-4 Factors affecting student attainment in Social Studies, Culture and Religion (Continued)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
School level:										
School size (Ref = Small) ▪ Medium ▪ Large and extra large	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
School type (Ref = Public)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School difficulties in Social Studies, Culture and Religion	NS	-1.077 (0.502)	NS	NS	NS	-1.077 (0.502)	-1.077 (0.502)	-1.077 (0.502)	-1.077 (0.502)	-1.077 (0.502)
School policy for school learning environment										
Dealing with student behaviours outside classroom	NS	NS	NS	NS	NS					
Collaboration and interactions among teachers	NS	NS	NS	NS	NS					
Partnership policy	NS	NS	NS	NS	NS					
Provision of sufficient learning resources	2.527 (1.177)	NS	2.972 (0.978)	2.086 (0.978)	2.974 (1.014)					
Value on favour of learning	1.364 (0.573)	NS	1.635 (0.505)	0.935 (0.538)	1.721 (0.596)					
School evaluation										
School policy for teaching						NS	NS	NS	NS	NS
School policy for school learning environment						NS	NS	NS	NS	NS
Variance components:										
School	2.013 (0.815)	1.948 (0.797)	1.959 (0.800)	1.912 (0.785)	1.886 (0.780)	1.948 (0.797)	1.948 (0.797)	1.948 (0.797)	1.948 (0.797)	1.948 (0.797)
Classroom	10.213 (2.485)	11.451 (2.640)	10.218 (2.432)	10.836 (2.493)	10.774 (2.477)	11.451 (2.640)	11.451 (2.640)	11.451 (2.640)	11.451 (2.640)	11.451 (2.640)
Student	90.373 (1.890)	90.375 (1.890)	90.357 (1.889)	90.361 (1.889)	90.359 (1.889)	90.375 (1.890)	90.375 (1.890)	90.375 (1.890)	90.375 (1.890)	90.375 (1.890)
Log likelihood	-17628.051	-17631.215	-17627.048	-17628.558	-17628.017	-17631.215	-17631.215	-17631.215	-17631.215	-17631.215

Table 8-4 Factors affecting student attainment in Social Studies, Culture and Religion (Continued)

❖ Science

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
Constant	32.405 (0.462)	23.563 (0.494)	23.563 (0.494)	23.903 (0.623)	11.021 (1.367)	10.910 (1.358)	11.616 (1.408)	11.093 (1.395)	11.507 (1.417)	10.910 (1.358)	11.146 (1.402)
Student level:											
Prior attainment in Science		0.253 (0.009)	0.253 (0.009)	0.232 (0.010)	0.214 (0.010)						
Sex (Ref=boy)			NS	NS	NS	NS	NS	NS	NS	NS	NS
Age			NS	NS	NS	NS	NS	NS	NS	NS	NS
SES			NS	NS	NS	NS	NS	NS	NS	NS	NS
Motivation in Science				NS	1.166 (0.191)	1.167 (0.191)	1.170 (0.191)	1.173 (0.191)	1.168 (0.191)	1.138 (0.191)	1.180 (0.191)
Parental involvement in Science				0.507 (0.136)	0.508 (0.136)	0.503 (0.136)	0.513 (0.136)	0.510 (0.136)	0.502 (0.136)	0.503 (0.135)	0.502 (0.136)
Time spent on reviewing lessons in Science (Ref = None)				0.330 ^{NS} (0.404)	0.228 ^{NS} (0.403)	0.227 ^{NS} (0.403)	0.233 ^{NS} (0.402)	0.257 ^{NS} (0.402)	0.235 ^{NS} (0.403)	0.237 ^{NS} (0.403)	0.207 ^{NS} (0.403)
▪ Medium				1.049 (0.504)	0.983 (0.501)	0.995 (0.501)	0.995 (0.501)	1.010 (0.501)	0.998 (0.501)	0.995 (0.501)	0.984 (0.501)
▪ High											
Attending tutorial in Science (Ref = not attend)				1.990 (0.399)	1.878 (0.395)	1.850 (0.395)	1.804 (0.396)	1.780 (0.369)	1.809 (0.396)	1.850 (0.395)	1.817 (0.396)
Classroom level:											
Average prior attainment in Science					0.323 (0.043)	0.319 (0.043)	0.305 (0.043)	0.343 (0.039)	0.347 (0.040)	0.319 (0.043)	0.320 (0.043)
Dispersion of prior attainment in Science					NS						
Average SES					NS						
Percentage of girls					0.043 (0.020)	0.046 (0.020)	0.043 (0.020)	0.046 (0.019)	0.044 (0.020)	0.047 (0.020)	0.043 (0.019)
Class size					NS						

Table 8-5 Factors affecting student attainment in Science

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
School level:											
School size (Ref = Small)							NS NS	NS NS	NS NS	NS NS	NS NS
▪ Medium											
▪ Large and extra large											
School type (Ref = Public)							NS	NS	NS	NS	NS
School SES							NS	NS	NS	NS	NS
School difficulties in Science							-0.861 (0.417)	-0.828 (0.406)	-0.866 (0.417)	-0.841 (0.409)	-0.861 (0.417)
School policy for teaching											
▪ Quantity of teaching							NS	NS	NS	NS	2.300 (0.814)
▪ Provision of learning							NS	NS	NS	NS	NS
▪ Quality of teaching							0605 (0.364)	0.706 (0.359)	0.614 (0.386)	NS	0.947 (0.406)
Variance components:											
School	7.930 (2.103)	5.179 (1.460)	5.517 (1.544)	4.455 (1.429)	5.336 (1.596)	5.118 (1.520)	4.541 (1.500)	4.055 (1.512)	4.211 (1.533)	5.118 (1.520)	4.573 (1.479)
Classroom	19.490 (2.444)	11.545 (1.577)	11.306 (1.657)	10.547 (1.547)	4.784 (1.019)	4.703 (0.996)	4.862 (1.035)	5.418 (1.108)	5.399 (1.107)	4.703 (0.996)	4.743 (1.013)
Student	73.595 (1.362)	66.264 (1.264)	65.327 (1.365)	63.534 (1.328)	63.557 (1.328)	63.549 (1.328)	63.546 (1.328)	63.528 (1.327)	63.528 (1.327)	63.549 (1.328)	63.543 (1.328)
Log likelihood	-21775.732	-20169.316	-16931.132	-16859.256	-16820.773	-16818.658	-16817.354	-16819.601	-16820.215	-16818.658	-16816.209

Table 8-5 Factors affecting student attainment in Science (*Continued*)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
Constant	10.910 (1.358)	10.910 (1.358)	11.250 (1.396)	11.110 (1.409)	11.091 (1.393)	10.910 (1.358)	10.910 (1.358)	10.910 (1.358)	10.910 (1.358)	10.910 (1.358)
Student level:										
Prior attainment in Science	0.214 (0.010)	0.214 (0.010)	0.215 (0.010)	0.214 (0.010)						
Sex (Ref=boy)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Age	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Motivation in Science	1.167 (0.191)	1.167 (0.191)	1.180 (0.191)	1.170 (0.191)	1.174 (0.191)	1.167 (0.191)	1.167 (0.191)	1.167 (0.191)	1.167 (0.191)	1.167 (0.191)
Parental Involvement in Science	0.503 (0.136)	0.503 (0.136)	0.496 (0.136)	0.502 (0.136)	0.499 (0.136)	0.503 (0.136)	0.503 (0.136)	0.503 (0.136)	0.503 (0.136)	0.503 (0.136)
Time spent on reviewing lessons in Science (Ref = None)										
▪ Medium	0.227 ^{NS} (0.403)	0.227 ^{NS} (0.403)	0.214 ^{NS} (0.403)	0.211 ^{NS} (0.403)	0.221 ^{NS} (0.403)	0.227 ^{NS} (0.403)				
▪ High	0.995 (0.501)	0.995 (0.501)	0.957 (0.501)	0.951 (0.501)	0.966 (0.501)	0.995 (0.501)	0.995 (0.501)	0.995 (0.501)	0.995 (0.501)	0.995 (0.501)
Attending tutorial in Science (Ref = not attend)	1.850 (0.395)	1.850 (0.395)	1.783 (0.395)	1.814 (0.396)	1.816 (0.396)	1.850 (0.395)	1.850 (0.395)	1.850 (0.395)	1.850 (0.395)	1.850 (0.395)
Classroom level:										
Average prior attainment in Science	0.319 (0.043)	0.319 (0.043)	0.311 (0.043)	0.319 (0.043)						
Dispersion of prior attainment in Science	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Average SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Percentage of girls	0.046 (0.020)	0.046 (0.020)	0.047 (0.019)	0.044 (0.019)	0.045 (0.019)	0.046 (0.020)	0.046 (0.020)	0.046 (0.020)	0.046 (0.020)	0.046 (0.020)
Class size	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 8-5 Factors affecting student attainment in Science (*Continued*)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
School level:										
School size (Ref = Small) ▪ Medium ▪ Large and extra large	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
School type (Ref = Public)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School difficulties in Science	-0.861 (0.417)	-0.861 (0.417)	-0.860 (0.417)	-0.859 (0.417)	-0.860 (0.417)	-0.861 (0.417)	-0.861 (0.417)	-0.861 (0.417)	-0.861 (0.417)	-0.861 (0.417)
School policy for school learning environment										
Dealing with student behaviours outside classroom	NS	NS	NS	NS	NS					
Collaboration and interactions among teachers	NS	NS	NS	NS	NS					
Partnership policy	NS	NS	NS	NS	NS					
Provision of sufficient learning resources	NS	NS	2.141 (0.813)	0.946 (0.419)	2.290 (0.826)					
Value on favour of learning	NS	NS	1.075 (0.398)	2.173 (0.799)	1.096 (0.458)					
School evaluation										
School policy for teaching						NS	NS	NS	NS	NS
School policy for school learning environment						NS	NS	NS	NS	NS
Variance components:										
School	5.118 (1.520)	5.118 (1.520)	4.300 (1.415)	4.648 (1.479)	4.614 (1.492)	5.118 (1.520)	5.118 (1.520)	5.118 (1.520)	5.118 (1.520)	5.118 (1.520)
Classroom	4.703 (0.996)	4.703 (0.996)	4.693 (0.999)	4.732 (1.009)	4.739 (1.015)	4.703 (0.996)	4.703 (0.996)	4.703 (0.996)	4.703 (0.996)	4.703 (0.996)
Student	63.549 (1.328)	63.549 (1.328)	65.534 (1.328)	63.542 (1.327)	63.543 (1.327)	63.549 (1.328)	63.549 (1.328)	63.549 (1.328)	63.549 (1.328)	63.549 (1.328)
Log likelihood	-16818.658	-16818.658	-16813.976	-16816.443	-16818.354	-16818.658	-16818.658	-16818.658	-16818.658	-16818.658

Table 8-5 Factors affecting student attainment in Science (Continued)

❖ English Language

Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	26.559 (0.339)	22.332 (0.354)	22.332 (0.354)	22.199 (0.446)	18.781 (0.974)
Student level:					
Prior attainment in English language		0.152 (0.007)	0.152 (0.007)	0.132 (0.008)	0.120 (0.008)
Sex (Ref=boy)			NS	NS	NS
Age			NS	NS	NS
SES			NS	NS	NS
Motivation in English Language			NS	NS	NS
Parental Involvement in English Language				0.399 (0.110)	0.386 (0.110)
Time spent on reviewing lessons in English Language (Ref = None)				0.630 (0.317) 1.540 (0.449)	0.581 ^{NS} (0.315) 1.500 (0.447)
▪ Medium					
▪ High					
Attending tutorial in English Language (Ref = not attend)				1.505 (0.360)	1.362 (0.359)
Classroom level:					
Average prior attainment in English Language					0.227 (0.038)
Dispersion of prior attainment in English language					-0.197 (0.081)
Average SES					1.505 (0.564)
Percentage of girls					NS
Class size					NS

Table 8-6 Factors affecting student attainment in English Language

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
School level:						
School size (Ref = Small) ▪ Medium ▪ Large and extra large						NS NS
School type (Ref = Public)						NS
School SES						NS
School difficulties in English Language						NS
Variance components:						
School	3.163 (1.000)	2.150 (0.757)	2.150 (0.757)	1.956 (0.750)	0.948 (0.692)	0.948 (0.692)
Classroom	11.8222 (1.496)	8.141 (1.116)	8.141 (1.116)	8.142 (1.227)	6.252 (1.056)	6.252 (1.056)
Student	60.634 (1.121)	57.009 (1.088)	57.009 (1.088)	54.620 (1.143)	54.623 (1.143)	54.623 (1.143)
Log likelihood	-21184.728	-19741.162	-19741.162	-16496.435	-16472.323	-16472.323

Table 8-6 Factors affecting student attainment in English Language (*Continued*)

❖ Mathematics

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	24.801 (0.303)	19.235 (0.356)	19.235 (0.356)	19.688 (0.369)	17.700 (0.936)	16.760 (0.952)
Student level:						
Prior attainment in Mathematics		0.174 (0.008)	0.174 (0.008)	0.157 (0.008)	0.144 (0.009)	0.144 (0.009)
Sex (Ref=boy)			NS	NS	NS	NS
Age			NS	NS	NS	NS
SES			NS	NS	NS	NS
Motivation in Mathematics				0.650 (0.171)	0.636 (0.171)	0.622 (0.170)
Parental Involvement in Mathematics				0.586 (0.135)	0.578 (0.135)	0.553 (0.135)
Time spent on reviewing lessons in Mathematics (Ref = None)				NS NS	NS NS	NS NS
▪ Medium						
▪ High						
Attending tutorial in Mathematics (Ref = not attend)				1.131 (0.370)	0.851 (0.369)	0.744 (0.368)
Classroom level:						
Average prior attainment in Mathematics					0.149 (0.032)	0.134 (0.031)
Dispersion of prior attainment in Mathematics					-0.157 (0.073)	-0.156 (0.071)
Average SES					NS	NS
Percentage of girls					NS	0.027 (0.013)
Class size					NS	NS

Table 8-7 Factors affecting student attainment in Mathematics

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5
School level:						
School size (Ref = Small) ▪ Medium ▪ Large and extra large						NS NS
School type (Ref = Public)						NS
School SES						1.941 (0.505)
School difficulties in Mathematics						-0.747 (0.255)
Variance components:						
School	3.243 (0.893)	2.262 (0.708)	2.262 (0.708)	1.904 (0.689)	0.602 (0.539)	0.869 (0.504)
Classroom	6.909 (1.029)	3.797 (0.714)	3.797 (0.714)	2.713 (0.679)	2.296 (0.655)	1.662 (0.559)
Student	72.366 (1.338)	67.474 (1.288)	67.474 (1.288)	65.662 (1.374)	65.665 (1.374)	65.662 (1.374)
Log likelihood	-20657.707	-20141.516	-20141.516	-16840.281	-16818.836	-16811.939

Table 8-7 Factors affecting student attainment in Mathematics (*Continued*)

❖ Health and Physical Education

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
Constant	54.050 (0.466)	32.428 (0.652)	47.808 (4.492)	47.711 (4.482)	30.732 (5.077)	30.732 (5.077)	33.283 (5.130)	33.186 (5.113)	33.283 (5.130)	33.092 (5.115)	30.732 (5.077)
Student level:											
Prior attainment in Health and Physical Education		0.348 (0.009)	0.335 (0.010)	0.331 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)
Sex (Ref=boy)			1.159 (0.281)	1.265 (0.283)	1.097 (0.285)	1.096 (0.285)	1.104 (0.285)	1.105 (0.285)	1.104 (0.285)	1.104 (0.285)	1.096 (0.285)
Age			-0.079 (0.024)	-0.078 (0.024)	-0.076 (0.023)	-0.076 (0.023)	-0.074 (0.023)	-0.073 (0.024)	-0.074 (0.024)	-0.073 (0.024)	-0.076 (0.023)
SES			0.442 (0.145)	0.446 (0.147)	0.401 (0.146)	0.401 (0.146)	0.379 (0.147)	0.379 (0.147)	0.379 (0.147)	0.381 (0.147)	0.401 (0.146)
Motivation in Health and Physical Education				0.437 (0.204)	0.430 (0.203)	0.431 (0.203)	0.427 (0.203)	0.428 (0.203)	0.426 (0.203)	0.429 (0.203)	0.431 (0.203)
Parental involvement in Health and Physical Education				0.435 (0.147)	0.462 (0.146)	0.462 (0.147)	0.467 (0.147)	0.468 (0.147)	0.467 (0.147)	0.468 (0.147)	0.462 (0.147)
Time spent on reviewing lessons in Health and Physical Education (Ref = None)				NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
▪ Medium											
▪ High											
Attending tutorial in Health and Physical Education (Ref = not attend)				NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:											
Average prior attainment in Health and Physical Education					0.218 (0.045)	0.218 (0.045)	0.169 (0.048)	0.170 (0.047)	0.169 (0.048)	0.172 (0.047)	0.218 (0.045)
Dispersion of prior attainment in Health and Physical Education					NS	NS	NS	NS	NS	NS	NS
Average SES					NS	NS	NS	NS	NS	NS	NS
Percentage of girls					0.076 (0.018)	0.076 (0.018)	0.076 (0.019)	0.075 (0.018)	0.075 (0.019)	0.075 (0.019)	0.076 (0.018)
Class size					NS	NS	NS	NS	NS	NS	NS

Table 8-8 Factors affecting student attainment in Health and Physical Education

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
School level:											
School size (Ref = Small)							NS	NS	NS	NS	NS
▪ Medium							NS	NS	NS	NS	NS
▪ Large and extra large							NS	NS	NS	NS	NS
School type (Ref = Public)							NS	NS	NS	NS	NS
School SES							NS	NS	NS	NS	NS
School difficulties in Health and Physical Education							NS	NS	NS	NS	NS
School policy for teaching											
▪ Quantity of teaching							NS	NS	NS	NS	NS
▪ Provision of learning							NS	NS	NS	NS	NS
▪ Quality of teaching							0.907 (0.361)	0.913 (0.337)	0.907 (0.360)	0.870 (0.335)	NS
Variance components:											
School	8.030 (2.648)	3.886 (1.373)	2.750 (1.079)	2.840 (1.075)	4.276 (1.383)	4.276 (1.383)	3.107 (1.351)	3.034 (1.335)	3.108 (1.352)	3.113 (1.340)	4.276 (1.383)
Classroom	18.361 (2.682)	8.119 (1.387)	7.001 (1.262)	6.919 (1.244)	2.735 (0.831)	2.735 (0.832)	3.121 (0.937)	3.121 (0.935)	3.121 (0.937)	3.096 (0.928)	2.735 (0.832)
Student	107.941 (2.001)	86.467 (1.653)	83.968 (1.756)	83.556 (1.747)	83.529 (1.746)	83.529 (1.746)	83.512 (1.745)	83.512 (1.745)	83.512 (1.745)	83.513 (1.746)	83.529 (1.746)
Log likelihood	-22893.068	-20868.235	-17465.488	-17453.926	-17420.919	-17420.919	-17418.19	-17417.734	-17418.190	-17417.973	-17420.919

Table 8-8 Factors affecting student attainment in Health and Physical Education (*Continued*)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
Constant	32.867 (5.119)	32.928 (5.118)	33.093 (50115)	32.536 (5.124)	30.732 (50.077) SAME 5	30.732 (5.077)	30.732 (5.077)	30.732 (5.077)	30.732 (5.077)	33.437 (5.121)
Student level:										
Prior attainment in Health and Physical Education	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)	0.319 (0.010)
Sex (Ref=boy)	1.105 (0.285)	1.105 (0.285)	1.104 (0.285)	1.100 (0.285)	1.097 (0.286)	1.097 (0.286)	1.097 (0.286)	1.097 (0.286)	1.097 (0.286)	1.106 (0.285)
Age	-0.073 (0.023)	-0.074 (0.024)	-0.073 (0.023)	-0.074 (0.024)	-0.076 (0.024)	-0.076 (0.024)	-0.076 (0.024)	-0.076 (0.024)	-0.076 (0.024)	-0.073 (0.024)
SES	0.381 (0.147)	0.381 (0.147)	0.380 (0.147)	0.385 (0.147)	0.402 (0.146)	0.402 (0.146)	0.402 (0.146)	0.402 (0.146)	0.402 (0.146)	0.377 (0.147)
Motivation in Health and Physical Education	0.404 (0.203)	0.432 (0.204)	0.429 (0.203)	0.426 (0.203)	0.401 (0.203)	0.401 (0.203)	0.401 (0.203)	0.401 (0.203)	0.401 (0.203)	0.424 (0.203)
Parental Involvement in Health and Physical Education	0.467 (0.147)	0.467 (0.147)	0.468 (0.147)	0.470 (0.147)	0.462 (0.147)	0.462 (0.147)	0.462 (0.147)	0.462 (0.147)	0.462 (0.147)	0.468 (0.147)
Time spent on reviewing lessons in Thai Language (Ref = None)										
▪ Medium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
▪ High	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Attending tutorial in Health and Physical Education (Ref = not attend)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:										
Average prior attainment in Health and Physical Education	0.177 (0.047)	0.175 (0.047)	0.172 (0.047)	0.184 (0.047)	0.218 (0.046)	0.218 (0.046)	0.218 (0.046)	0.218 (0.046)	0.218 (0.046)	0.164 (0.047)
Dispersion of prior attainment in Health and Physical Education	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Average SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Percentage of girls	0.075 (0.019)	0.075 (0.019)	0.075 (0.019)	0.076 (0.019)	0.076 (0.019)	0.076 (0.019)	0.076 (0.019)	0.076 (0.019)	0.076 (0.019)	0.076 (0.019)
Class size	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 8-8 Factors affecting student attainment in Health and Physical Education (Continued)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
School level:										
School size (Ref = Small) ▪ Medium ▪ Large and extra large	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
School type (Ref = Public)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School difficulties in Health and Physical Education	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School policy for school learning environment										
Dealing with student behaviours outside classroom	NS	NS	NS	NS	NS					
Collaboration and interactions among teachers	NS	NS	NS	NS	NS					
Partnership policy	NS	NS	NS	NS	NS					
Provision of sufficient learning resources	NS	0.846 (0.350)	NS	NS	NS					
Value on favour of learning	0.832 (0.352)	NS	0.870 (0.335)	0.731 (0.362)	NS					
School evaluation										
School policy for teaching						NS	NS	NS	NS	0.972 (0.351)
School policy for school learning environment						NS	NS	NS	NS	NS
Variance components:										
School	3.314 (1.345)	3.251 (1.348)	3.113 (1.340)	3.580 (1.333)	4.276 (1.383)	4.276 (1.383)	4.276 (1.383)	4.276 (1.383)	4.276 (1.383)	2.939 (1.333)
Classroom	3.037 (0.911)	3.062 (0.919)	3.096 (0.928)	2.944 (0.880)	2.735 (0.832)	2.735 (0.832)	2.735 (0.832)	2.735 (0.832)	2.735 (0.832)	3.158 (0.944)
Student	83.510 (1.745)	83.560 (1.745)	83.513 (1.750)	83.514 (1.745)	83.529 (1.746)	83.529 (1.746)	83.529 (1.746)	83.529 (1.746)	83.529 (1.746)	83.516 (1.746)
Log likelihood	-17418.417	-17418.321	-17417.973	-17419.016	-17420.919	-17420.919	-17420.919	-17420.919	-17420.919	-17417.666

Table 8-8 Factors affecting student attainment in Health and Physical Education (*Continued*)

❖ Arts

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
Constant	41.101 (0.331)	32.814 (0.450)	31.801 (0.441)	31.998 (0.469)	25.268 (1.379)	23.715 (1.133)	26.478 (1.334)	24.737 (1.345)	25.952 (1.342)	25.852 (1.355)	24.737 (1.345)
Student level:											
Prior attainment in Arts		0.207 (0.009)	0.186 (0.009)	0.190 (0.009)	0.177 (0.009)	0.177 (0.009)	0.177 (0.010)	0.178 (0.010)	0.177 (0.009)	0.177 (0.010)	0.178 (0.010)
Sex (Ref=boy)			3.686 (0.232)	3.464 (0.251)	3.313 (0.254)	3.316 (0.253)	3.315 (0.254)	3.315 (0.254)	3.320 (0.253)	3.316 (0.254)	3.315 (0.254)
Age			NS	NS	NS	NS	NS	NS	NS	NS	NS
SES			NS	NS	NS	NS	NS	NS	NS	NS	NS
Motivation in Arts				NS	NS	NS	NS	NS	NS	NS	NS
Parental Involvement in Arts				0.371 (0.119)	0.383 (0.118)	0.374 (0.118)	0.387 (0.118)	0.385 (0.118)	0.383 (0.118)	0.388 (0.118)	0.385 (0.118)
Time spent on reviewing lessons in Arts (Ref = None)				NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
▪ Medium				NS	NS	NS	NS	NS	NS	NS	NS
▪ High				NS	NS	NS	NS	NS	NS	NS	NS
Attending tutorial in Art (Ref = not attend)				NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:											
Average prior attainment in Arts					0.114 (0.038)	0.142 (0.038)	0.084 (0.036)	0.123 (0.037)	0.092 (0.037)	0.098 (0.037)	0.092 (0.037)
Dispersion of prior attainment in Arts					NS	NS	NS	NS	NS	NS	NS
Average SES					NS	NS	NS	NS	NS	NS	NS
Percentage of girls					0.057 (0.017)	0.060 (0.017)	0.051 (0.016)	0.053 (0.016)	0.057 (0.016)	0.053 (0.016)	NS
Class size					NS	NS	NS	NS	NS	NS	NS

Table 8-9 Factors affecting student attainment in Arts

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
School level:											
School size (Ref = Small)							NS NS	NS NS	NS NS	NS NS	NS NS
▪ Medium											
▪ Large and extra large											
School type (Ref = Public)						NS	NS	NS	NS	NS	NS
School SES						NS	NS	NS	NS	NS	NS
School difficulties in Arts						-0.725 (0.327)	NS	-0.558 (0.283)	NS	NS	-0.558 (0.282)
School policy for teaching											
▪ Quantity of teaching							NS	1.222 (0.592)	NS	NS	1.222 (0.592)
▪ Provision of learning							NS	NS	NS	NS	NS
▪ Quality of teaching							1.286 (0.239)	1.297 (0.272)	1.193 (0.246)	1.167 (0.231)	1.297 (0.272)
Variance components:											
School	2.722 (1.053)	1.929 (0.834)	1.947 (0.789)	1.638 (0.724)	1.254 (0.692)	1.532 (0.725)	0.062 (0.422)	0.470 (0.523)	0.239 (0.447)	0.025 (0.440)	0.469 (0.523)
Classroom	10.981 (1.543)	6.417 (1.079)	5.439 (0.961)	5.217 (0.964)	3.256 (0.785)	3.170 (0.770)	3.838 (0.816)	3.307 (0.765)	3.569 (0.783)	3.553 (0.780)	3.307 (0.765)
Student	80.638 (1.493)	73.143 (1.143)	70.953 (1.357)	68.922 (1.441)	68.954 (1.442)	68.952 (1.442)	68.953 (1.442)	68.943 (1.441)	68.948 (1.441)	68.951 (1.442)	68.943 (1.441)
Log likelihood	-21978.225	-20399.144	-20276.457	-16981.416	-16956.065	-16957.38	-16950.919	-16948.221	-16949.305	-16948.710	-16948.221

Table 8-9 Factors affecting student attainment in Arts (Continued)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
Constant	25.763 (1.332)	25.765 (1.323)	25.37 (1.335)	24.501 (1.372)	25.148 (1.323)	23.715 (1.133)	24.826 (1.313)	25.398 (1.322)	24.832 (1.354)	25.830 (1.321)
Student level:										
Prior attainment in Arts	0.177 (0.010)	0.177 (0.010)	0.177 (0.009)	0.177 (0.010)	0.177 (0.009)	0.177 (0.009)	0.177 (0.010)	0.177 (0.010)	0.177 (0.009)	0.177 (0.010)
Sex (Ref=boy)	3.320 (0.254)	3.321 (0.254)	3.309 (0.254)	3.311 (0.254)	3.313 (0.254)	3.316 (0.253)	3.315 (0.254)	3.319 (0.254)	3.317 (0.254)	3.321 (0.253)
Age	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Motivation in Arts	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Parental Involvement in Arts	0.385 (0.118)	0.388 (0.118)	0.388 (0.118)	0.380 (0.118)	0.387 (0.117)	0.374 (0.118)	0.385 (0.118)	0.383 (0.118)	0.379 (0.118)	0.383 (0.118)
Time spent on reviewing lessons in Arts (Ref = None)										
▪ Medium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
▪ High	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Attending tutorial in Arts (Ref = not attend)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:										
Average prior attainment in Arts	0.098 (0.036)	0.098 (0.036)	0.108 (0.036)	0.126 (0.038)	0.109 (0.036)	0.142 (0.038)	0.110 (0.036)	0.107 (0.036)	0.117 (0.038)	0.093 (0.036)
Dispersion of prior attainment in Arts	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Average SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Percentage of girls	0.053 (0.016)	0.053 (0.016)	0.055 (0.016)	0.056 (0.017)	0.057 (0.016)	0.060 (0.017)	0.064 (0.017)	0.053 (0.017)	0.058 (0.017)	0.054 (0.016)
Class size	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 8-9 Factors affecting student attainment in Arts (Continued)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
School level:										
School size (Ref = Small)										
▪ Medium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
▪ Large and extra large	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School type (Ref = Public)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School difficulties in Arts	-0.569 (0.243)	-0.531 (0.271)	NS	-0.650 (0.293)	NS	-0.725 (0.327)	-0.671 (0.292)	-0.643 (0.280)	-0.721 (0.301)	0.582 (0.270)
School policy for school learning environment										
▪ Dealing with student behaviours outside classroom	NS	NS	NS	NS	NS					
▪ Collaboration and interactions among teachers	NS	NS	NS	NS	NS					
▪ Partnership policy	NS	NS	NS	NS	NS					
▪ Provision of sufficient learning resources	NS	1.157 (0.237)	1.482 (0.583)	1.241 (0.591)	1.562 (0.585)					
▪ Value on favour of learning	1.143 (0.244)	NS	1.426 (0.255)	1.143 (0.281)	1.635 (0.272)					
School evaluation										
▪ School policy for teaching						NS	2.272 (0.628)	1.079 (0.251)	1.000 (0.382)	1.207 (0.239)
▪ School policy for school learning environment						NS	NS	NS	NS	NS
Variance components:										
School	0.293 (0.450)	0.240 (0.418)	0.256 (0.479)	0.693 (0.578)	0.127 (0.465)	1.532 (0.725)	0.596 (0.599)	0.393 (0.487)	0.791 (0.627)	0.206 (0.425)
Classroom	3.519 (0.776)	3.521 (0.766)	3.361 (0.771)	3.255 (0.767)	3.576 (0.799)	3.170 (0.770)	3.490 (0.813)	3.489 (0.778)	3.454 (0.803)	3.538 (0.773)
Student	68.960 (1.1442)	68.965 (1.442)	68.919 (1.440)	68.947 (1.442)	68.920 (1.441)	68.952 (1.442)	68.942 (1.441)	68.966 (1.442)	68.969 (1.442)	68.956 (1.442)
Log likelihood	-16949.638	-16949.177	-16945.505	-16950.138	-16946.954	-16957.38	-16952.231	-16950.648	-16954.715	-16948.674

Table 8-9 Factors affecting student attainment in Arts (Continued)

❖ Occupation and Technology

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching				
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)
Constant	44.572 (0.547)	42.882 (3.702)	40.917 (4.954)	39.973 (4.935)	17.550 (5.478)	15.401 (5.424)	15.270 (5.451)	14.124 (5.424)	16.092 (5.456)	17.514 (5.451)	13.460 (5.421)
Student level:											
Prior attainment in Occupation and Technology		0.393 (0.111)	0.340 (0.012)	0.336 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.321 (0.012)	0.320 (0.012)
Sex (Ref=boy)			5.291 (0.310)	5.320 (0.309)	5.198 (0.311)	5.179 (0.310)	5.185 (0.311)	5.174 (0.310)	5.186 (0.311)	5.184 (0.311)	5.175 (0.310)
Age			-0.085 (0.027)	-0.079 (0.027)	-0.077 (0.026)	-0.079 (0.026)	-0.077 (0.026)	-0.080 (0.026)	-0.077 (0.026)	-0.077 (0.026)	-0.080 (0.026)
SES			0.554 (0.163)	0.545 (0.162)	0.430 (0.165)	0.503 (0.162)	0.490 (0.162)	0.507 (0.162)	0.488 (0.162)	0.489 (0.162)	0.510 (0.162)
Motivation in Occupation and Technology				0.773 (0.217)	0.734 (0.215)	0.728 (0.216)	0.741 (0.215)	0.728 (0.215)	0.733 (0.215)	0.729 (0.215)	0.734 (0.215)
Parental Involvement in Occupation and Technology				0.488 (0.165)	0.538 (0.164)	0.529 (0.164)	0.526 (0.162)	0.527 (0.164)	0.526 (0.164)	0.530 (0.164)	0.527 (0.164)
Time spent on reviewing lessons in Occupation and Technology (Ref = None)					NS NS	NS NS	NS NS	NS NS	NS NS	NS NS	NS NS
▪ Medium											
▪ High											
Attending tutorial in Occupation and Technology (Ref = not attend)					NS	NS	NS	NS	NS	NS	NS
Classroom level:											
Average prior attainment in Occupation and Technology					0.448 (0.060)	0.430 (0.058)	0.429 (0.060)	0.460 (0.059)	0.407 (0.060)	0.378 (0.059)	0.480 (0.058)
Dispersion of prior attainment in Occupation and Technology					-0.333 (0.169)	NS	NS	NS	NS	NS	NS
Average SES						NS	NS	NS	NS	NS	NS
Percentage of girls						0.076 (0.023)	0.074 (0.023)	0.076 (0.023)	0.078 (0.023)	0.078 (0.024)	0.070 (0.023)
Class size						NS	NS	NS	NS	NS	NS

Table 8-10 Factors affecting student attainment in Occupation and Technology

Independent variables	Model 0	Model 1	Model 2	Model 3	Model 4	Model 5	School policy for teaching					
							Model 6 (Frequency)	Model 7 (Focus)	Model 8 (Stage)	Model 9 (Quality)	Model 10 (Differentiation)	
School level:												
School size (Ref = Small)							NS NS	NS NS	NS NS	NS NS	NS NS	
▪ Medium												
▪ Large and extra large												
School type (Ref = Public)							NS	NS	NS	NS	NS	
School SES							NS	NS	NS	NS	NS	
School difficulties in Occupation and Technology							-0.900 (0.488)	NS	-0.874 (0.402)	-0.789 (0.401)	-0.943 (0.461)	NS
School policy for teaching												
▪ Quantity of teaching								NS	NS	NS	NS	
▪ Provision of learning								1.484 (0.619)	NS	2.047 (0.924)	NS	NS
▪ Quality of teaching								2.273 (1.010)	1.970 (0.978)	1.256 (0.561)	0.940 (0.456)	2.069 (0.999)
Variance components:												
School	9.510 (2.883)	5.913 (1.887)	5.417 (1.869)	5.458 (1.849)	3.439 (1.263)	3.699 (1.306)	3.713 (1.362)	3.321 (1.197)	3.945 (1.416)	4.347 (1.543)	3.168 (1.154)	
Classroom	29.277 (3.791)	15.274 (2.241)	14.870 (2.278)	14.715 (2.248)	11.656 (3.402)	11.574 (3.391)	11.188 (3.503)	12.156 (3.291)	10.345 (3.345)	9.234 (3.395)	13.207 (3.390)	
Student	133.908 (2.480)	110.796 (2.118)	101.424 (2.122)	100.580 (2.104)	100.700 (2.107)	100.743 (2.109)	100.710 (2.108)	100.219 (2.111)	100.703 (2.107)	100.727 (2.108)	100.735 (2.109)	
Log likelihood	-23552.856	-21581.808	-17952.988	-17933.167	-17887.152	-17890.147	-17888.422	-17888.162	-17886.841	-17888.302	-17889.684	

Table 8-10 Factors affecting student attainment in Occupation and Technology (Continued)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
Constant	15.401 (5.425)	15.270 (5.451)	15.427 (5.430)	13.386 (5.423)	14.641 (5.422)	15.270 (5.451)	15.270 (5.451)	15.270 (5.451)	15.270 (5.451)	14.917 (5.467)
Student level:										
Prior attainment in Occupation and Technology	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)	0.320 (0.012)
Sex (Ref=boy)	5.179 (0.311)	5.179 (0.310)	5.179 (0.311)	5.175 (0.311)	5.180 (0.311)	5.179 (0.310)	5.179 (0.310)	5.179 (0.310)	5.179 (0.310)	5.186 (0.311)
Age	-0.079 (0.026)	-0.079 (0.026)	-0.078 (0.026)	-0.081 (0.026)	-0.078 (0.026)	-0.079 (0.026)	-0.079 (0.026)	-0.079 (0.026)	-0.079 (0.026)	-0.077 (0.026)
SES	0.504 (0.162)	0.503 (0.162)	0.487 (0.162)	0.509 (0.161)	0.486 (0.162)	0.503 (0.162)	0.503 (0.162)	0.503 (0.162)	0.503 (0.162)	0.491 (0.162)
Motivation in Occupation and Technology	0.728 (0.216)	0.728 (0.216)	0.735 (0.215)	0.734 (0.215)	0.735 (0.215)	0.728 (0.216)	0.728 (0.216)	0.728 (0.216)	0.728 (0.216)	0.739 (0.215)
Parental Involvement in Occupation and Technology	0.529 (0.164)	0.529 (0.164)	0.527 (0.164)	0.527 (0.164)	0.526 (0.164)	0.529 (0.164)	0.529 (0.164)	0.529 (0.164)	0.529 (0.164)	0.073 (0.023)
Time spent on reviewing lessons in Occupation and Technology (Ref = None)										
▪ Medium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
▪ High	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Attending tutorial in Occupation and Technology (Ref = not attend)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Classroom level:										
Average prior attainment in Occupation and Technology	0.429 (0.058)	0.430 (0.058)	0.427 (0.059)	0.481 (0.058)	0.447 (0.058)	0.430 (0.058)	0.430 (0.058)	0.430 (0.058)	0.430 (0.058)	0.426 (0.060)
Dispersion of prior attainment in Occupation and Technology	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Average SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Percentage of girls	0.076 (0.023)	NS	0.073 (0.023)	0.070 (0.023)	0.072 (0.023)	0.076 (0.023)	0.076 (0.023)	0.076 (0.023)	0.076 (0.023)	0.073 (0.023)
Class size	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 8-10 Factors affecting student attainment in Occupation and Technology (Continued)

Independent variables	School policy for learning environment					School evaluation				
	Model 11 (Frequency)	Model 12 (Focus)	Model 13 (Stage)	Model 14 (Quality)	Model 15 (Differentiation)	Model 16 (Frequency)	Model 17 (Focus)	Model 18 (Stage)	Model 19 (Quality)	Model 20 (Differentiation)
School level:										
School size (Ref = Small)										
▪ Medium	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
▪ Large and extra large	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School type (Ref = Public)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School SES	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
School difficulties in Occupation and Technology	-0.900 (0.460)	-0.900 (0.488)	NS	NS	NS	-0.900 (0.488)	-0.900 (0.488)	-0.900 (0.488)	-0.900 (0.488)	-0.900 (0.488)
School policy for school learning environment										
▪ Dealing with student behaviours outside classroom	NS	NS	NS	NS	NS					
▪ Collaboration and interactions among teachers	NS	NS	NS	NS	NS					
▪ Partnership policy	NS	NS	NS	NS	NS					
▪ Provision of sufficient learning resources	NS	NS	3.203 (1.036)	1.988 (0.987)	1.709 (0.601)					
▪ Value on favour of learning	NS	NS	1.664 (0.517)	NS	3.227 (1.071)					
School evaluation										
▪ School policy for teaching						NS	NS	NS	NS	1.275 (0.562)
▪ School policy for school learning environment						NS	NS	NS	NS	2.172 (0.937)
Variance components:										
School	3.699 (1.306)	3.699 (1.306)	3.666 (1.324)	3.156 (3.411)	3.502 (1.273)	3.699 (1.306)	3.699 (1.306)	3.699 (1.306)	3.699 (1.306)	3.828 (1.390)
Classroom	11.574 (3.391)	11.574 (3.391)	10.336 (3.218)	13.313 (3.411)	11.013 (3.263)	11.574 (3.391)	11.574 (3.391)	11.574 (3.391)	11.574 (3.391)	10.769 (3.459)
Student	100.743 (2.109)	100.743 (2.109)	100.694 (2.107)	100.733 (2.109)	100.713 (2.108)	100.743 (2.109)	100.743 (2.109)	100.743 (2.109)	100.743 (2.109)	100.716 (2.108)
Log likelihood	-17890.147	-17890.147	-17885.202	-17889.801	-17886.184	-17890.147	-17890.147	-17890.147	-17890.147	-17888.323

Table 8-10 Factors affecting student attainment in Occupation and Technology (Continued)

8.1.3 School contextual value-added analysis

After fitting the models shown in the earlier section, the next step of the study aims to estimate the magnitude of school effects that schools added to their students given student intakes, and classroom and school contextual effects. It is straightforward to justify and compare the level of effectiveness among schools. To achieve this, the residual at school level was estimated from the multilevel model. By predicting this, the residual from Model 5 in each subject, which included all significant factors of student characteristics, as well as classroom and school contextual effects, was computed.

The 'caterpillar plots' with a 95% confidence interval of the school effects are shown in Figure 8-2. In addition, the value of school CVA scores are shown in the supplementary material in detail in each subject at each school.

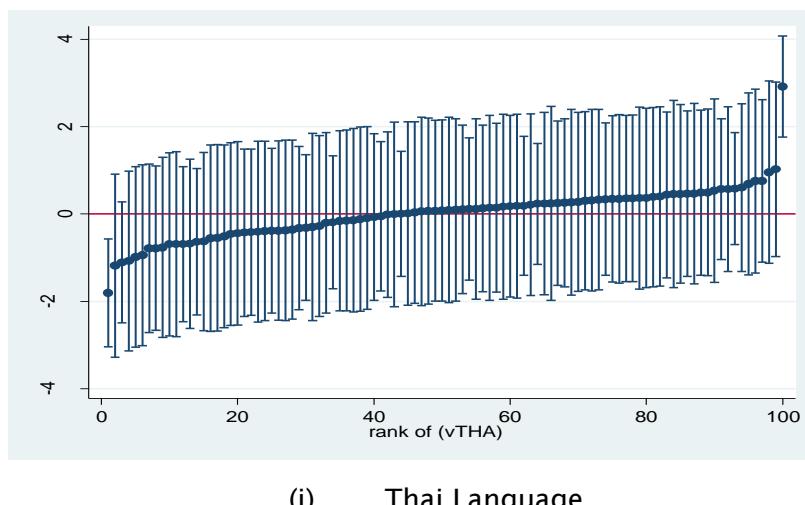
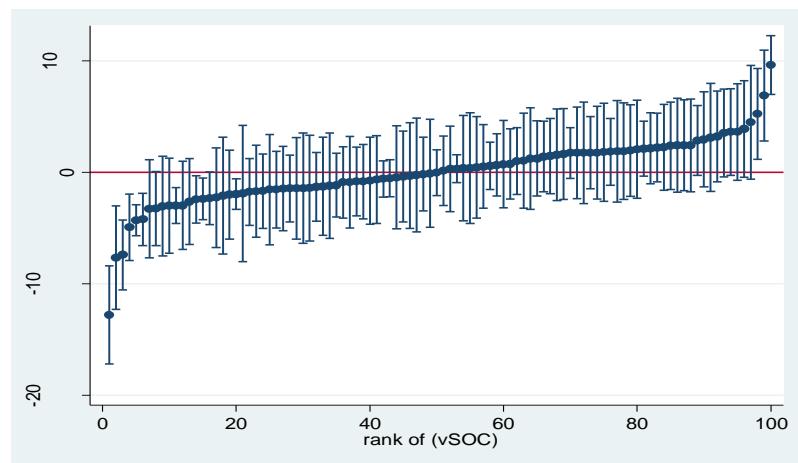
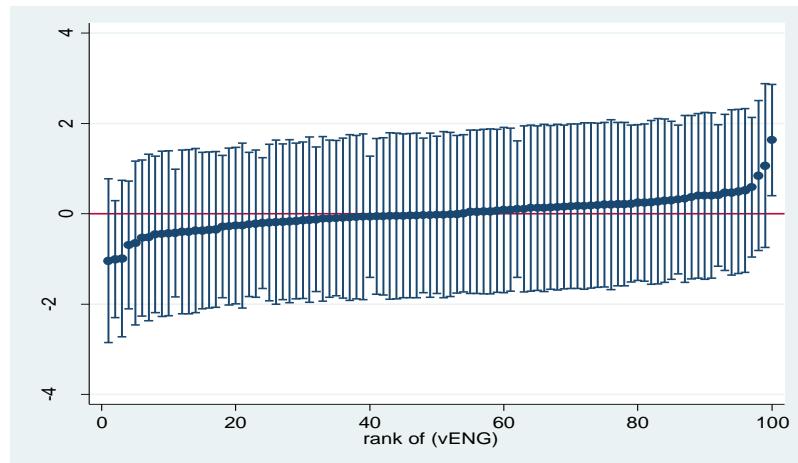


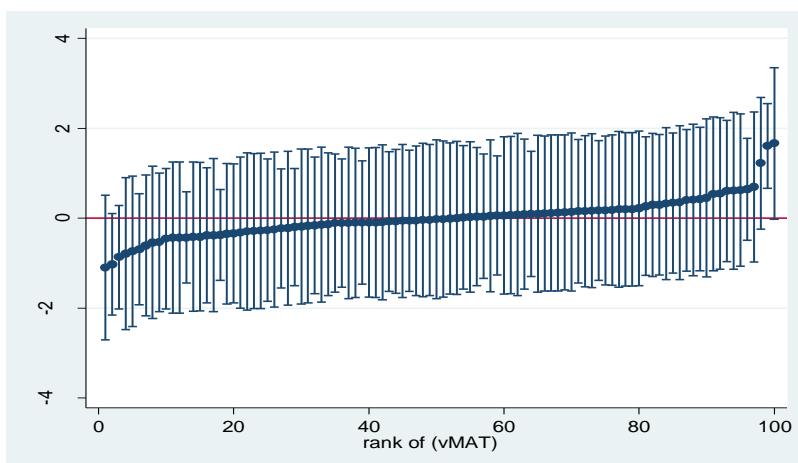
Figure 8-2 Caterpillar plots presenting the school effects in each school



(ii) Social Studies, Culture and Religion

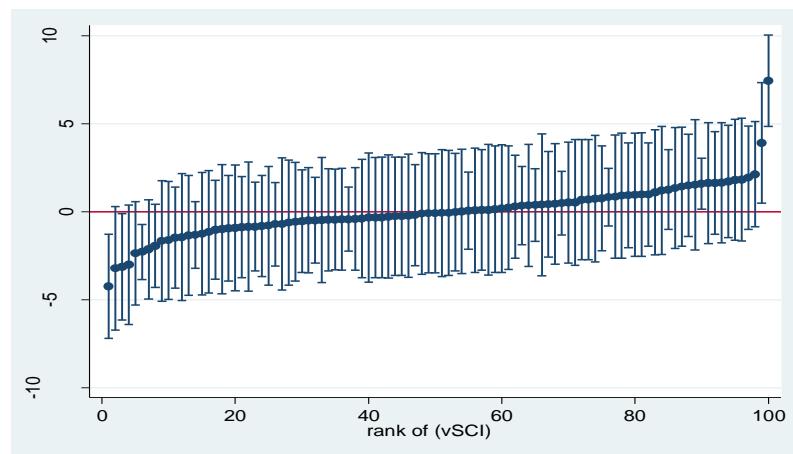


(iii) English Language

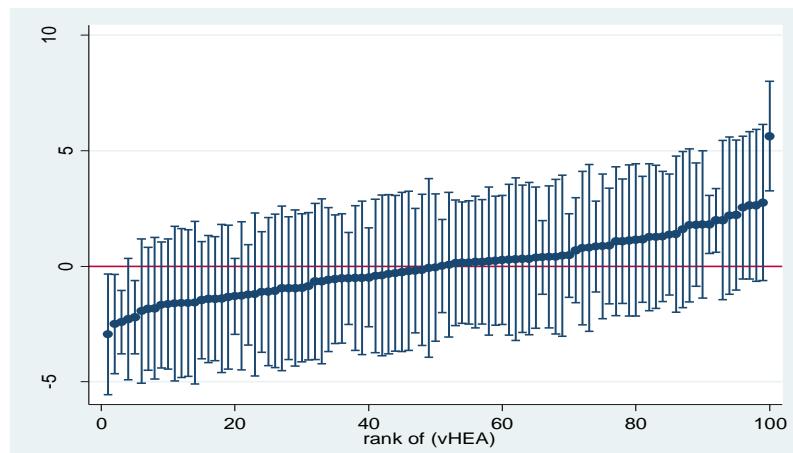


(iv) Mathematics

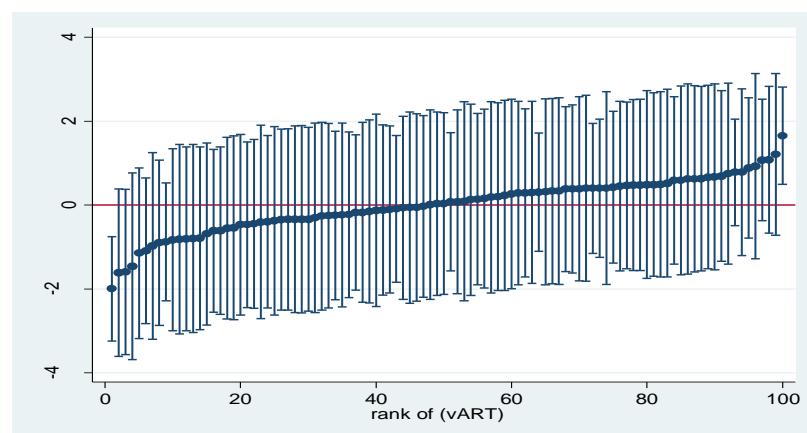
Figure 8-2 Caterpillar plots presenting the school effects in each school
(Continued)



(v) Science

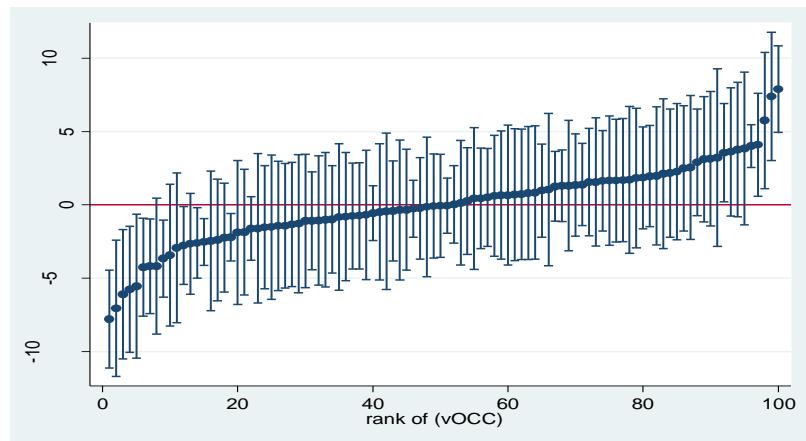


(vi) Health and Physical Education



(vii) Arts

Figure 8-2 Caterpillar plots presenting the school effects in each school
(Continued)



(viii) Occupation and Technology

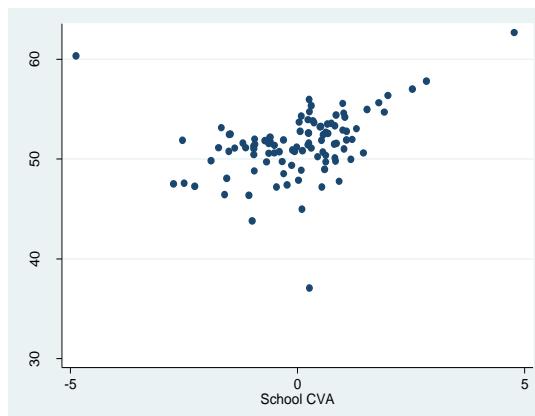
Figure 8-2 Caterpillar plots presenting the school effects in each school
(Continued)

8.1.4 Relationship between the school raw scores and school CVA

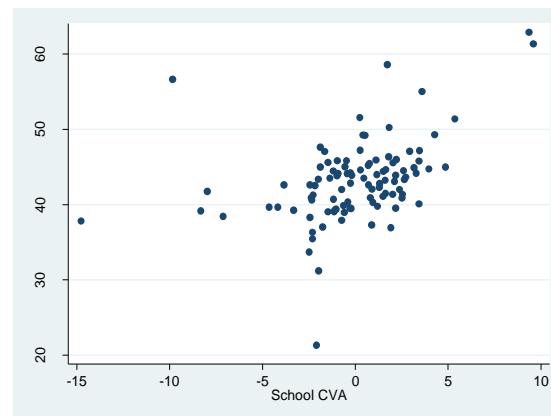
After obtaining information on school quality measured by school CVA, this section presents the relationship between school raw scores and school CVA in each subject. Considering the school value-added together with school raw scores, in Table 8-11 and Figure 8-3, the findings indicate that there are positive relationships between such data in all subjects. Using Pearson Product Moment Correlation Coefficient, the magnitudes of all relationship were moderate ($p < .01$). It is shown that among these eight subjects, the degree of correlation was highest in Mathematics ($r = 0.68$), followed by Science, Arts and English which were at similar degrees at around 0.63. For Thai Language, Health and Physical Education, and Occupation, their relationship were less than 0.5. This implies that schools performing higher in adding value to students are likely to have higher average raw scores, and vice versa, especially in Mathematics, Science, Arts and English.

Subjects	Pearson correlation between the school raw scores and school CVA
Thai Language	0.357***
Social Studies, Culture and Religion	0.426***
English Language	0.633***
Mathematics	0.683***
Science	0.639***
Health and Physical Education	0.460***
Arts	0.636***
Occupation and Technology	0.441***

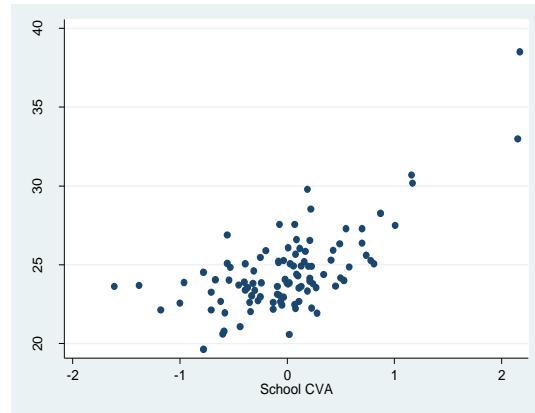
Table 8-11 Relationship between the school raw scores and the school CVA scores using Pearson Product Moment Correlation



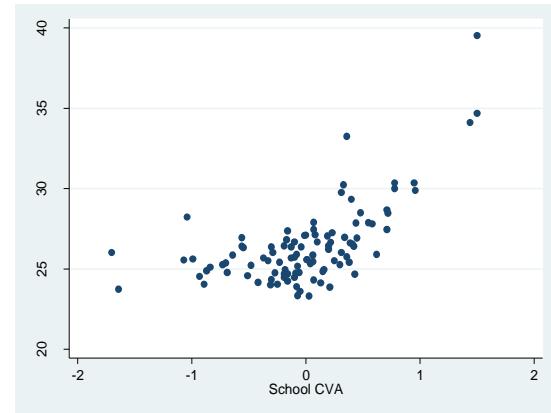
a. Thai Language



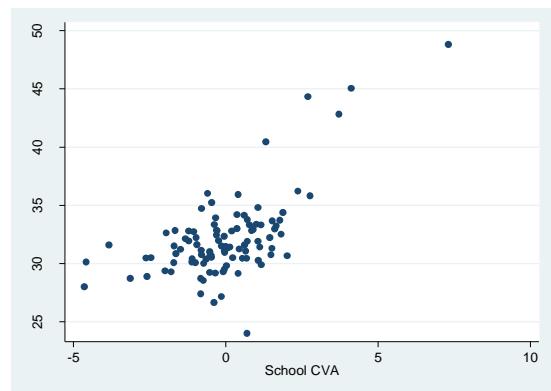
b. Social Studies, Culture and Religion



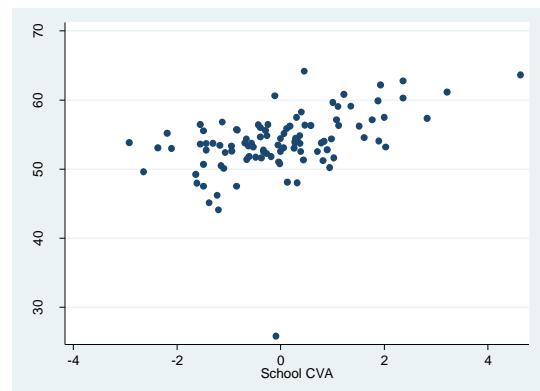
c. Mathematics



d. English Language

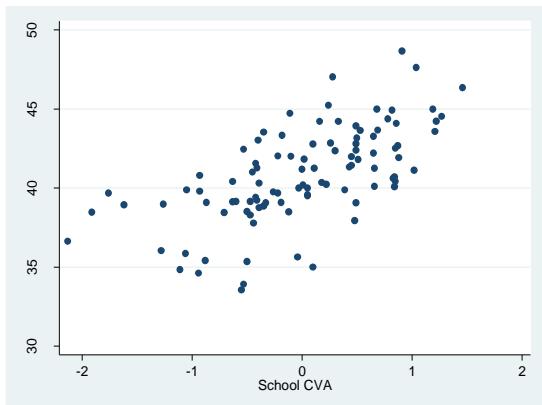


e. Science

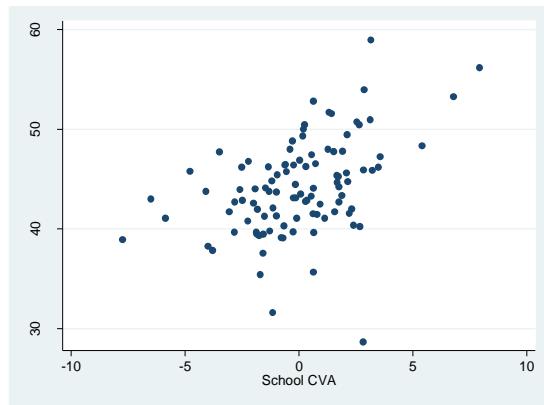


f. Health and Physical Education

Figure 8-3 Scatter plots presenting the relationship between school raw scores and school CVA in eight subjects



g. Arts



h. Occupation and Technology

Figure 8-3 Scatter plots presenting the relationship between school raw scores and school CVA in eight subjects (*Continued*)

8.2 Research question 2

What is the extent of student attainment equity in Thailand? Which school factors significantly affect attainment equity at the school level in Thailand?

8.2.1 Measuring attainment equity

As discussed earlier in Chapter 4 about the properties of the equity metrics applied in educational contexts, Kelly's AE and Thiel's T index were both used when measuring the attainment equity at school level in the study. In this section, we present how to calculate these two indices from the national testing scores, O-NET, in the academic year 2012/13, in a sample school and at a provincial level. However, as suggested by the general rule of thumb which refers to the principle of population and robustness of indices, the appropriate number of a sample size should be at least twenty. For this reason, we included only schools with twenty and above Grade 9 students, which consisted of 76 schools.

- ❖ **Calculating attainment equity using Kelly's AE index for schools using a grouped data approach: an example**

In this section, we begin to measure the magnitude of attainment equity using Kelly's AE index in terms of a grouped data approach, which is called a piece wise linear function. According to the O-NET scores from the NIETS, School A (see

accompanying material), for example, has the following O-NET score distribution in Thai language:

- The bottom 10% obtained 7.02% O-Net scores in Thai Language in School ‘A’
- The bottom 20% obtained 14.90% O-Net scores in Thai Language in School ‘A’
- The bottom 30% obtained 23. 42% O-Net scores in Thai Language in School ‘A’
- The bottom 40% obtained 33.23% O-Net scores in Thai Language in School ‘A’
- The bottom 50% obtained 43.57% O-Net scores in Thai Language in School ‘A’
- The bottom 60% obtained 54.23% O-Net scores in Thai Language in School ‘A’
- The bottom 70% obtained 65.11% O-Net scores in Thai Language in School ‘A’
- The bottom 80% obtained 76.31% O-Net scores in Thai Language in School ‘A’
- The bottom 90% obtained 87.94% O-Net scores in Thai Language in School ‘A’.

This is shown in Table 8-12 as a piecewise linear function, which presents the cumulative percentage of students and the cumulative percentage of student attainment in Thai Language within School A.

Student (<i>i</i>)	Score (<i>v_i</i>)	Score (<i>v_i</i>)	Percentage of score obtained by the percentage bottom								
			10%	20%	30%	40%	50%	60%	70%	80%	90%
1	39.20	32.80	32.80	32.80	32.80	32.80	32.80	32.80	32.80	32.80	32.80
2	48.80	34.40	34.40	34.40	34.40	34.40	34.40	34.40	34.40	34.40	34.40
3	56.80	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60	37.60
4	45.60	39.20		39.20	39.20	39.20	39.20	39.20	39.20	39.20	39.20
5	40.80	39.20		39.20	39.20	39.20	39.20	39.20	39.20	39.20	39.20
6	55.20	39.20		39.20	39.20	39.20	39.20	39.20	39.20	39.20	39.20
7	55.20	40.80			40.80	40.80	40.80	40.80	40.80	40.80	40.80
8	58.40	40.80			40.80	40.80	40.80	40.80	40.80	40.80	40.80
9	60.00	45.60			45.60	45.60	45.60	45.60	45.60	45.60	45.60
10	52.00	48.80				48.80	48.80	48.80	48.80	48.80	48.80
11	34.40	48.80				48.80	48.80	48.80	48.80	48.80	48.80
12	52.00	48.80				48.80	48.80	48.80	48.80	48.80	48.80
13	53.60	50.40					50.40	50.40	50.40	50.40	50.40
14	40.80	52.00					52.00	52.00	52.00	52.00	52.00
15	32.80	52.00					52.00	52.00	52.00	52.00	52.00
16	39.20	52.00						52.00	52.00	52.00	52.00
17	53.60	53.60						53.60	53.60	53.60	53.60
18	60.00	53.60						53.60	53.60	53.60	53.60
19	48.80	53.60							53.60	53.60	53.60
20	53.60	53.60							53.60	53.60	53.60
21	55.20	55.20							55.20	55.20	55.20
22	37.60	55.20								55.20	55.20
23	56.80	55.20								55.20	55.20
24	58.40	56.80								56.80	56.80
25	50.40	56.80									56.80
26	39.20	58.40									58.40
27	48.80	58.40									58.40
28	60.00	60.00									
29	52.00	60.00									
30	53.60	60.00									
Σn_i	30	30	3	6	9	12	15	18	21	24	27
Σv_i	1492.8	1492.8	104.8	222.4	349.6	496.0	650.4	809.6	972.0	1139.2	1312.8
%	100	1.000	0.0702	0.1490	0.2342	0.3323	0.4357	0.5423	0.6511	0.7631	0.8794

Table 8-12 Sample of calculating Kelly's AE index in Thai Language in the case of School 'A' using the piecewise function approach

Graphically, the distribution of the Thai language scores is presented in Figure 8-4 as a Lorenz curve.

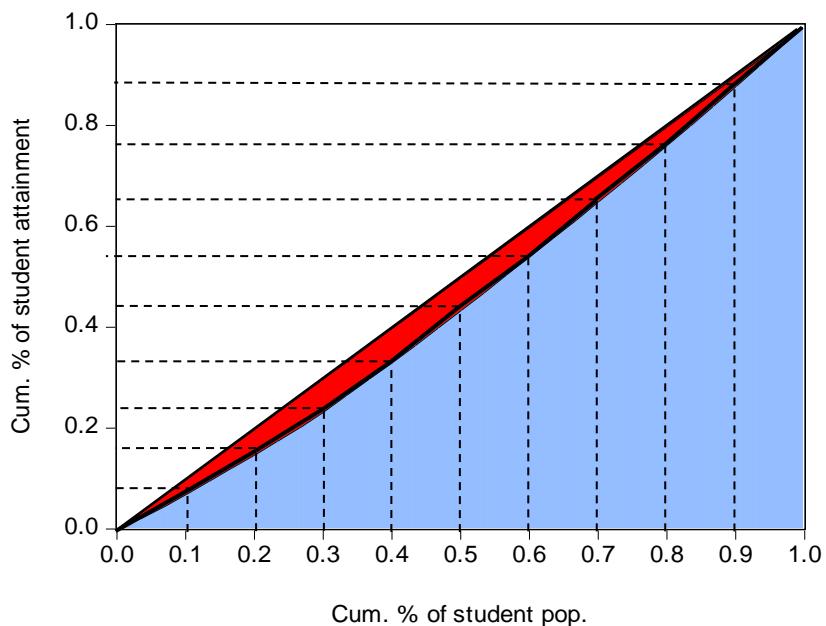


Figure 8-4 Sample of the Lorenz curve in Thai Language in the case of School 'A' using a piecewise linear function

Using Kelly's AE equation (see Chapter 4), with the cumulative intervals calculated every 10 percent, $X_k - X_{k-1} = 0.1$, Kelly's AE index in Thai language for School A can be calculated:

$$\begin{aligned}
 AE_{THA} &= 1 - 0.1 \sum_{i=1}^{10} (Y_i + Y_{i-1}) \\
 &= 1 - 0.1 [(0.0702+0)+(0.1490+0.0702)+\dots+(1+0.8794)] \\
 &= 0.0885
 \end{aligned}$$

Therefore, Kelly's AE index in Thai language for School A is 0.0885.

As shown above, a similar procedure was then used to calculate individually for each of the seventy-six schools. The findings of individual schools for Kelly's AE index in each school is shown in the accompanying materials.

The summary statistic of Kelly's AE indices (N=76) in each subject is shown in Table 8-13.

Subjects	Mean	SD	Minimum	Maximum	Skewness	Kurtosis
Thai Language	0.0914	0.0113	0.0638	0.1241	0.2953	0.3839
Social Studies, Culture and Religion	0.1499	0.0233	0.1057	0.2275	0.6023	1.1287
English Language	0.1408	0.0258	0.0975	0.2404	1.4692	3.2886
Mathematics	0.1801	0.0228	0.1071	0.2287	-4.135	0.8956
Science	0.1374	0.0224	0.0622	0.1895	-0.4919	1.0977
Health and Physical Education	0.1169	0.0250	0.0688	0.1795	0.5027	-0.1156
Arts	0.1281	0.0182	0.0852	0.1704	0.0226	-0.4795
Occupation and Technology	0.1608	0.0256	0.0957	0.2222	-0.1204	0.6115

Note: Schools with less than 20 students in Grade 9 were excluded in the analysis.

Table 8-13 Summary statistic of Kelly's AE indices in eight subjects among schools in Prachin Buri Province

❖ **Calculating attainment equity using Kelly's AE index for schools using an ungroup data approach: an example**

Using the same data from School A presented in the earlier section, Kelly's AE index was calculated by using ungrouped data. To do this, student O-NET scores within the school were treated individually. The procedure of calculating Kelly's AE index using ungrouped data was similar to using grouped data.

This is shown in Table 8-14 as ungrouped data, which presents the cumulative percentage of students and the cumulative percentage of student attainment in Thai Language within School A. Using Kelly's AE equation (see Chapter 4), Kelly's AE index in Thai language for School A is 0.0892.

Student (i)	Score (v_i)
-	-
1	39.20
2	48.80
3	56.80
4	45.60
5	40.80
6	55.20
7	55.20
8	58.40
9	60.00
10	52.00
11	34.40
12	52.00
13	53.60
14	40.80
15	32.80
16	39.20
17	53.60
18	60.00
19	48.80
20	53.60
21	55.20
22	37.60
23	56.80
24	58.40
25	50.40
26	39.20
27	48.80
28	60.00
29	52.00
30	53.60
$\Sigma n_i = 30$	
$\mu = 49.7600$	

Sort cases
Ascending



Student (v_i)	Cum. pop (n_i)	Cum. % of Pop	Cum. score (n_i)	Cum. % of score		Kelly's AE index
Expected	Observed					
-	0	0	0	0.00000	0.00000	0.0893
32.80	1	3	32.80	0.03333	0.02197	
34.40	2	7	67.20	0.06667	0.04502	
37.60	3	10	104.80	0.10000	0.07020	
39.20	4	13	144.00	0.13333	0.09646	
39.20	5	17	183.20	0.16667	0.12272	
39.20	6	20	222.40	0.20000	0.14898	
40.80	7	23	263.20	0.23333	0.17631	
40.80	8	27	304.00	0.26667	0.20364	
45.60	9	30	349.60	0.30000	0.23419	
48.80	10	33	398.40	0.33333	0.26688	
48.80	11	37	447.20	0.36667	0.29957	
48.80	12	40	496.00	0.40000	0.33226	
50.40	13	43	546.40	0.43333	0.36602	
52.00	14	47	598.40	0.46667	0.40086	
52.00	15	50	650.40	0.50000	0.43569	
52.00	16	53	702.40	0.53333	0.47053	
53.60	17	57	756.00	0.56667	0.50643	
53.60	18	60	809.60	0.60000	0.54234	
53.60	19	63	863.20	0.63333	0.57824	
53.60	20	67	916.80	0.66667	0.61415	
55.20	21	70	972.00	0.70000	0.65113	
55.20	22	73	1027.20	0.73333	0.68810	
55.20	23	77	1082.40	0.76667	0.72508	
56.80	24	80	1139.20	0.80000	0.76313	
56.80	25	83	1196.00	0.83333	0.80118	
58.40	26	87	1254.40	0.86667	0.84030	
58.40	27	90	1312.80	0.90000	0.87942	
60.00	28	93	1372.80	0.93333	0.91961	
60.00	29	97	1432.80	0.96667	0.95981	
60.00	30	100	1492.80	1.00000	1.00000	

Table 8-14 Sample of calculating Kelly's AE index in Thai Language in School 'A' using the ungrouped data approach

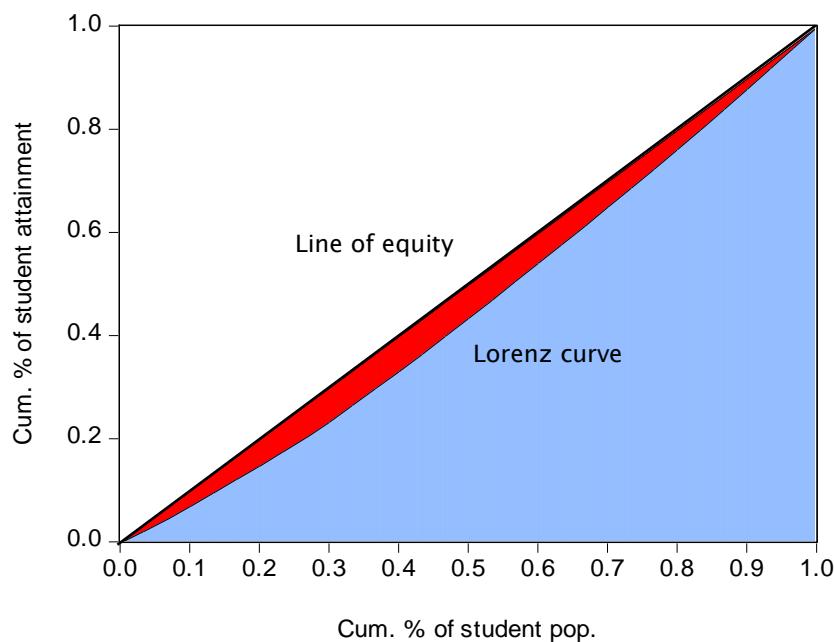
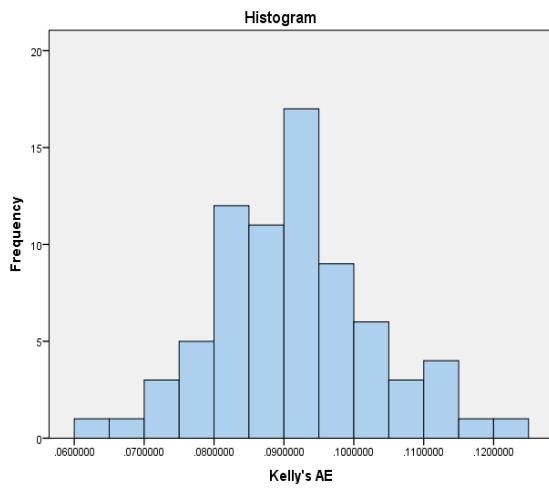
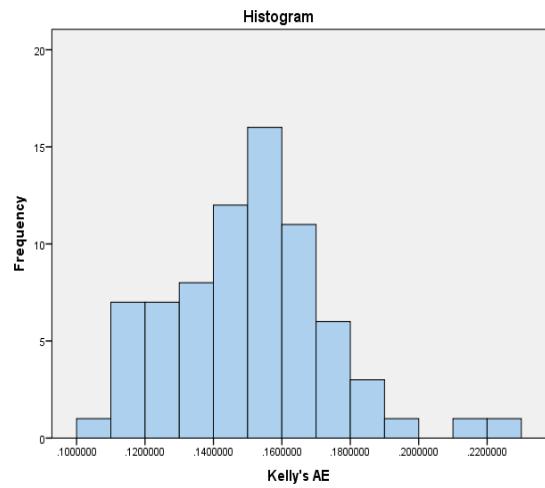


Figure 8-5 Sample of the Lorenz curve in Thai Language in the case of school A using the ungrouped data

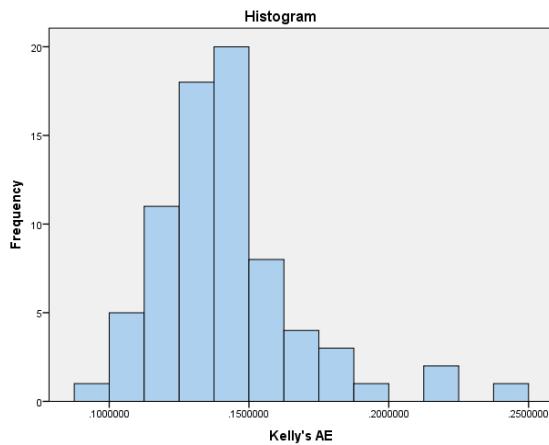
As shown above, a similar procedure was then used to calculate individually for each of the seventy-six schools. The findings of individual schools for Kelly's AE index in each school is shown in the accompanying materials.



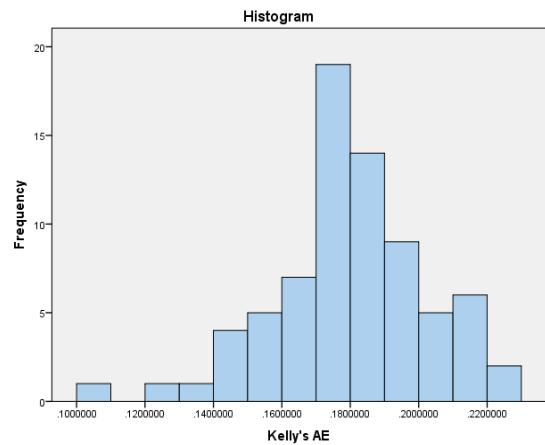
(i) Thai Language



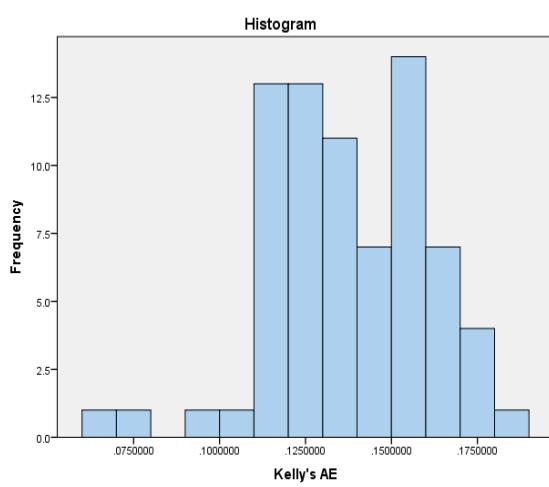
(ii) Social Studies, Culture and Religion



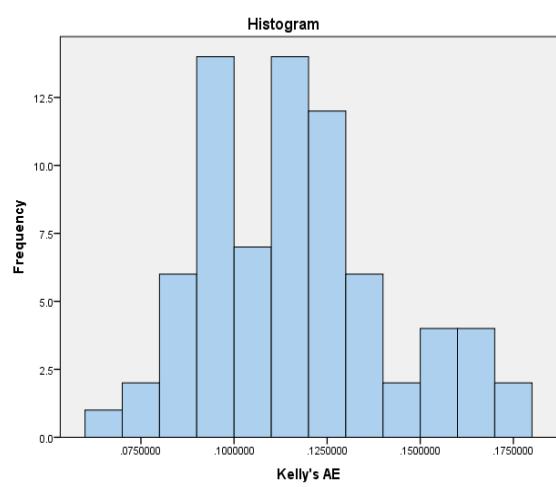
(iii) English Language



(iv) Mathematics

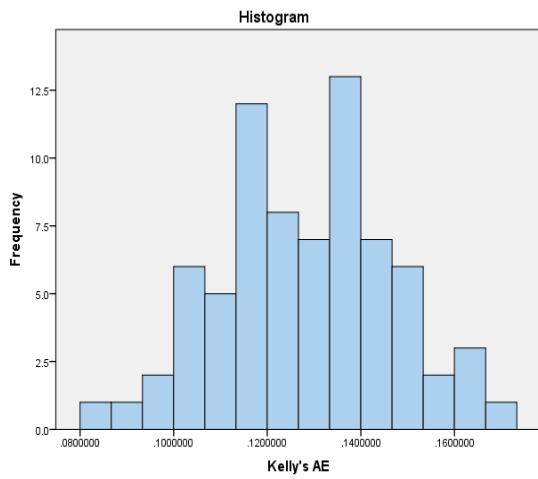


(v) Science

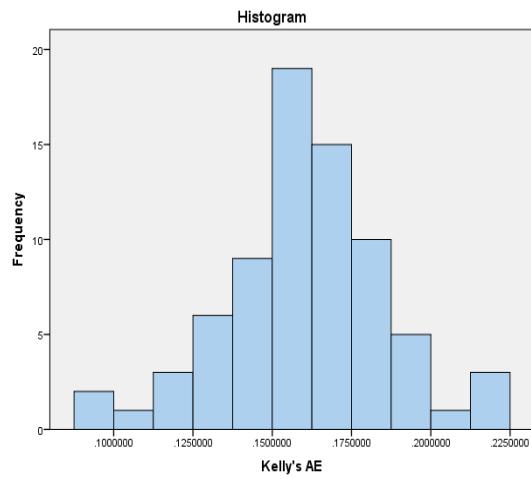


(vi) Health and Physical Education

Table 8-15 Distribution of Kelly's AE indices among schools in Prachin Buri



(vii) Arts



(viii) Occupation and Technology

**Table 8-15 Distribution of Kelly's AE indices among schools in Prachin Buri
(continued)**

❖ **Calculating Kelly's AE index at the provincial level**

A similar procedure of calculating Kelly's AE indices used for individual schools is also applied for the provincial AE indices across eight main subjects. The results are shown in Table 8-16 and Figure 8-6.

Subjects	Cumulative % of students											Kelly's AE index
	0	10	20	30	40	50	60	70	80	90	100	
Thai Language	0	0.0704	0.1512	0.2384	0.3312	0.4288	0.5309	0.6381	0.7503	0.8692	1.000	0.0994
Social Studies, Culture and Religion	0	0.0513	0.1195	0.1983	0.2862	0.3823	0.4858	0.5970	0.7172	0.8493	1.000	0.1651
English Language	0	0.0558	0.1267	0.2063	0.2927	0.3860	0.4849	0.5908	0.7048	0.8308	1.000	0.1678
Mathematics	0	0.0455	0.1100	0.1852	0.2710	0.3635	0.4639	0.5739	0.6940	0.8287	1.000	0.1961
Science	0	0.0559	0.1262	0.2053	0.2908	0.3831	0.4815	0.5886	0.7045	0.8362	1.000	0.1688
Health and Physical Education	0	0.0577	0.1361	0.2240	0.3189	0.4189	0.5235	0.6330	0.7474	0.8699	1.000	0.1161
Arts	0	0.0568	0.1315	0.2166	0.3085	0.4070	0.5111	0.6211	0.7373	0.8629	1.000	0.1317
Occupation and Technology	0	0.0483	0.1141	0.1925	0.2816	0.3797	0.4858	0.6000	0.7222	0.8550	1.000	0.1664

Table 8-16 Kelly's AE index (whole students) in eight subjects in Prachin Buri Province

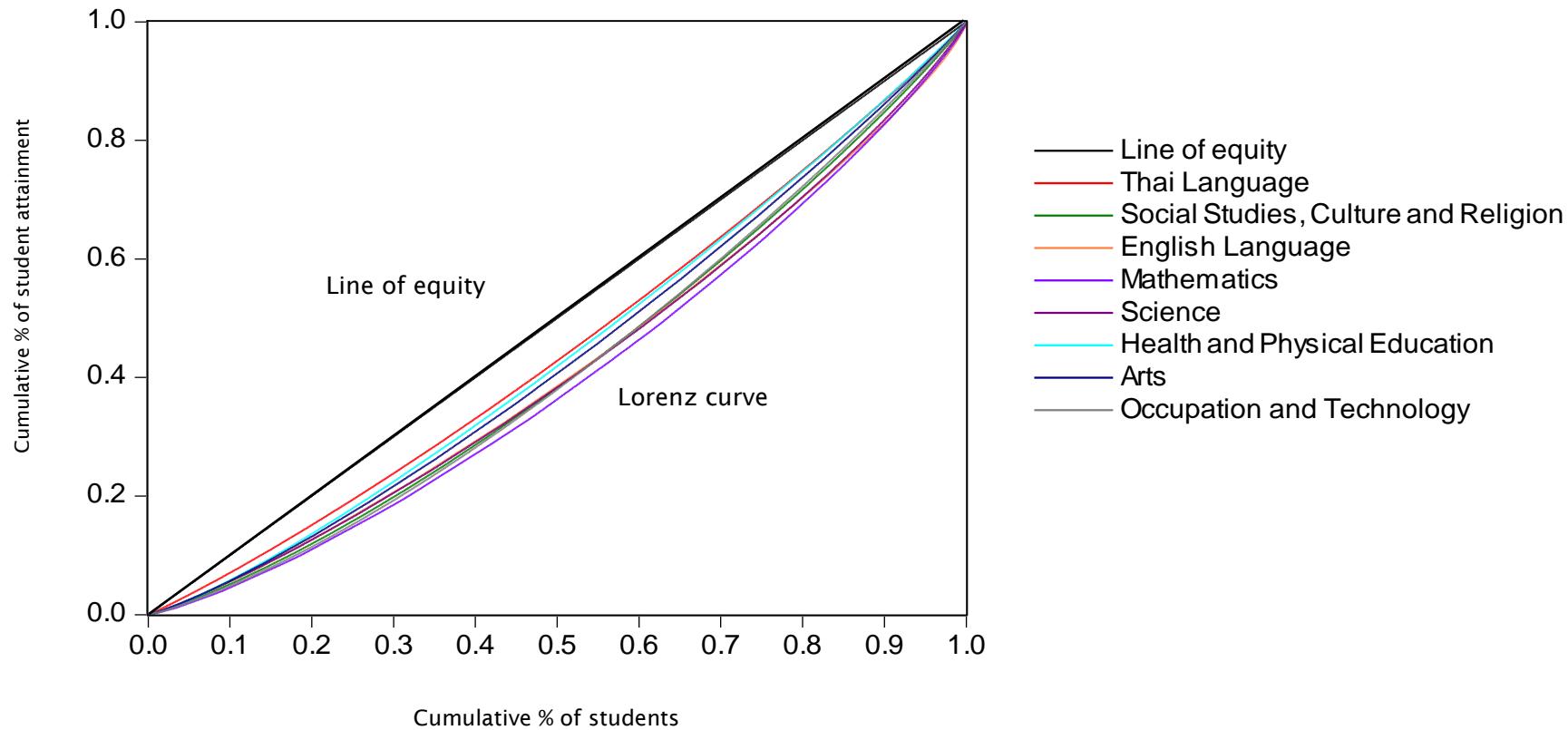


Figure 8-6 Kelly's AE index among whole students in eight subjects in Prachin Buri Province

❖ Calculating attainment equity using Theil's T index

Using the same data shown in calculating Kelly's AE index above, the individual school Theil's T can be calculated using the following equation:

$$T = \frac{1}{n} \sum_{i=1}^n \left[\left(\frac{V_i}{\mu} \right) \cdot \ln \left(\frac{V_i}{\mu} \right) \right]$$

where n is the number of Grade 9 (therefore $1/n$ identifies every student's share of the overall T), V_i is the value of student achievement or scores for student i , and μ is the mean of student achievement at the school level. Thus, V_i/μ implies the ratio of individual student to average.

According to the equation above, T , Table 8-17 presents the procedure to calculate Theil's T index at School A.

Student (<i>i</i>)	Score (<i>v_i</i>)
1	39.20
2	48.80
3	56.80
4	45.60
5	40.80
6	55.20
7	55.20
8	58.40
9	60.00
10	52.00
11	34.40
12	52.00
13	53.60
14	40.80
15	32.80
16	39.20
17	53.60
18	60.00
19	48.80
20	53.60
21	55.20
22	37.60
23	56.80
24	58.40
25	50.40
26	39.20
27	48.80
28	60.00
29	52.00
30	53.60
$\sum n_i = 30$	
$\mu = 49.7600$	

Score (<i>v_i</i>)	Frequency (<i>n_i</i>)	$r = v_i/\mu$	$\ln(r)$	$n_i(1/N)(r)(\ln(r))$	$Tsch$ (Σ)
32.80	1	0.65916	-0.41678	-0.00916	0.01344
34.40	1	0.69132	-0.36915	-0.00851	
37.60	1	0.75563	-0.28021	-0.00706	
39.20	3	0.78778	-0.23853	-0.01879	
40.80	2	0.81994	-0.19853	-0.01085	
45.60	1	0.91640	-0.08730	-0.00267	
48.80	3	0.98071	-0.01948	-0.00191	
50.40	1	1.01286	0.01278	0.00043	
52.00	3	1.04502	0.04403	0.00460	
53.60	4	1.07717	0.07434	0.01068	
55.20	3	1.10932	0.10375	0.01151	
56.80	2	1.14148	0.13232	0.01007	
58.40	2	1.17363	0.16010	0.01253	
60.00	3	1.20579	0.18713	0.02256	

Note: The upper limit for Theil's T in School A is $\ln(30)=3.4012$

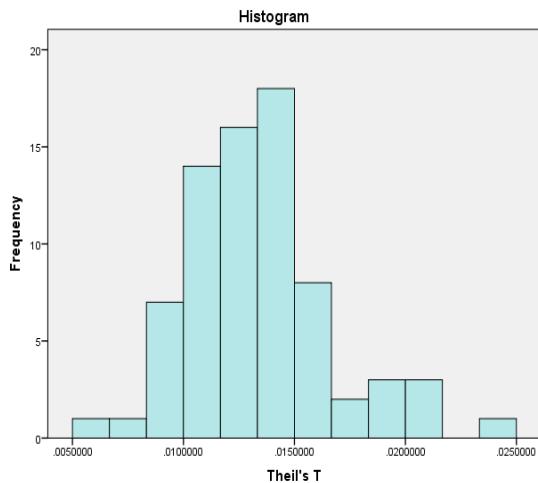
Table 8-17 The calculation of Theil's T index of 'School A' in Thai Language

The summary statistic of Theil's T indices (N=74) in each subject is shown in Table 8-18, and its distribution is illustrated in Figure 8-7.

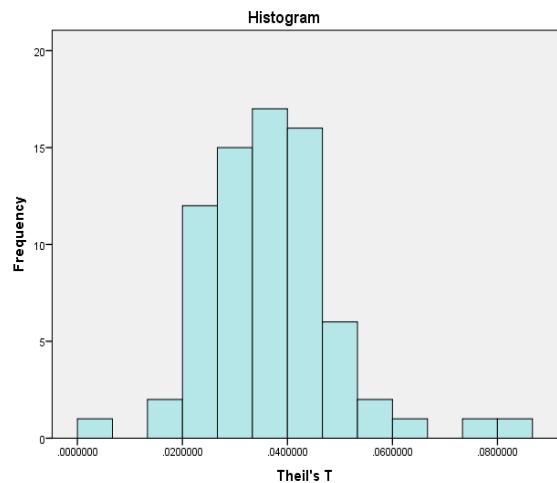
Subjects	Mean	SD	Minimum	Maximum	Skewness	Kurtosis
Thai Language	0.0134	0.0033	0.0065	0.0248	0.7945	1.3017
Social Studies, Culture and Religion	0.0367	0.0123	0.0064	0.0820	0.8958	2.5505
English Language	0.0336	0.0146	0.0005	0.0971	1.7963	5.3488
Mathematics	0.0539	0.0130	0.0186	0.0853	0.0222	0.3494
Science	0.0315	0.0098	0.0668	0.0566	0.0869	-0.0967
Health and Physical Education	0.0248	0.0110	0.0084	0.0530	0.8942	0.0844
Arts	0.0278	0.0074	0.2936	0.0470	0.2936	-0.3624
Occupation and Technology	0.4339	0.0133	0.0141	0.0814	0.5326	0.8342

Note: Schools with less than 20 students in Grade 9 were excluded in the analysis.

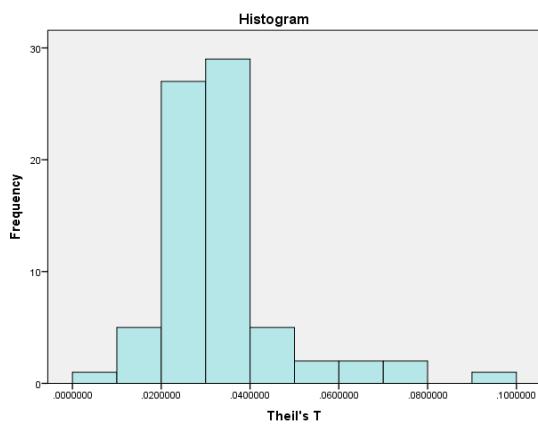
Table 8-18 Descriptive statistic of Theil's T indices among schools in Prachin Buri Province



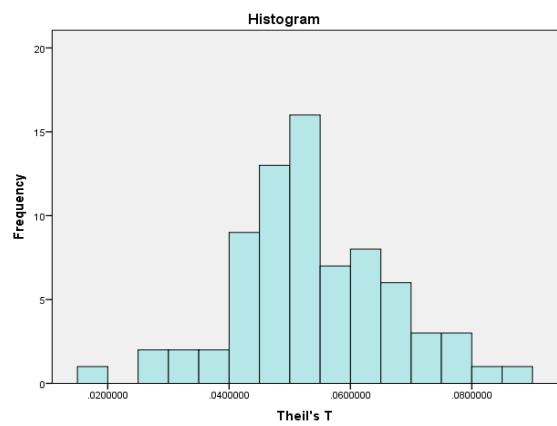
(ii) Thai Language



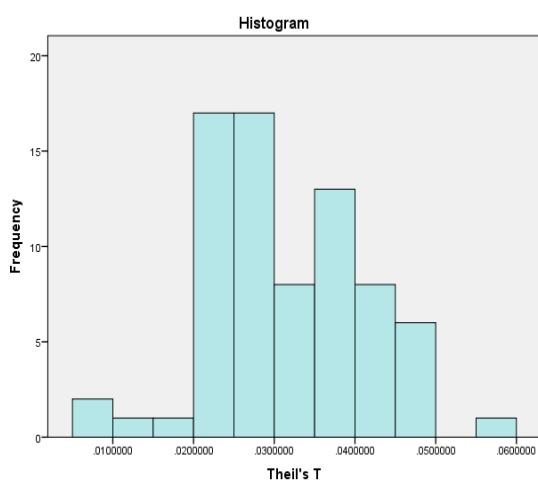
(ii) Social Studies, Culture and Religion



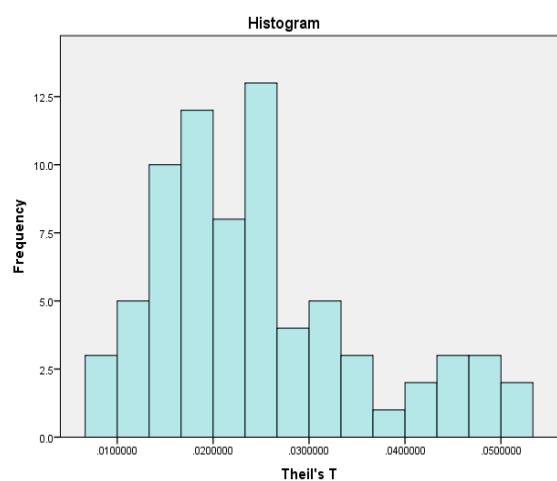
(iii) English Language



(iv) Mathematics



(v) Science



(vi) Health and Physical Education

Figure 8-7 Distribution of Theil's T indices among schools in Prachin Buri Province

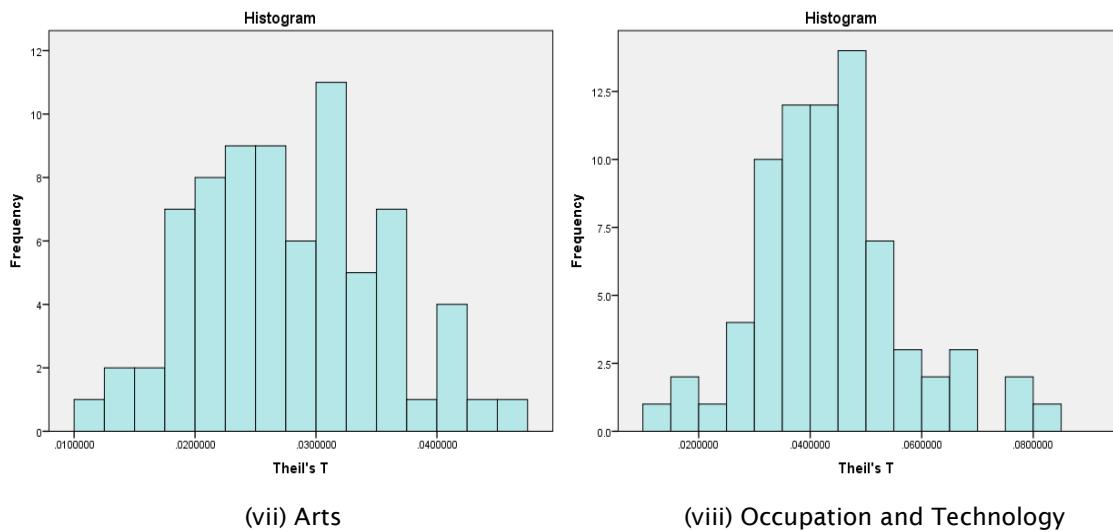


Figure 8-7 Distribution of Theil's T indices among schools in Prachin Buri Province
(continued)

8.2.2 Relationship between Kelly's AE index and Theil's T index

As discussed in Chapter 4, the general criteria to select the metrics are regarded as their desirable properties: lower and upper bound, scale invariance, transferability, and sensitivity. However, such metrics may vary from subject to subject according to the specific nature of the subject. Besides concerning the desirable properties of both Kelly's AE index and Theil's T index, this study is also concerned with their robustness. To test this, the Pearson Product Moment Correlation Coefficient was adopted to justify the relationship between these metrics.

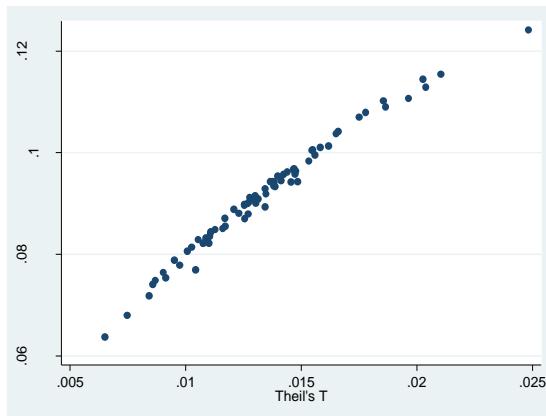
Table 8-19 and Figure 8-8 depict the relationship between Kelly's AE and Theil's T index among eight main subjects. It is evident from the Pearson Product Moment Correlation Coefficients and scatter plot diagrams that there were strongly positive relationships between Kelly's AE and Theil's T index among eight main subjects ($p < .01$). This affirms that Kelly's AE yielded similar findings as another metric, here, Theil T. Therefore, it can be concluded that Kelly's AE satisfies the robustness and is appropriate to use in a Thai educational context.

Subjects	Pearson correlation between Kelly's AE index and Theil's T index
Thai Language	0.990***
Social Studies, Culture and Religion	0.982***
English Language	0.984***
Mathematics	0.983***
Science	0.985***
Health and Physical Education	0.979***
Arts	0.982***
Occupation and Technology	0.972***

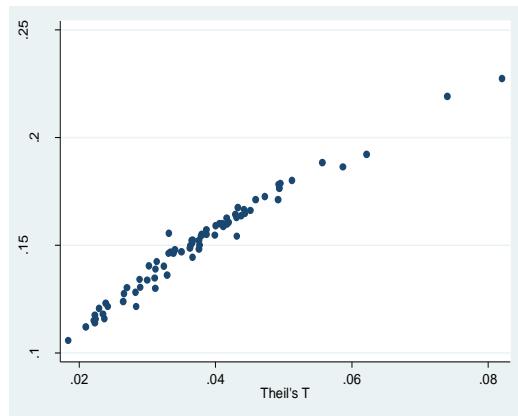
*** P < .01

Note: Schools with less than 20 students in Grade 9 were excluded in the analysis.

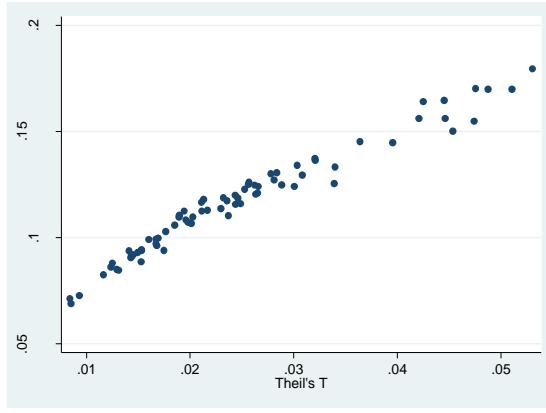
Table 8-19 Relationship between Kelly's AE index and Theil's T index in eight subjects



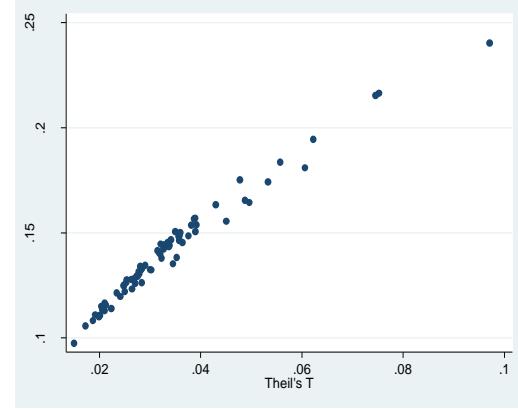
a. Thai Language



b. Social Studies, Culture and Religion



c. Mathematics



d. English Language

Figure 8-8 Scatter plot diagrams presenting the relationship between Kelly's AE index and Theil's T index

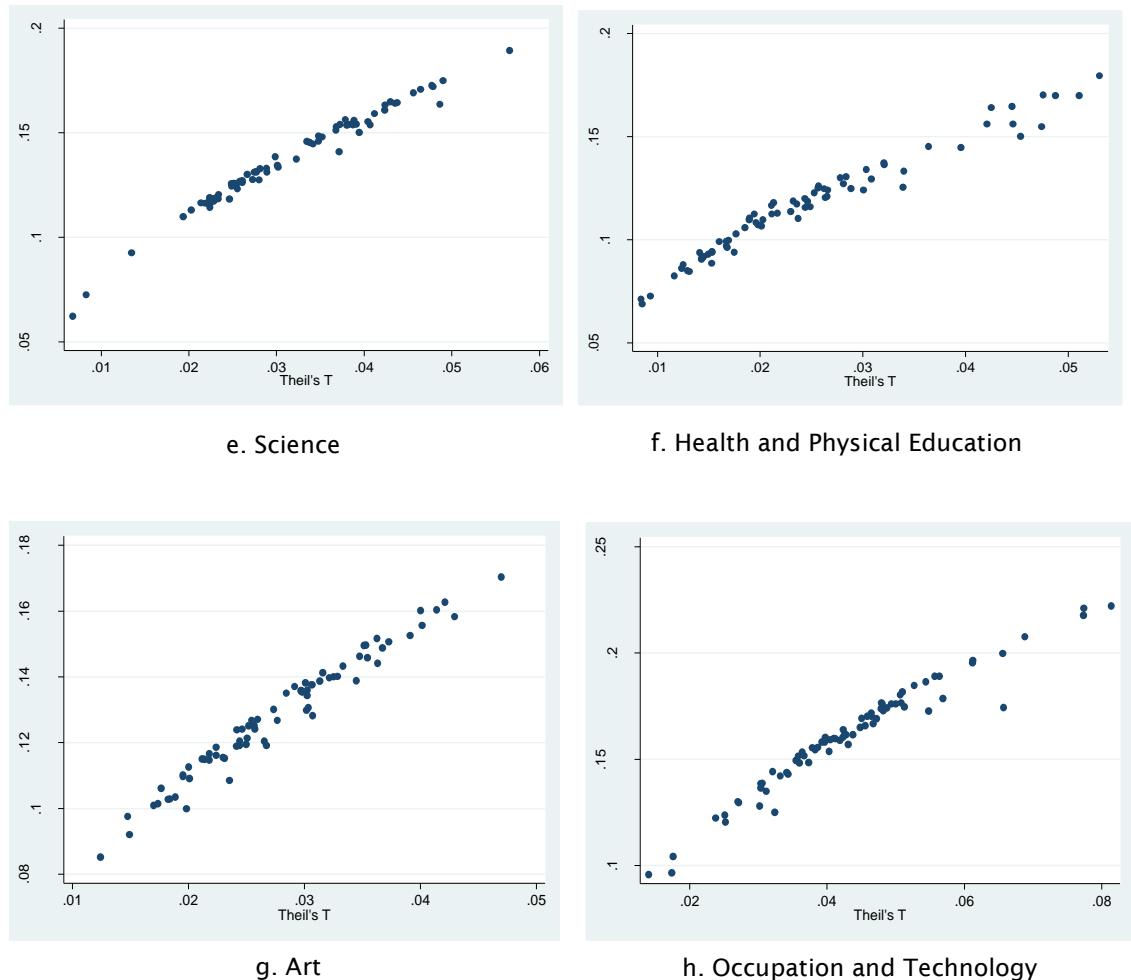


Figure 8-8 Scatter plot diagrams presenting the relationship between Kelly's AE index and Theil's T index (*Continued*)

8.2.3 Factors affecting attainment equity: Multiple regression models

In this section, we investigate school contextual effects on attainment equity at school level among eight main subjects using a multiple regression analysis. The independent variables used in the study consisted of average prior attainment, average SES, percentage of girls, school difficulties in each subject, school type, and school size, and the dependent variable was Kelly's AE index. However, to establish the parsimonious model, non-statistically significant independent variables at .05 level ($p > .05$) were removed. The findings were the following:

- Average prior attainment does not significantly affect Kelly's AE index in *all* subjects ($p>.05$).
- Average SES has a negative relationship with Kelly's AE index in THA, SOC, ENG, HEA, ART and OCC ($p<.05$). This means that the higher the average SES among students in the school, the higher the equity in terms of attainment.
- Percentage of girls has a negative effect on Kelly's AE index in HEA, ART and OCC ($p<.05$), but not in THA, SOC, ENG, MAT and SCI ($p>.05$). This implies that the higher the percentage of girls within the school, the higher equity in terms of attainment exists in HEA, ART and OCC.
- School type has *no* significant effect on Kelly's AE index in all subjects ($p>.05$).
- School difficulties (in its own subject) have *no* significant effect on Kelly's AE index in all subjects ($p>.05$).
- School type positively affects Kelly's AE index in ENG, MAT, and SCI ($p<.05$). This means that the large-sized/extra-large-sized schools have lower attainment equity than medium and small sized schools, respectively, in SCI. For ENG and MAT, the large-sized/extra-large-sized schools have lower attainment equity than medium-sized schools, but there is *no* significant difference between medium- and small-sized schools.

Variables	Subjects							
	Thai Language	Social Studies, Culture and Religion	English Language	Mathematics	Science	Health and Physical Education	Arts	Occupation and Technology
Constant	9.238 (0.147)	15.229 (0.299)	14.001 (0.632)	17.231 (0.744)	12.236 (0.542)	15.948 (1.782)	15.927 (1.010)	19.684 (1.493)
Average prior attainment	NS	NS	NS	NS	NS	NS	NS	NS
Average SES	-0.768 (0.223)	-1.707 (0.518)	-2.402 (1.024)	NS	NS	-2.685 (0.547)	-1.704 (0.450)	-3.492 (0.688)
Percentage of girls	NS	NS	NS	NS	NS	-0.097 (0.034)	-0.070 (0.019)	-0.087 (0.029)
School difficulties in its subject	NS	NS	NS	NS	NS	NS	NS	NS
School type (Ref=public)	NS	NS	NS	NS	NS	NS	NS	NS
School size (Ref=small)								
▪ Medium	NS	NS	0.259 ^{NS} (0.588)	0.704 ^{NS} (0.820)	1.222 (0.611)	NS	NS	NS
▪ Large and extra large	NS	NS	1.732 (0.815)	1.559 (0.822)	3.443 (0.769)	NS	NS	NS
R-square	0.049	0.057	0.282	0.051	0.264	0.268	0.234	0.328

Note: Kelly's AE index is multiplied with 100. () = Standard error

Figure 8-9 Factors explaining Kelly's AE indices among schools in Prachin Buri Province

8.2.4 Combining school CVA with Kelly's AE index in each subject at each school

As proposed by Kelly (2012), this is useful to identify whether schools provide added value to students across a range of students in terms of student attainment. To achieve this, after obtaining the school CVA scores and Kelly's AE indices in each subject and in each school, the next step was to combine these two power measures which justify quality and equity of education. According to Kelly's concepts (2012) of identifying the effectiveness of school in particular subjects, schools can be classified into four types across eight main subjects:

Type I: Schools that showed a high level of equitability in the subject

Type II: Schools that were differentially effective in the subject

Type III: Schools that showed a low level of equitability in the subject

Type IV: Schools that were consistently ineffective in the subject

This is shown in Figure 8-10 through Figure 8-17 and the accompanying material also shows the school types in each subject in each school.

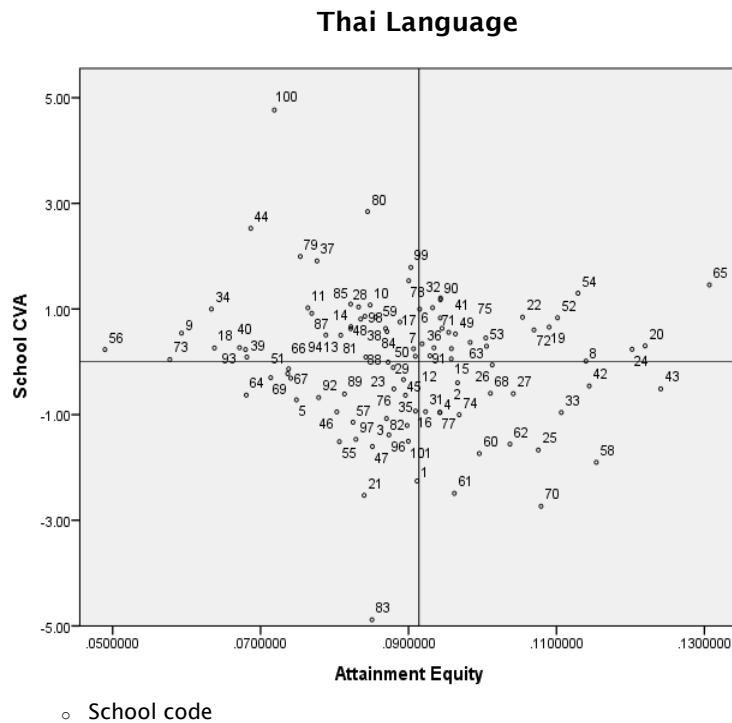


Figure 8-10 Combining the school CVA with Kelly's AE index in Thai Language

Social Studies, Culture and Religion

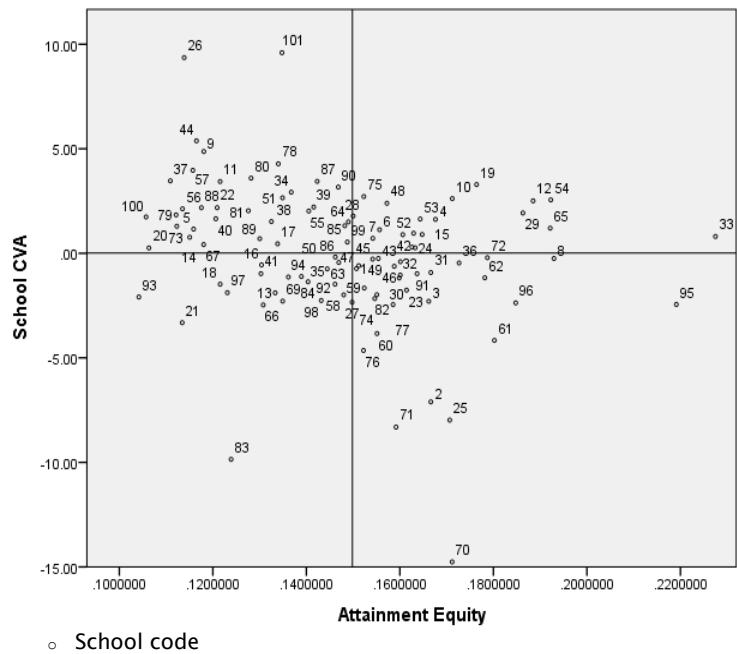


Figure 8-11 Combining the school CVA with Kelly's AE index in Social Studies, Culture and Religion

English Language

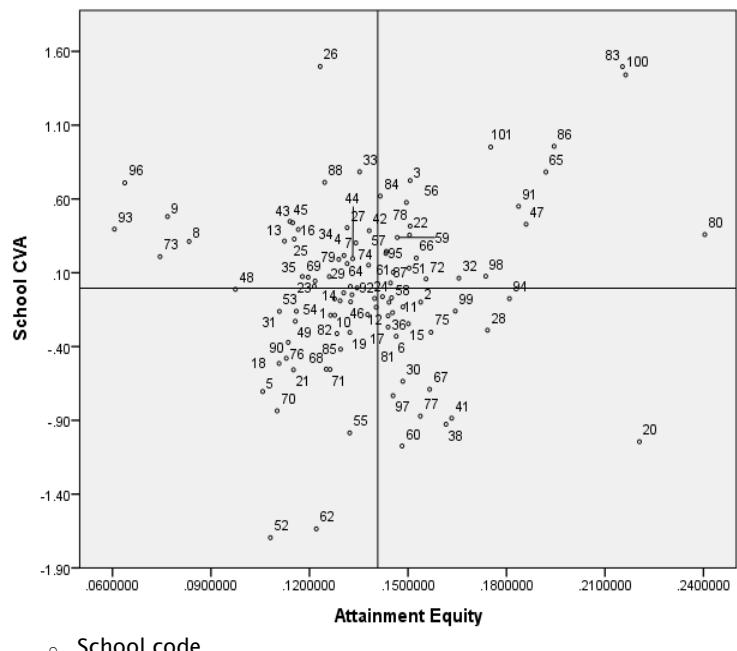


Figure 8-12 Combining the school CVA with Kelly's AE index in English Language

Mathematics

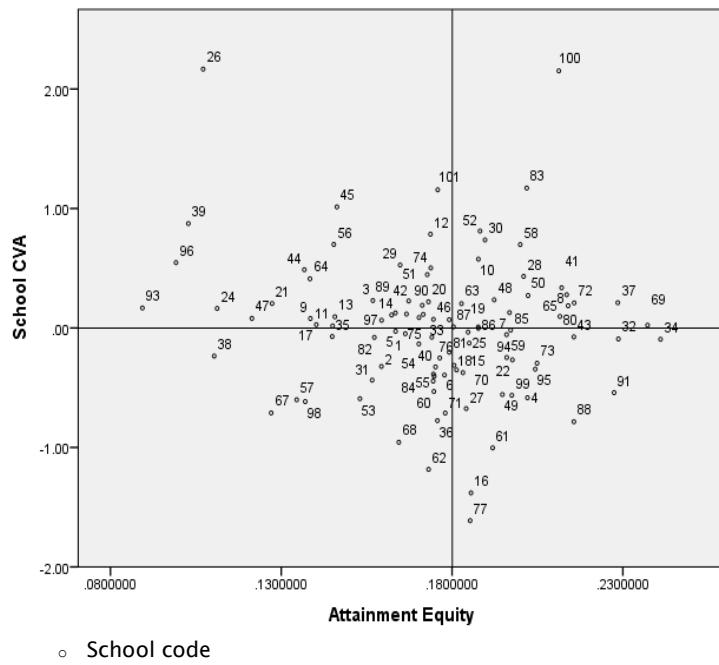


Figure 8-13 Combining the school CVA with Kelly's AE index in Mathematics

Science

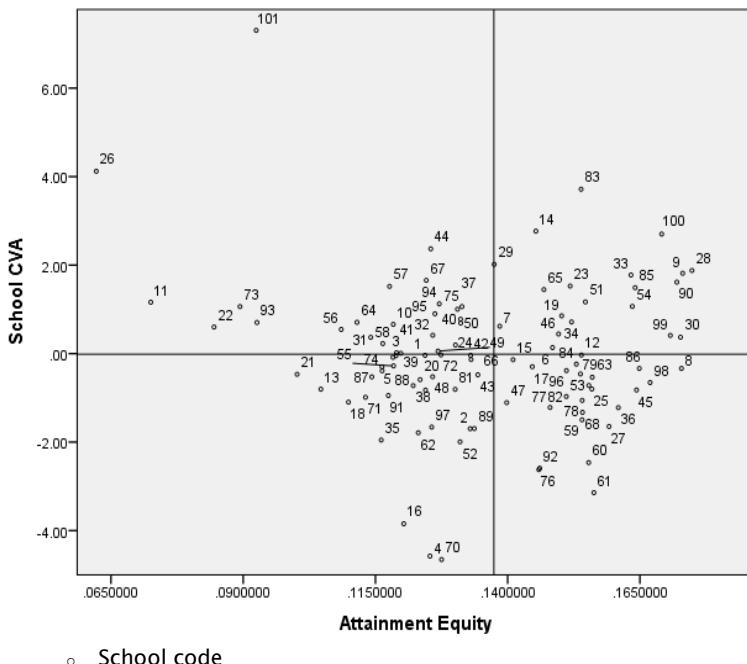


Figure 8-14 Combining the school CVA with Kelly's AE index in Science

Health and Physical Education

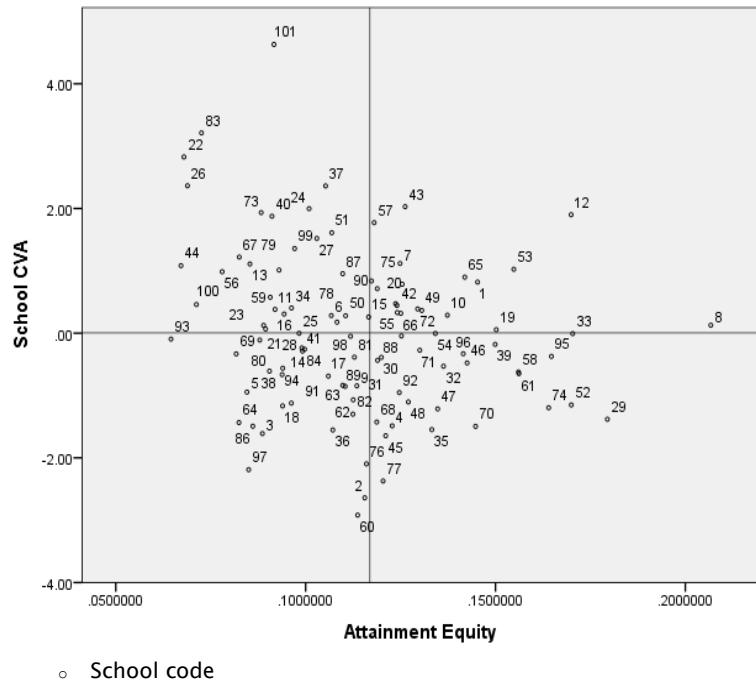


Figure 8-15 Combining the school CVA with Kelly's AE index in Health and Physical Education

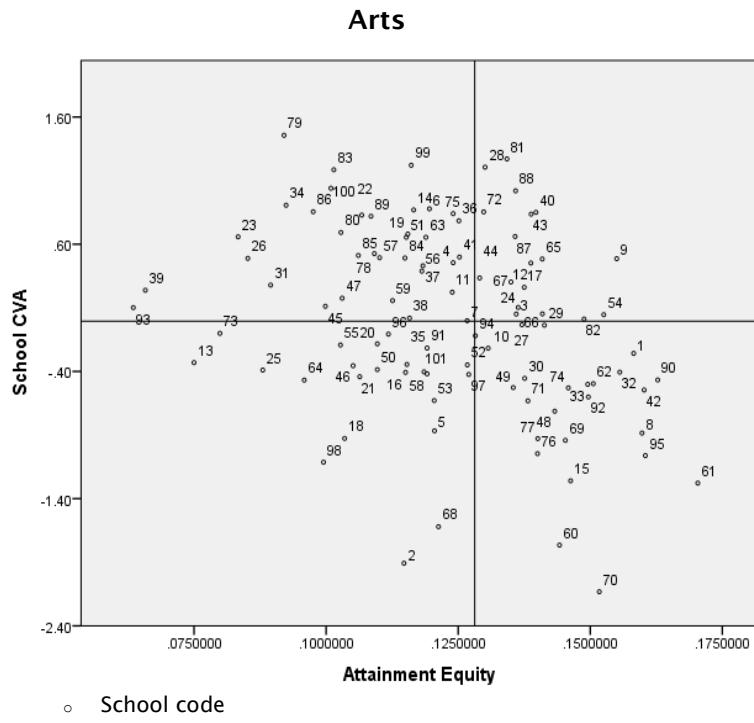


Figure 8-16 Combining the school CVA with Kelly's AE index in Arts

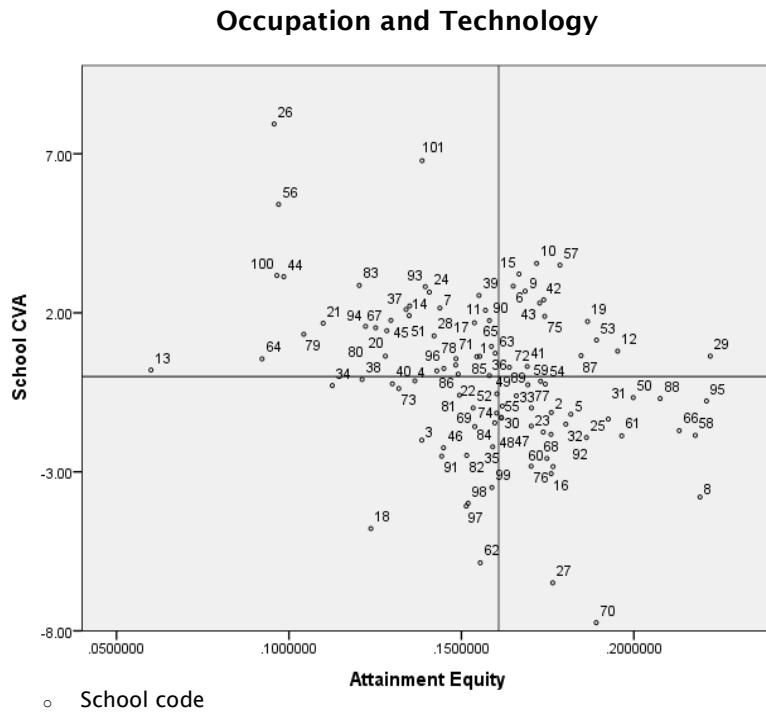


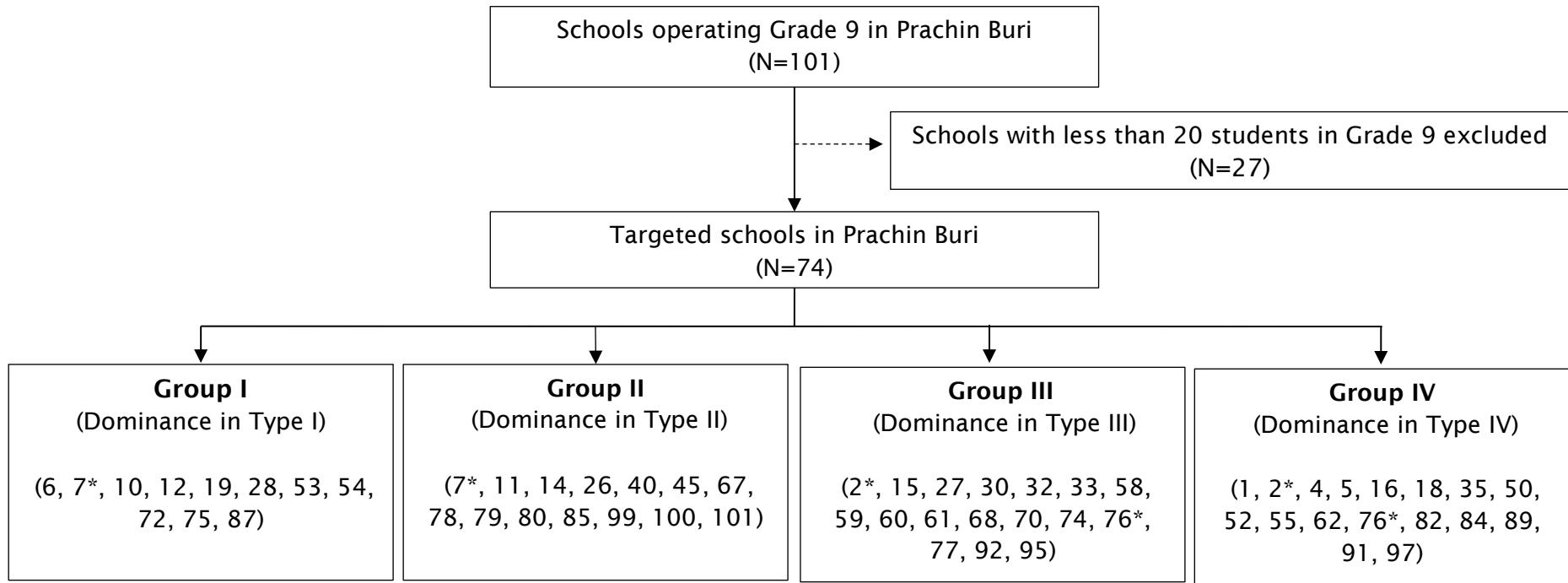
Figure 8-17 Combining the school CVA with Kelly's AE index in Occupation and Technology

8.2.5 Classifying schools based on similar patterns of the school CVA with Kelly's AE index across eight main subjects within schools

In the next step, we aimed to justify the overall characteristics of school based on equity-school contextual value added measures (AE-CVA measure) as proposed by Kelly (2012). The outcomes from the previous section were used to compare the similarities of school type at subject level within the school. For this reason, this referred to the distinguished characteristics of schools across eight main subjects. Based on this idea, schools were classified into four main types:

- Type I:** Schools that showed a high level of equitability across subjects
- Type II:** Schools that were differentially effective across subjects
- Type III:** Schools that showed a low level of equitability across subjects
- Type IV:** Schools that were consistently ineffective across subjects

Figure 8-18 presents the finding of school classification according to the similarities of the patterns of school quality and equity according to eight main subjects.



() = school codes * dominance more than one types

Figure 8-18 Findings of the cases classification according to similarities in terms of school types among eight subjects

8.3 Chapter summary

This quantitative study comprised three main parts.

Part I describes the variation in student attainment at different levels – student, classroom and school level – and school factors that influence student attainment in Thailand context. The results of the study based on the null/naive models in eight subjects shows that the highest variation in student attainment lies at student level, followed in turn by classroom and school level, respectively. Overall, the multilevel analysis indicated that after controlling with student characteristics and classroom and school contextual factors, school effectiveness factors significantly affecting student attainment include school policy and practice on quality of teaching, provision of sufficient learning environment and value of favour in learning. All three such effectiveness factors are powerful in combination with the five dimensions of effectiveness, including frequency, stage, focus, quality and differentiation.

Part II involves the level of attainment equity at school level across eight main subjects and factors affecting the attainment equity. The results of the study showed that overall the factors affecting the attainment equity in the school included average SES, percentage of girls and school size. However, *no* consistency in these three factors was found across eight subjects.

Part III presents the school classification by using the quality and equity, measured by the school CVA and Kelly's AE index, respectively, across eight subjects. The schools are classified into four main types based on the similarities of the attainment equity-school CVA (AE-CVA) patterns across eight main subjects.

Factors	Thai Language	Social Studies, Culture and Religion	English Language	Mathematics	Science	Health and Physical Education	Arts	Occupation and Technology
Student level:								
Prior attainment	+	+	+	+	+	+	+	+
Sex (Ref=boy)	+	+	NS	NS	NS	+	+	+
Age	-*	NS	NS	NS	NS	-	NS	-
SES	+	+	NS	NS	NS	+	NS	+
Study motivation	+	+	NS	+	+	+	NS	+
Parent interaction	+	+	+	+	+	+	+	+
Time spent on reviewing lessons	NS	NS	+	NS	+	NS	NS	NS
Attending tutorials	NS	NS	+	+	+	NS	NS	NS
Classroom level:								
Average prior attainment	+	+	+	+	+	+	+	+
Dispersion of prior attainment	-	-	-	-	NS	NS	NS	-*
Average SES	NS	+	+	NS	NS	NS	NS	NS
Percentage of girls	+	+	NS	+	+	+	+	+
Class size	NS	NS	NS	NS	NS	NS	NS	NS
School level:								
School size (Ref=small)	NS	NS	NS	NS	NS	NS	NS	NS
Type of school (Ref=public)	NS	NS	NS	NS	NS	NS	NS	NS
School SES	NS	NS	NS	+	NS	NS	NS	NS
School educational difficulties	-*	-	NS	-	-	NS	-*	-*

+ positive relationship - negative relationship NS=Not statistically significant (p-value>.05)

Table 8-20 Summary findings of factors affecting student attainment in eight subjects

FR=Frequency; FO=Focus; ST=Stage; QU=Quality; DI=Differentiation + =Positive relationship NS=Not statistically significant (p-value>.05)

+ positive relationship - negative relationship NS=Not statistically significant (p-value>.05)

Table 8-20 Summary findings of factors affecting student attainment in eight subjects

Factors	Thai Language	Social Studies, Culture and Religion	English Language	Mathematics	Science	Health and Physical Education	Arts	Occupation and Technology
School level:								
Average prior attainment	NS	NS	NS	NS	NS	NS	NS	NS
Average SES	-	-	NS	NS	-	-	-	-
Percentage of girls	NS	NS	NS	NS	NS	-	-	-
School difficulties in its subject	NS	NS	NS	NS	NS	NS	NS	NS
School type (ref=small)	NS	NS	NS	NS	NS	NS	NS	NS
School size	NS	NS	+	+	+	NS	NS	NS

+ positive relationship - negative relationship NS=Not statistically significant (p-value>.05)

Table 8-21 Summary findings of school factors affecting attainment equity (Kelly's AE index)

9. Chapter 9: Findings from qualitative research: Case study research

In the previous chapter, this thesis described the quantitative study of the factors affecting school effectiveness with respect to quality and attainment equity. Accordingly, the findings of combinations between school CVA and attainment equity across eight subjects, based on the Thai national curriculum, classified the schools into four main school types. In attempting to explain why Thai schools had such different performance in outcomes, research from multiple case studies has been adopted. Data obtained in this chapter has mainly been derived from interviewing one headteacher and eight teachers of eight main academic strands in each school. To answer research question number three, this chapter begins with a discussion of the case selection, along with the cases and findings from interviews. In the final section of this chapter, a cross-case analysis is performed, presenting a comparison among the cases.

9.1 Case selection

Aiming to contribute to both practical considerations and theoretical development in school/educational effectiveness, this study seeks to investigate different types of schools by selecting schools that provide the specifically distinguished characteristics across eight main subjects, in each school type. This research framework is in accordance with school typology and has sought to focus on education in Thailand. The varying sampling techniques utilized in this research have enabled the researcher to gain a deeper understanding of the content at hand.

As shown in the accompanying material attached, school A (#72), school B (#11), school C (#61), and school D (#18) were identified as school type I, II, III and IV respectively (see Figure 9-1 and Table 9-1).

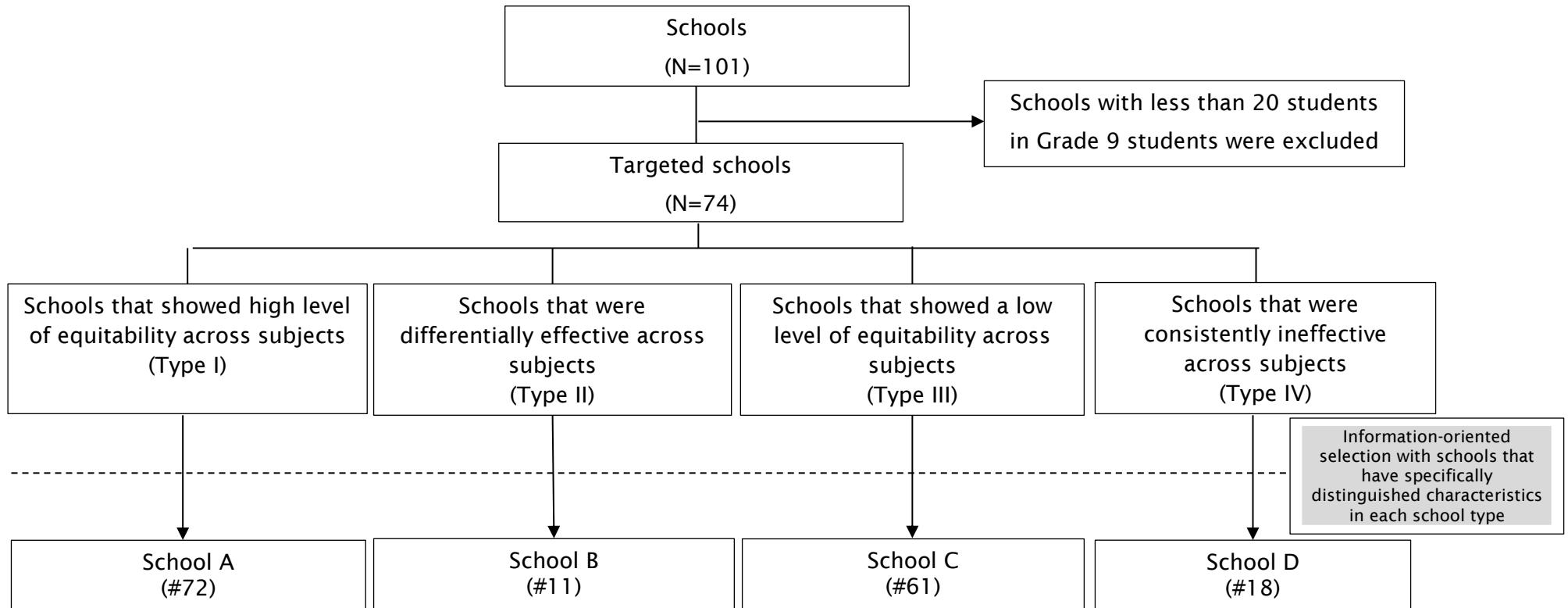


Figure 9-1 Schools selected in case studies research

Case	Subject types based on Kelly's AE classification criteria							
	Thai Language	Social Studies, Culture and Religion	English Language	Mathematics	Science	Health and Physical Education	Arts	Occupation and Technology
School A (#72)	Type I	Type III	Type I	Type I	Type IV	Type I	Type I	Type I
School B (#11)	Type II	Type II	Type III	Type II	Type II	Type II	Type II	Type II
School C (#61)	Type III	Type III	Type I	Type III	Type III	Type III	Type III	Type III
School D (#18)	Type II	Type IV	Type IV	Type III	Type IV	Type IV	Type IV	Type IV

Table 9-1 Characteristics of schools selected as cases in the study

9.2 Findings of multiple case study

Research Question III: Do schools perform differently in terms of quality and equity across subjects? How and why do schools perform in this manner?

This section aims to investigate why Thai schools perform differently in terms of quality and equity. To answer the research question of Phase II, the process of developing themes and sub-themes were developed within the case study analysis. According to the process of data analysis presented in Chapter 6, Figure 9-2 presents three main themes:

 **Theme 1: School policy on quality of teaching**

- Sub-theme 1.1: Rigorous teaching/instruction aligned to the Thai national curriculum
- Sub-theme 1.2: Teaching for the national testing (O-NET)

 **Theme 2: School policy on providing school learning environment**

 **Theme 3: Ensuring every student can succeed**

- Sub-theme 3.1: Dealing with different students' backgrounds at intake (Grade 7)
- Sub-theme 3.2: Providing instruction/teaching opportunities in accordance with student needs and/or capacities

In the next section of this chapter, themes and sub-themes in each case are presented.

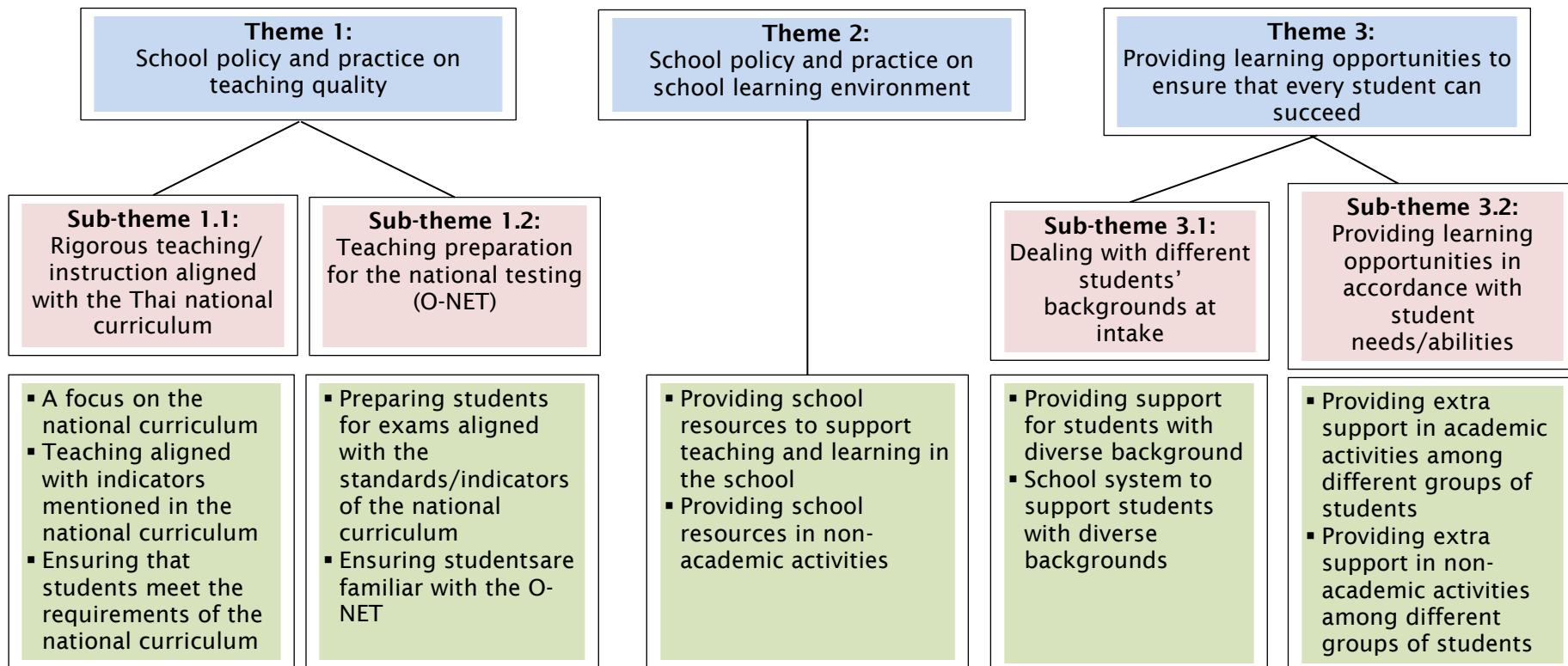


Figure 9-2 Samples of themes and sub-themes emerged from coding

9.2.1 Case I: School that showed high level of equitability across subjects [School A]

The 'School A' case demonstrates an educational environment wherein exists a high level of equitability across subjects. It is a small public school located in a rural area approximately 30 to 100 kilometres from the district and from the centre of the province. The students are from kindergarten to Grade 9, and School A is identified as a community area surrounded by an agricultural area with some industries. The majority of the students come from the local community and nearby village and are in low- to middle-class families.

The following are three themes which have emerged from thematic analysis via the headteacher and teacher interviews:

- ❖ **Theme 1: School policy and practices on quality of teaching**
 - **Sub-theme 1.1: Rigorous teaching/instruction aligned to the Thai national curriculum**

Commitment to the teaching and learning of the Thai national core curriculum has been a critical priority in this school. The interview with the headteacher demonstrated that school policy and teaching practices have relied strictly upon the criteria and requirements provided by the Basic Education Core Curriculum across all academic levels. To ensure that students are equipped with the desirable qualifications and knowledge required by the Ministry of Education, the school's policy expects that students master the national standards, indicators, and benchmarks, as demonstrated in the Basic Core Educational Curriculum.

In this school, I strictly ask my teachers in each academic strand and in each level to study and understand well the national curriculum and learning areas. They must teach aligned to the national curriculum, the learning standards, benchmarks and indicators proposed by the Ministry. Tests, assessments and related things must be consistent with the standards and indicators shown in the national curriculum in each level and each academic strand. [Headteacher]

Several teachers further confirmed the headteacher's sentiments by stating the following:

In our school, the headteacher has teaching and learning policies and practices according to the guidelines from the basic education core curriculum of the Ministry. [Physical and Health Education teacher]

...They [the students] have nothing much from primary levels. When they begin in Grade 7, we also start adding knowledge and skills to [their curriculum] according to indicators and learning standards. In Grade 8, they continuously achieve. Up until Grade 9 however, they should achieve according to the learner's key competencies. [Social Studies, Culture and Religion teacher]

Apart from producing qualified students as required by the Ministry of Education, the teaching and learning development under the Basic Education Core Curriculum contributes to student development in each grade via a step-by-step process. Furthermore, it equips students with a body of knowledge that is both sufficient and suitable for their learning requirements and applies to their national examinations. As a result, the outcome of students' performance meet the requirements and desirable characteristics required by the Ministry of Education. At the same time, moreover, teachers do not need to work very hard in the final stage in order to raise the school's O-NET since they have prepared students well in accordance to the Ministry's requirements. At the very least, students are prepared throughout the year and do not face high bouts of pressure before their national exams.

Practically, the headteacher has established school practices where the teachers are responsible for the analysis of their respective curriculum structure based on the weight of the essential learning standard. In addition, the school has control over the students' quality of learning for each grade level to acquire the knowledge and understanding in accordance with the national indicators and standards, through both formal and informal assessments, to ensure that learners have met the quality and qualification corresponding to the key indicators and standards provided by the Ministry of Education.

...teachers in each academic strand need to analyse and to comprehend the national curriculum in the subject they have taught. Moreover, lesson plans, teaching time in the class, assessment etc. need to be consistent with their weights in each academic strand in the subjects. [Headteacher]

There is a school meeting before the semester starts. Teachers in each subject [are instructed] to brainstorm designs [pertaining to] the lesson of each week, to design [instruction plans that are both innovative and instructional], and to design assessment methods. Teachers use many assessments: such as diagnostic tests, previous exam papers, and informal conversations. Sometimes the headteacher comes to assess the students informally. For example, during the afternoon break, he chatted to students and asked simple questions to students about what they have learnt in the class. [Science teacher]

❖ **Sub-theme 1.2: Teaching preparation for the national testing (O-NET)**

The overall emphasis on academic success has resulted in school strategies in teaching preparation for national testing. To raise the school's O-NET scores, School A operates a policy and practice by beginning with teachers who possess an intensive understanding of the O-NET. The individual subject each teacher has been assigned to examine corresponds to the characteristics and trends of the exams along with the focal point of each exam, with respect to each academic strand's standards and indicators.

It is the responsibility [of] teachers to teach lessons and understand learning standards in the subjects they are teaching. They have to know which standards should be highly focused and which standards are always [present] in the exams. They have to analyse tests in each standard and then apply this to teach their students. [Headteacher]

In addition, the headteacher provides the teachers with an analysis of exam results for the students of the previous years to determine which indicators and standards students have achieved and, furthermore, in what areas students have underperformed with respect to indicators and standards. Such information effectively reflects individual teaching quality and can be useful for teaching and preparing students for O-NET exams.

Every teacher analyses which academic standards the students perform not well from the internal testing done by each teacher. Then the teacher will analyse which standards the students still perform not well. In addition, the school uses the educational district to retest our students and we will analyse what the student has done. In addition, after the students take the national exams, the school will utilise such data to examine which academic standards

improve. Such data is [for each] teaching plan in the next academic year.
[Headteacher]

Once the teachers become accustomed to the O-NET characteristics and understand the strengths and weaknesses of each student, the teachers then apply the results to their teaching preparation to equip students with O-NET testing so that they may become familiar with the nature of the test and practice exercises and exam test from prior years.

To raise the average scores in each academic strand, I asked my teachers to provide an opportunity to make every student familiar with the O-NET exam styles and practice to analyse such questions as much as possible.

[Headteacher]

With regard to the school's quality at different level, the headteacher explained, the school requires that all teachers at all levels contribute to enhance academic achievement quality. This further pertains to maintaining core policies and practices regarding mobilization from teachers and school staff at both primary and secondary levels to help in tutoring students for the O-NET.

When the national exam period is coming, every teacher in both the primary and secondary level will match each other to teach students for the O-NET exams. For example, the teacher who teaches English at the primary level matches the teachers who teach English at the secondary level. The teachers who teach Maths at the primary level match the teacher who teaches Maths at the secondary level. They can help each other as a team to prepare students for the O-NET. Primary teachers will help secondary teachers to tutor in Grade 9 O-NET. At the same time, secondary teachers will help primary teachers to tutor in Grade 6 O-NET. [English Teacher]

Furthermore, preparation by students with national testing is not simply executed when approaching a time of the examination. Rather, students of any and all academic levels are prepared so that they may become familiar with the O-NET test. This includes having the opportunity to practice and learn continuously to ensure readiness for national testing.

There are many tutorials and tests to allow our students to practice throughout the year. We have tutorial classes for not only Grade 9 students, but also at every level. They would get used to the O-NET exam style and items. [Mathematics teacher]

In addition, the school seeks external experts as sources of assistance in tutoring the O-NET test to supplement the strengths and weaknesses of students and their respective readiness for the exam. Experts are invited to help foster an academic atmosphere that yields excitement for students and school personnel.

In each academic year, we provide a budget to hire external teachers to tutor our students in some subjects, such as maths and English. I think it makes not only our students excited and curious to learn new things, but also our teachers learn new ideas and techniques to teach students [...] I feel that if we have qualified or experienced external guests or experts who know how to deliver to come to teach in the school sometime, then both teachers and students will perform well, and it will be beneficial for both my staff and students. [Headteacher]

- ❖ **Theme 2: School policy and practices on provision of school learning environment**

The learning resource mobilization is another significant aspect leading to a productive school. School A's highlights include its effort to supply the school with the appropriate learning resources in two major areas. The first includes educational investment in academic activities, and the second includes establishing an attractive learning atmosphere in both academic and non-academic learning environments.

Regarding educational investment in academic activities, the school policy and practices cover budgeting, which is typically appropriated by the school and the government for purposes related to academic activities held by the school. These activities furthermore ought to have a direct contribution to students, thereby leading to a suitable learning environment and academic experience in addition to traditional classroom learning.

The school highly focused on academic work, [whereby] a minimum of 70% of the school budget funded by the government has been invested in academic work and school activities in order to enhance the school's learning environment for students. [This] recent year includes English, science, math, and Asian camp, Sports Day, etc. In addition, math doctoral students are employed from the university to tutor our students. [Mathematics teacher]

Given a limited school budget, however, a certain amount is allocated to purchase educational materials and various technological equipment to heighten teaching quality in classrooms.

In the fiscal and academic year, with a restricted budget, the school attempts to allocate a budget to optimize teaching quality. [...] It is spent on personal computer purchases, along with internet and hi-tech educational materials for purposes of teaching and non-traditional teaching [...] Sometimes I convert the teaching environment by using Koo Too [The Educational TV programs launched by the King Rama IX's project], Youtube. It makes my students more excited than the traditional classroom materials of blackboard or paper. They are satisfied by the virtual experience, especially in science. [Science teacher]

Once I had introduced the personal computer and internet, I found it so helpful with encouraging students' learning. Based on our experiences, some Grade 7 students who are weak in reading and writing skills are found to have improved reading and writing skills following the adoption of social media: Facebook and Google. More naturally, they are motivated to practice reading and writing. [Thai language teacher]

During the semester, the school carries out activities to create a conducive atmosphere for the students' academic learning which brings forth an effective interaction among students as well as between classes. For example, the 'Big Brother Teaches the Younger' is an activity that engages the secondary students to assist primary students who are weak in reading and writing. This further includes interactive learning activities amongst students in the same class or the same group. For example, the 'Friends Help Friends' discusses leading to learning and sharing academic cooperation amongst students.

The school provides a learning clinic, the 'Friends Help Friends' project, and "Friends Helps Friend" project during the afternoon break. It works effectively as they communicate in the same language. The classroom teacher functions by encouraging underperformed students to participate in Thai language projects. [Arts teacher]

Regarding non-academic activities, the school encourages and promotes vocational learning that benefits students and helps develop their corresponding careers in the community after they have completed their studies. At the very least, the school encourages students to their fullest potential and attempts to effectively ease them into society.

[...] Not all students are capable of continuing to study at a higher level and some are not interested in further study [...] However, we realise that 'all can do and all can learn'. In fact, not all students become doctors or engineers; however, everyone can be what they are able to be. [...] Accordingly, the school tries to optimize the students and encourage them to learn as much as they can. Many projects are carried out by the school, for example: English Club, English in everyday life, or at the very least, students are able to learn how to read the elements of chemicals in English labels on fertilizer bags. In job applications, they can identify themselves as having a good command of English via reading and writing, even if it is deemed imperfect, to some extent they could understand English, or suppose running a grocery, they would not be disadvantaged. [Social studies, culture and religion teacher]

Aside from academic work, the school tries to encourage students' vocational education through activities such as 'Sufficient Economy Garden'. The students are taught how to farm small fish, vegetation and herbs, or even a hydroponic garden. [Occupation and technology teacher]

❖ **Theme 3: Providing learning opportunity to ensure that every student can succeed**

▪ **Sub-theme 3.1: Dealing with different students' backgrounds at intake (Grade 7)**

School A starts dealing with each student's individual background in the school admission process (Grade 7). Interviews have demonstrated that during the transition from primary to lower secondary level, schools administered recruiting and screening tests to evaluate students' readiness prior to admission and their level of basic skills. These skills include reading, writing, and fundamental math,

and the tests are completed in order to ensure that the students possess the skills necessary for continuing to a higher educational level. Screening tests are intended to make the school aware of potential shortcomings and strengths of each individual student.

[W]e have to accept all students to study in our school. We cannot reject anyone! However, the school has a strong entrance testing system as a screening test. We test them for reading and writing abilities in Thai language and reading in English language, for example. We test their basic maths to see if they are able to understand +, -, X and /. The data from screening tests are used to classify students according to their academic backgrounds. Then, we will help to improve them based on their problems. You know, some still can't read and write and some can't calculate basic maths! How can they continue studying in lower secondary level if they don't have these necessary backgrounds? Thus, our screening test will enormously help to plan and deal with various backgrounds of students. [Thai language teacher]

With the recognition of the diverse backgrounds of the learners, the school has established an orientation camp prior to the commencement of the course. This orientation camp aims to teach learners with diverse backgrounds so that they may adjust adequately to the secondary level. It not only benefits learners but also benefits teachers in the sense that teachers become deeply aware of the strengths and weaknesses of individual students. Such information is essentially beneficial to both the school and teachers, as it establishes a useful guide to further improve student performance and enhance the quality of the school as whole.

Before the semester starts, we provide remedial camp for the new students. Students will learn various activities that we provide such as maths, science, sports etc. So, this will allow us to know their backgrounds and which subjects they perform well and which areas they still need to improve. [Health and physical education teacher]

- **Sub-theme 3.2: Providing learning opportunity according to student needs and abilities**

A learning opportunity is granted among different groups of students and is thus recognized as a mechanism which contributes to the equity within the school. The interview conducted with the headteacher revealed that the value and importance of individuals implies the equality of the individuals. The headteacher states that:

'everyone can learn within this school' and 'everyone can go through when his/her problems are resolved correctly.'

According to the headteacher and teachers, an important way to take care of each group of students involves classifying them into groups based on their prior O-NET test results for elementary classes (Grade 6) in addition to providing students with a screening test upon their admission. The school pushes forward the development and value addition to each group of children to achieve academic progress as much as possible.

At school, students are divided into 3 main groups based on the NIETS' average scores. In the grading system, students with scores of 75% and above are "Outperformed", students with scores of 50% to 75% are "Moderate", and students with scores of 50% are considered "Weak". The "weak" group must be paid close attention to and must be monitored so that they may upgrade to the "moderate" group. Meanwhile, the "moderate" group is encouraged to upgrade to the "outperformed" group. School strategies implemented include assigning high-performing students extra homework or activities. However, not all high-performing students are treated this way, depending on an individual's personal interests and requirements. [With regard to] the "weak group", [students] are given close attention by the teacher and their parents are encouraged to monitor and support them.

[Headteacher]

In terms of practices, the teacher interview indicated that the school has implemented the 'besiege' strategy to resolve student and performance based problems. These include assigning teachers to students in order to problem solve. As a result, problems faced by students may be solved more specifically and efficiently.

For example, Teacher Joy [teacher's name] pairs with student X [student's name] and Teacher Bee [teacher's name] pairs with student Y [student's name] to do maths exercises. As a result, the exact problems facing the weak group would be resolved [Occupation and technology teacher]

9.2.2 Case II: School that was differentially effective across subjects [School B]

The 'School B' case presents a school that was differentially effective across subjects. It is a small public school located in the centre of the district surrounded by local markets and shops as well as government institutions. This school provides classes from kindergarten to Grade 9. A majority of the students come from the local community and the nearby village, and are in low- to middle-class families.

The following findings present the three themes that have emerged from thematic analysis from interviews with the headteacher and teachers:

❖ Theme 1: School policy and practices on teaching

- **Sub-theme 1.1: Rigorous instruction aligned to the national standards [provided by the Ministry of Education]**

The commitment to teaching and learning for the Thai national core curriculum has been a priority for this school; namely, the headteacher represents the apparent standing point of the school for 'academic excellence'. With regard to interviews, the headteacher and teachers have stated that the implementation of teaching practices has been executed strictly in accordance with the requirements provided by the Basic Core Education Curriculum, the Ministry of Education.

The school's standards and implementation strictly follow the teaching and learning standard based on the central core curriculum [...] The school's guidelines focus on the core curriculum. As headteacher, I follow up and monitor teaching quality and student quality according to the criteria of the core curriculum. I can make sure [at the very least] that teachers don't miss or ignore any topics or issues which are mentioned in standards and indicators. [Headteacher]

In addition to complying with the teaching practices of the Basic Core Education Curriculum, the school, in combination with the core curriculum, provides a pedagogical approach vis-à-vis the "*local wisdom*". This has enabled students to acquire an exact understanding of the requirements and characteristics provided by the national standard, while also allowing students to develop the requisite skills to live and work in their local communities. 'Local wisdom' introduced by the school has been combined with the school curriculum, indicating the school's endeavours to integrate teaching, various learning standards and learner

development to achieve the ultimate outcomes as outlined in the Basic Core Education Curriculum. In addition, the school has maintained efforts to enable and equip students with the appropriate and consistent characteristics of local contexts and the way in which locals live in nearby communities.

[T]he school doesn't ignore the local way of life [...] So, they can learn from what is mentioned in the national standard and they can also learn from what we have in our local community [...] They would learn the national things and at the same time they would learn the local things. [Headteacher]

[T]he school adopted the local wisdom [and] merged [it] with the core curriculum. In particular, for example, planting and gardening based on the concept of Sufficient Economy's King [King Rama IX], the Thai classical arts and Thai sports such as Thai boxing are included as a part of the school curriculum. It is very beneficial for both those who plan to study further at a higher level and for those who will quit school after compulsory education. [Physical and health education teacher]

In practice, the school has focused on traditional teaching and learning in five core subjects. These include: Thai language, mathematics, science, English language, and social studies, religion and culture. Supplementary courses, however, such as health and physical education, arts, and occupation and technology have focused on creating a better understanding for students through applied practice.

To raise the student attainment at the school level, we have to focus on five core subjects. Five core subjects must be strong enough. Students need to perform academically and well in these five subjects while we do not ignore the rest. [Headteacher]

Subjects on O-NET exams that the school is highly concerned with consist of Thai, maths, science, social studies and English. The other three subjects are OK, although teachers don't teach them much. They can pass in O-NET exams. For example, in health education, if the students know how to take care of themselves very well, they will know how to do the tests. In physical education, if they play and know the sports rules, they can also do the tests. [Health and physical education teacher]

The school, furthermore, continually includes learning assessment for students across all subjects and academic levels to ensure that individual learners may improve their learning and apply themselves to achieving high grades. The data

obtained has further been utilized as a guide to suitably improve students' learning.

I believe that every teacher in this school puts an effort to [teach] students. We don't work hard just only in the O-NET exams or one month before O-NET exams. We have planned it since they started in Grade 7. We have taught and assessed them since the beginning of the academic year. We have continuous assessments, not summative assessment, not just once and then finished. We provide assessment and then remedial assessment. We have pre-test and post-test. We use pre-test only to classify the students' backgrounds and plan lessons to fill in what they lack and to add knowledge as much as we can. For the post-test, we use it to point out whether our students reach the national standards or not. If many are far from the standards, we need to provide them another remedial. After that we will train them by using the tests aligned with the O-NET exam style... I can say that our school focuses on the process rather than the outcome! [Mathematics teacher]

- **Sub-theme 1.2: Teaching preparation for the national testing (O-NET)**

Aside from promoting the teaching quality under the standards and indicators required by the Basic Core Education Curriculum, the active policy for raising the school O-NET scores focuses heavily on pedagogical preparation in academic contexts in both traditional classes and tutorial settings for the O-NET exams. The core subjects covered include (I) Thai language, (II) Social studies, Religion and culture (III), English language, (IV) Mathematics and (V) Science. The supplementary courses, however, which include health and physical education, arts, and occupation and technology, have focused primarily on applied teaching. The headteacher has stressed that when practising these subjects, a student's understanding must flow naturally.

In O-NET exams, the school policy from the headteacher focuses on raising student achievement in 5 core subjects: Thai, maths, science, social studies and English. For the rest of the subjects, our students can learn by doing and practicing. [Thai language teacher]

In preparation for tutoring the O-NET exam, the school policy covers a change in the school timetable and teachers are required by the Basic Core Education Curriculum to cover their teaching with wide-ranging content. This process begins

during the second semester and time allowances are available for the intensive tutoring of the O-NET exam.

Before the second semester begins, we have a school meeting, followed by each academic strand in our school. It is about a strategic plan to raise the school O-NET scores. So, we set up the teaching strategies that we try to finish the lessons according to the National Curriculum within the first two month of the semester. After that we will provide tutorial aligned with the past paper exams. [Headteacher]

The mobilisation by the school for the teachers in academic strands at both the primary and secondary levels is to help and ensure that students are tutored, while maintaining adherence to the budget allocated for hiring external experts to aid students further.

[W]e use both internal and external resources to raise O-NET scores... Within the school, we try to create a new environment for students. Primary school teachers tutor the Grade 9 students. At the same time, secondary teachers also tutor Grade 6 students. And if we have enough budget, we will hire teacher(s) from outside to tutor our students for exam. But we can't do this every year, and it depends on the school's budget. [Social studies, culture and religion teacher]

As to interviewing the teachers, the school has prepared students to enter Grade 7 and the teachers adopt continuous assessments to monitor and follow-up with student progress. Teachers and staff further analyse what each learner must adhere to, outside of group classroom dynamics. Also, the data obtained is to be used to further follow up with students' achievements and how teachers may become continually aware of student strengths and weaknesses. This in turn will allow the school to raise its O-NET scores.

❖ **Theme 2: School policy and practices on provisions related to the school's learning environment**

The learning resources utilised by the school under examination are considered a vital contribution to student improvement, wherein the students' academic progress is a primary focus. The headteacher interview has shown that a school's development approach is fundamentally based on words, such as with the following sayings: '*the centre of school development is the student development; without children, without school, without encouraging the students academically,*

for what does the school survive?" Based on such an implication, the development of 'School B' then focuses on creating values for students via a facilitating atmosphere which recognises a variety of academic and non-academic activities throughout the year to ensure the students reach their full potential in appropriate learning.

At our school, various activities are carried out throughout the year, for example Asian Camp, English Camp, Language Camp, Buddhism Day, Christmas, and Sports Day. All students participate in these events which, in my opinion, sustains and facilitates learning improvement in both academic and non-academic areas among students in several ways. [Arts teacher]

Furthermore, the school has encouraged and driven all teachers to create an attractive teaching atmosphere via visual learning in the classroom, as well as applying technology and modern teaching materials.

In spite of there being many senior teachers in our school, all teachers are required to undergo training on how to use E-Book, PowerPoint, Excel, Notebook, and Projector for improving their teaching in the class.
[Occupation and technology teacher]

- ❖ **Theme 3: Providing learning opportunities to ensure that every student can succeed**
 - **Sub-theme 3.1: Dealing with different students' backgrounds at intake (Grade 7)**

The school has faced a significant amount of admission problems continuing the lower secondary education level due to having integrated courses for students with diverse backgrounds and low performance results, have been considered problematic. Interviews with teachers have revealed that the school includes the ways in which students' fundamental knowledge may be reviewed and supplemented prior to the school's opening semester. These methods have been included in order to level certain students' knowledge and the in-process teaching and learning during the semester can be provided effectively.

[O]ur school has lots of problems with students' backgrounds during the transit period between primary and secondary level because it mixes between our own primary students and students who come from other schools. It is especially the students from other schools whose backgrounds aren't ready to study at the secondary level, but I think that our own students are quite OK

and our teachers know them very well in both their strengths and weaknesses. But for the new students, we have to work hard to help them to catch up and sometimes teachers need to reteach and revise the primary lessons before the semester starts if possible. [English teacher]

However, school practices have focused on principles that have a substantial impact on students' learning at a higher level. These include both reading and writing. Over the past, some students still have had problems regarding literacy. During the opening semester, the '*Friend helps Friend*' project was held by the school in order to address students' issues.

*Similar to many schools, we have the same problems regarding reading and writing. Now we have Student Club and the '*Friend Helps Friend*' project run by about ten voluntary senior students to help this group of students and supervised by teachers. We run this project about 25 minutes during afternoon break and 20 minutes after school on every Monday, Tuesday, and Thursday. [Thai language teacher]*

- **Sub-theme 3.2: Providing instruction and learning opportunities in accordance to student needs**

The interview with the headteacher and teachers demonstrated that the school focuses on traditional teaching and applied learning and not a particular teaching method. In a group of weak students who are in need of special attention, the subject teacher must provide supplementary teaching beyond the traditional classroom.

[N]o special thing is required to deal with students of each group, however, in the case of those underperformed students who fail to catch up with the lessons, extraordinary teaching is needed for them. [Arts teacher]

9.2.3 Case III: School that demonstrated low level of equitability across subjects [School C]

The case pertaining to 'School C' presents a school that demonstrates a low level of equitability across subjects. It is a small public school located in a rural area, approximately 20 to 50 kilometres from the district and the centre of the Province. The school provides classes from Grade 7 to 12. The majority of the students come from the local community and are in low- to middle-class families. The findings that follow present the three themes that emerged from thematic analysis from the interviews conducted with the headteacher and teachers.

❖ **Theme 1: School policy and practice of teaching**

▪ **Sub-theme 1.1: Rigorous teaching and instruction aligned with the Thai national curriculum**

The teacher interview reflected pressures exerted upon the school. These included numerous 'low' and "failed" performances, indicated by each student's achievement standards. The school was identified as "failed" under the Office for National Education Standards and Quality Assurance. Thus, the school has been denied being an accredited school.

For this reason, the school has teaching practices and policies emphasizing that '*teaching for exams*' is crucial for student achievement. That is to say, the school has sought to integrate content in accordance with the Basic Core Educational Curriculum into a single semester so that it may have more success with regard to tutoring students for O-NET exams. With many time constraints at hand, pedagogical arrangements at School C have failed to cover the appropriate content that establishes a high standard for student progress.

Sometime[s] I'm a bit confused. [The headteacher] launched the policy that every teacher should merge the lesson and content of the first and second semester within the first semester. So, all lessons must be finished within one semester. Then, the 2nd semester should be for O-NET exams. Only focus on O-NET. [...] Even I teach according to what it should be in the lesson plan. I still can't finish it on time as my students can't get it. So, some lessons are missing as I can't cover them within the right time. [English language teacher]

[B]y acting like our school is a tutorial school, in my opinion, means this isn't a school now. It is something else. We are now tutors, not teachers anymore! Many teachers teach only the topics that are likely to be in the exam paper. I don't know now, as everyone now has his/her own way to teach! And I don't know how students can learn without a good background. [Physical and health education teacher]

For me, I feel it is very difficult to condense the maths lesson within only four months in one semester. It's impossible. If you ask any expert teaching maths or Doctor in teaching, there is no way to do it. It's impossible [...] OK, if you teach in [School's name] [Top school in Bangkok], maybe it is possible [...]

Anyway, I do my best in my own way. If they fail, they fail. [Mathematics teacher]

Most teachers at School C have become aware of the problems associated with performance failure that preclude the school from obtaining the appropriate accreditation rendered by the Office for National Education Standards and Quality Assurance (ONESQA). Teachers in each academic strand have attempted to improve their respective teaching practices as best as possible in ways they think are most appropriate.

For this school, quality of instruction is not very OK and should be urgently improved. In terms of external assessment, the school failed and hasn't been accredited by Sor Mor Sor [ONESQA]. The quality of student outcomes is still the main problem and is far from the [appropriate] standard. To solve this, I am responsible in subjects I teach. [Social studies teacher]

Nevertheless, the interview generates a contradictory picture in terms of students' desirable outcomes between the headteacher, and the teachers with respect to the imbalance between academic and non-academic outcomes. In fact, some teachers express that School C places too much emphasis on non-academic activities for their students. For this reason, the time spent has been replaced with other activities, whereby teachers have not been able to complete their required teaching lessons as required by the Basic Education Core Curriculum. Consequently, a significant amount of content in some indicators and standards has not been included in classrooms.

I have to say that this organisation doesn't focus on academic work as it ought to. He [the headteacher] is more focused on non-academic activities rather than academic work. For me, it is questionable if an educational institution doesn't concern itself much with academic work. What is going on? [Science teacher]

*Too many activities in each month in each semester. No time to teach.
[Occupation and technology teacher]*

My headteacher likes non-academic activities, so he supports less academic work. When the school spends lots of time on non-academic activities, the students aren't in the class. [Thai language teacher]

- **Sub-theme 1.2: Teaching preparation for national testing (O-NET)**

In preparing for national testing for School C, it was considered critical to raise the school quality for national tests. The teacher interview similarly reflected that this is possible because of the continued deficit of the intensive pedagogy over the academic year in all levels as well as incomplete compliance with teaching under the standards and indicators required by the Basic Core Education Curriculum. Consequently, student preparations for the O-NET fail because students lack the essential, fundamental knowledge in spite of teachers attempting to tutor students' O-NET activities, thereby resulting in low O-NET scores.

Like any other school, our school has tutorial classes for O-NET. However, our school hasn't focused on academic work for the whole year. We are interested in external activities for competition such as singing contests etc. When the O-NET is coming and we have got only one month left, our [headteacher] just said that our O-NET must be better than last year. Do you think that it is enough to get it on time? It's impossible! [Mathematics teacher]

Based on my experience sharing with my colleagues, if the average scores are not OK, we feel that we are under pressure. Some teachers ignore teaching some content of the lessons. They teach only what topics should be in the exams. In the classroom, they work as a tutor to train students for exams only. In each semester, they only tutor, tutor, tutor! They don't do anything else except tutor. [Social studies, culture and religion teacher]

- ❖ **Theme 2: School policies and practices regarding the provision of school learning environment**

As previously mentioned, many teachers' reflections suggest that the school contribution may result in an imbalance between enhanced academic and non-academic activities, thereby resulting in poor academic development. One teacher has been quoted as saying:

I feel that the school overspends on non-academic work and investment. It sounds reasonable that these activities improve the students' quality to some extent. It is a pleasure to hear that our students are in good spirits, empathy and social awareness. Personally, I think this is a secondary school and why we can't go beyond this. [Arts Teacher]

On the other hand, a problem the school faces is falling short of the accreditation granted by the ONESQA. As a result, some teachers have tried to find a way to raise the school O-NET scores with encouraging improper values in its students, whether this be by corrupting the exam or answering questions on tests homogenously throughout. For this reason, such practices have a critical impact on students and decrease their motivation to learn. These practices further instigate prejudices with respect to the value and importance of educational institutions. As quoted by a teacher who has problems with the school:

In my opinion, teaching just to achieve the paper exam has undermined the formal teaching and learning process and has adverse effect on both learners and teachers intensively. You know, in order to escape from external assessment criteria, the students are taught how to cheat the national exams and how to manipulate the multiple-choice tests in exams. Did you know the average scores at the national or provincial level on maths and some other subjects are as low as 25%? Thus, the students acquire no knowledge because they know only how to mark a choice of A, B, C or D, our school average scores represented an average, just a deceived pass, right? [Health and physical education teacher]

Many teachers have mentioned problems relating to students' learning by stating there is a practice of '*learning just to acquire the degree or just to support a job seeking after graduation*'. Most students have fallen short of higher educational opportunities due to socio-economic barriers and/or family debts. The expected academic atmosphere of the school therefore may not bring forth enthusiasm in learning. Many teachers interviewed were of a similar opinion.

Having served in a teaching career for many years, personally it can hardly be denied that our students do not love studying much, as they have thought it a waste of time to spend many years at school. Studying to them means obtaining the certification to apply for a job and work for an industry. This is the reason why they think study is not important, but time-consuming, and that this is all they need for basic knowledge and/or everyday life concerns. [Occupation and technology teacher]

However, some students give attention to their study. The problem is that once they are finished with their secondary level, they are not interested in continuing to a higher level. They think higher level of education is not meant for them; why do they need to learn more, or why do they need to learn

maths or science? For what? They [students] expect the degree and do not want to continue studying after graduating. [Science teacher]

They [the students] were taught to 'just graduate'. Some who would like to learn more continue to the higher level while those who wouldn't like to learn more enter the manufacturing plant. [Thai language teacher]

Therefore, it can be said that School C faces the issue of most students not appreciating learning. This in turn may lead to the destruction of the learning atmosphere and the lack of significance of learning for students.

❖ **Theme 3: Providing instruction and learning opportunities to ensure that every student can succeed**

- **Sub-theme 3.1: Dealing with different students' backgrounds at intake**

The school's policies and practices regarding how students with diverse background are managed remains unclear. This is because School C offers only a secondary education level and most of its students come from a diverse background. The management-associated issues then primarily fall onto the instructors or subject teacher.

I have to say that our students are the rest of the students who can't go to study at another place. If they could go, they wouldn't be here. For this reason, this school is a mixture of students with various backgrounds, but tends to be lower than normal standards. Haha! So, to deal with this, it depends on each teacher and each classroom teacher. [English teacher]

However, issues regarding diverse student backgrounds have been insinuated and mentioned by teachers. Interviews demonstrated that many teachers reported that the problems related to student performance were largely due to the low academic standard of students and their poor relationships with teachers.

The school can't select the students like the big schools in the city or Bangkok. We have to reteach them, but it depends on children themselves whether they want to receive or not. If not, we can't do anything. [Arts teacher]

- **Sub-theme 3.2: Providing instruction and learning opportunities in accordance with student needs**

The headteacher interview revealed that School C's policy was to support and grant certain competent students with the opportunities for external completion in different fields.

This is a golden year of [School C]. I support all activities... I referred our students to join the contests at provincial, regional and national level, and it did not upset me, they won the gold and silver medal, and certificates.
[Headteacher]

A teacher also reflected this school policy:

Our leader [headteacher] emphasises encouraging the students to join many external activities. They sometimes lose, but they had an experience.
[Occupation and technology teacher]

Nonetheless, granting or providing a learning opportunity in School C is simply limited to a certain group of students. The school moreover implements the practices that encourage some outstanding students to join external contests, activities, or academic events in order to improve the school's reputation. Thus, the school requires the teacher personnel to act as coach for certain students while neglecting other students. One teacher reflects:

It is difficult to raise educational standards in this school! For example, when a teacher needs to practice with some students for contest, he quotes he has no full-day teaching. Two students are chosen and what about the remaining thirty students? I believe that if teachers function in the class, school quality development is promising. [Physical education]

Likewise, another teacher reflected on the same problems:

Researcher: *What school policies have been implemented to deal with students with various backgrounds?*
English Teacher: *A contribution to the high-performing students*
Researcher: *Could you please give me an example?*
English Teacher: *Every year students are encouraged to join contests outside school. This includes more than 20 projects carried out each year since I have commenced my service here. The participants are those same students supported by the school.*

<i>Researcher:</i>	<i>How about the low performance students?</i>
<i>English Teacher:</i>	<i>Not much to support them. Typically, a particular group such as students who won the contest prize will be supported constantly to progress on their skills toward the national level. For low performance students, they are also encouraged to the extent which it depends on an individual's own performance.</i>

This emphasis on activity promotion results in a particular group of students being given special attention while other students are ignored. A teacher reflects on this with the following:

No time to teach, no time to get things done because the teacher is often busy referring students to join contests. This is a problem facing this school.
[Science teacher]

9.2.4 Case IV: School that was consistently ineffective across all subjects [School D]

‘School D’ presents a school that was consistently ineffective across all subjects. It is a small public school located in a rural area approximately 30 km from the centre of the Province. The school provides classes from kindergarten to Grade 9. School D is identified as a community school surrounded by an agricultural area. The majority of the students come from the local community and are in low- to middle-class families.

❖ Theme 1: School policy and practices on teaching

- **Sub-theme 1.1: Rigorous teaching and instruction aligned to the national curriculum**

Interviews showed that the headteacher reported that School D mainly focused on the career development of students rather than on academic performance. A majority of students admitted come from local communities and their family occupation’s mainly involve agriculture. The school provides little opportunity for students with families and interests in agriculture to pursue these interests in high education. Therefore, to develop the learners’ quality, the school essentially focuses on learning vocation and surmount prior to their respective careers. Consequently, the school pedagogy has not concentrated on and has not geared towards ultimate academic outcomes.

Researcher: What is the school's policy with respect to raising its quality of student?

Headteacher: We focus on every subject.

Researcher: Can you explain?

Headteacher: The school focuses on both academic and non-academic subjects. I have to say that almost all students discontinue studying. Only 3-4 students continue studying on the academic or vocational pathway. The highest educational level they plan to continue studying is only lower vocational or higher vocational level. After that they plan to work in factory. This is the maximum capacity of students here. So, we try to put our effort on every subject equally. But I have to say that we need to know our students. So, we try to train them in careers rather than academic pathways. It will be more advantageous to them.

Researcher: Can you give me a sample?

Headteacher: Many schools are from the agricultural community. We teach them to make fertilizers, to understand 'Sufficient Economy' [Theory developed by King Rama IX], and to do basic accounting in order to satisfy certain career skills.

In addition to this school's policy, their endeavour has been to contribute to student's career skills. The headteacher, moreover, has sought to raise student's expectations with respect to their future career paths, and has subsequently designed several courses for students. Therefore, understanding how teaching and learning has been developed involves understanding the respective responsibilities of teachers. In the interviews, teachers used the phrase "my own way". This has indicated furthermore that this school does not maintain a strict adherence to the Basic Core Education Curriculum.

...He [the Headteacher] gives us advice in general. Then it depends on my own way to do. He asked every teacher to write down the plan to raise the school O-NET scores. [Mathematics Teacher]

Frankly, in this school, 'teachers' [are] the key person[s] [driving] the school. The head [Headteacher] just command that the O-NET scores must increase. He will order us. Each has to plan by oneself to teach students. How to train students depends on each teacher according to personal understandings. ... even me myself, sometimes I haven't taught in depth. [Arts Teacher]

- **Sub-theme 1.2: Target teaching preparation for the national testing**

The interviews demonstrated that the headteacher and teachers reflected ambiguity with respect to policies and practices implemented to raise the school's O-NET scores. It is discovered that raising the school's O-NET scores remains the responsibility of teachers over individual subject. Thus, the strategy implemented to raise the school's O-NET scores is based on practices and the experiences of individual teachers.

I think teachers in each subject should know what they should teach and prepare for O-NET exams. Thus, I as a headteacher trust them and believe that they can do it. If they need any support, I will support them all what they need. [Headteacher]

My boss [headteacher] just said that it is responsibility and duty to make students pass O-NET. If they can pass, then the school will survive. I think we don't have a clear plan at the school level. Depending on individuals, everyone has to design and make decision by his own strategies. For me, I have practiced my students by doing exercises from previous exams and textbooks published by many company. For any other teacher, I have no idea. It depends on everyone's strategies to make its own subject survive. So, it is each teacher's responsibility to make him save. [Thai language teacher]

- ❖ **Theme 2: School policies and practices on the provision of a school's learning environment**

As mentioned earlier, School D focuses on developing students through vocational training programs and promotes preparatory work for students for when they leave school. Hence, school policy and practices on provision of school learning environment are more likely to focus on non-academic than academic activities. The headteacher and teacher interview revealed a corresponding opinion as follows.

Regarding students from poor to middle family background, they are highly instructed on agricultural affairs and related occupations corresponding to their agricultural background and not focus on continuing the higher level. [Occupation and Technology Teacher]

Since most of our student do not further the higher level owing to family financial drawbacks, such careers such herb refreshment production, enzyme Lonicasma, agriproduct processing are highly focused to teach them in parallel with academic performance, but the former is more focused. [Science Teacher]

Researcher: What school policies have been implemented to raise your students' academic performance?

Health and Physical Education Teacher:

Base on the low-income family background, schooling policies focus on occupational development and support... In doing so, the occupation must generate income that supports themselves and their family.

Researcher: Occupation is emphasized more than academics, right?

Health and Physical Education Teacher:

A focus is exerted on academic rather than occupation.

❖ **Theme 3: Providing instructional and learning opportunities to ensure that every student can succeed**

- **Sub-theme 3.1: Dealing with different students' backgrounds at intake**

The interviews indicated that the school had no exact practices on how students with diverse backgrounds are managed at the intake. Thus, the practice rests heavily on classroom instructors.

To deal with the different academic background in this school, there is no specific policy. It depends on the individual teacher in each subject.

Personally, I think there are no problems with non-core subjects, but we have lots of problems in core subjects. These include English, maths, and science. Difficult to cope with! [English language teacher]

- **Sub-theme 3.2: Providing instruction and learning opportunities in accordance with student needs**

Interviews with several teachers found that school policies and practices with respect to the surveillance of students of varying backgrounds are common and unremarkable. Some teachers mentioned that the function of taking care of students rested on the subject teacher. Some teachers reported that it relied on

the classroom teacher or subject teachers regarding a surveillance of students' learning and behaviour in general.

Researcher: How does your school deal with students with different performance (such as high, medium, and low performance)?

Social Studies, Culture and Religion Teacher:

All groups of students are given equal attention to.

Researcher: Can you explain?

Social Studies, Culture and Religion Teacher:

To be honest, we are pleased to get things done, but in any case, if the student requires help for arising problems, we are willing to relieve them. My teaching responsibilities are considerable. Otherwise I might put more efforts to relieve students of any issues they suffer.

9.3 Findings of cross-case analysis

Research Question III: Do schools perform differently in terms of quality and equity across subjects within schools? How and why do schools perform in this manner?

This section presents the comparative findings among four cases by themes and sub-themes under the scope of case analysis. The cross-case analysis allows the researcher to make a comparison between and among cases.

9.3.1 Theme 1: School policy and practice on quality of teaching

This first theme investigates the wider school policies and practices that structure their approach to teaching. This section will be divided into two related sub-themes. These include: (I) rigorous teaching aligned to the Thai nation curriculum and (II) teaching preparation for the national O-NET examinations.

- **Sub-theme 1.1: Rigorous teaching and instruction aligned to the Thai national curriculum**

School policy and practice with regard to commitment to learning and instruction align with the Thai national curriculum. The national curriculum furthermore has a crucial role in considerably raising the learner's quality of education. In this study, it is obvious that effective schools in terms of quality of education (Schools A and B) strictly follow the requirements of the quality of learning and teaching under the

standard national curriculum. However, Schools A and B are different in their policies and practices.

School B focuses on improving the quality of teaching in five core subjects: Thai language, social studies, culture and religion, English language, mathematics, and science, with traditional teaching and supplementary courses including: health and physical education, arts, and occupation and technology. These latter courses emphasize applied learning with respect to knowledge related to local wisdom. This is to ensure that students possess the knowledge and understanding in accordance with the appropriate educational standard. Both schools provide a follow-up along with continuous formal and informal assessments.

Schools identified as ineffective (Schools C and D) have common practices in some areas. These include student development with respect to future careers. Both schools yielded graduates with no intention of studying higher education. Thus, the student development has shifted from that required by the national curriculum to that which is focused on career development instead. As a result, the policies relating to classroom teaching and learning mainly depend on the teachers. Since School C has failed the accreditation required by the ONESQA, and the indicators related to student attainment in O-NET exams are non-compliant with the relevant standards, teaching practices for O-NET are merely placed upon the areas assumed to be in accordance with the exam. As a result, students are not sufficiently taught the standards listed in the national curriculum.

- **Sub-theme 1.2: Teaching preparation for the national testing (O-NET)**

Specific preparatory teaching for students for exams is considered a way for the school to raise the school O-NET scores. In practice, it could be achieved in several ways, such as scheduling tutorials and hiring external tutors, and so on. In this study, the results have demonstrated that effective schools implement policies and practices which prepare students for their O-NET testing systematically.

Certain dissimilarities between Schools A and B were discovered. At School A, for example, the subject teachers performed investigations and analysed the tests systematically regarding the O-NET while at School B they did not. Despite these differences, both School A and B have been preparing their students on a continuous basis, across all levels. This has meant that students are exposed to tutorial opportunities and are subsequently familiarised with the style of O-NET testing. On one hand, in School A, the recent results of the students' O-NET tests serve as a guideline to determine the strengths and weaknesses of students,

leading to the development and improvement of teaching preparation. In addition, School A's teachers in all grade levels and all subjects together pursued the tutoring of the students for the exam. On the other hand, School B scheduled a time for the testing, and responsibility for exam preparation was placed on the five core subjects. In addition, both Schools A and B allocated some funds to hire external instructors to do tutoring concerning the O-NET.

As for the ineffective schools, to address the non-complying quality of their school, School C has defined exactly a way of 'teaching for O-NET', focusing particularly on topics that are presumed to be most relevant to the O-NET testing. In turn, School D followed with policies and practices that remained vague. The head teacher assigned duties and responsibilities to the subject teachers alone.

9.3.2 Theme 2: School policy on providing school learning environment

It is apparent that the learning atmosphere in schools is important to motivate students so that they may express enthusiasm to learn. The results show that the effective schools (School A and B) focus on promoting a balanced and attractive atmosphere for both academic and non-academic learning (e.g. academic camps, events, professional development, etc.). Furthermore, these schools focus on adopting innovative educational technologies to improve the quality of traditional and non-traditional teaching and learning interactions amongst students at the same grade level and students with differing academic grades and achievements.

Schools C and D emphasize and promote a learning environment which involves vocational development and aims to prepare students for life after school. For this reason, the schools have no policies or practices to enhance their academic atmosphere. Therefore, promoting the productive learning atmosphere in the school largely depends on the classroom atmosphere created by the class instructor.

However, School C has been under pressure from the external assessment regarding the non-complying quality of the students on the O-NET. Thus, some teachers have tried to raise the O-NET scores by encouraging improper values in students. These improper values include cheating on exams or establishing irrational homogeneous answer choices throughout exams, thereby resulting in a corrosive learning atmosphere. This environment further establishes a negative approach to learning.

Meanwhile, the school has no solutions to solve its destroyed values, further encouraging the view that learning exists for the sole sake of acquiring a degree and supporting oneself after graduation. This school's academic environment is considered a critical problem by its teachers.

9.3.3 Theme 3: Ensuring that every student can succeed

The third theme investigates the wider school policies and practices that structure their approach to diverse students. This section can be divided into two related sub-themes: (I) dealing with different students' backgrounds at intake and (II) providing instruction and teaching in accordance to students' needs and/or capacities.

- Sub-theme 3.1: Dealing with different students' backgrounds at intake**

Dealing with the different backgrounds of students at intake is a vital strategy implemented by schools to raise the quality of learning and to improve the equity at the school. The results show that Schools A and B have similarities in their approach to student intake. The fundamental teaching is given to students before commencing a semester, aiming to prepare students in each group so that they may be best equipped with a knowledge base to sufficiently meet their lower secondary level. This also ensures that all the students possess a similar knowledge base, further leading to a more effective instructional arrangement. Meanwhile, Schools C and D have several differences with respect to how they manage students with different backgrounds. In practice, it is primarily considered the function and responsibility of the classroom teacher and/or subject teacher.

- Sub-theme 3.2: Providing instruction and teaching according to students' needs and/or capacities**

Providing instruction and teaching based on the students' needs and competencies is essential to boosting the equity of a given school. The results demonstrate that effective schools are highly focused on managing students' diverse needs. School A administers a screening test to determine the extent of students' prior attainment, and what the strengths and weaknesses of the individual students are. This is in order to assign students with the same quality to the same group and attempts to optimise each group of the students to their full potential. In addition, the school has implemented the 'besiege strategy' in which individual teachers take care of students with problems individually. School B provides only practices

relating to taking care of the students with low performance through the extra teaching outside the classroom, but it is still an uncommon practice for other groups of students.

In addition, School C focuses on extra-curriculum activities for students with particularly excellent performance, so that may be placed in competitions and further bolster the school's reputation. Instead, School D has implemented an ambiguous policy where the practices depend heavily on classroom teachers and subject teachers.

9.4 Chapter summary

A qualitative study with the use of the multiple-case study research design is utilised to examine how effective and ineffective schools implement their practices related to their quality and equity. A cross-case analysis for four different types of schools in terms of quality and equity is shown. Thai effective schools have implemented the following policies and practices:

- Rigorous teaching/instruction aligned to the Thai national curriculum
- Teaching preparation for the national exams
- Providing school academic learning environment
- Dealing with different students' background at intake
- Providing teaching/instruction according to students' needs and/or abilities

The first two items refer to the school policies and practices regarding the quality of teaching. The third involves the school policies and practices on creating a school learning environment. The last two refer to the school policies and practices implemented to ensure that all students can achieve their learning performance.

Table 9-2 presents the summary of school profiles, themes and sub-themes in each school.

School context/themes	School that showed high level of equitability across subjects	School that was differentially effective across subjects	School that showed a low level of equitability across subjects	School that was consistently ineffective type across subject
	School A	School B	School C	School D
School context:				
▪ School type	Public	Public	Public	Public
▪ School size	Small	Small	Small	Small
▪ Grade levels	Kindergarten to Grade9	Kindergarten to Grade9	Grade 7-12	Kindergarten to Grade9
▪ Location	Rural	The centre of district	Rural	Suburb
▪ Economically disadvantaged students	Middle to poor	Middle to poor	Middle to poor	Middle to poor
Factor affecting school effectiveness in terms of quality of education and attainment equity				
▪ Theme 1: School policy and practice on quality of teaching				
▪ Theme 1.1: Rigorous teaching/instruction aligned to Thai national curriculum	<ul style="list-style-type: none"> ▪ Strictly teaching aligned to the national curriculum ▪ Assessment and follow-up of the student quality under the standards and indicators required by the national curriculum 	<ul style="list-style-type: none"> ▪ Strictly teaching aligned to the national curriculum ▪ Particularly in five core subjects ▪ Follow-up of student quality under the standards and indicators required by the national curriculum ▪ Merging the local wisdom into the school curriculum 	<ul style="list-style-type: none"> ▪ Focus on teaching for examination ▪ Teach topics that are presumed to concern the exam ▪ Promote extra-curriculum/non-academic activities rather than academic activities 	<ul style="list-style-type: none"> ▪ Focus on non-academic/vocational pathway rather than academic pathway ▪ Teaching/instruction design primarily depending on individual subject teachers

Table 9-2 Summary of school profiles, and themes and sub-themes

School context/themes	School that showed high level of equitability across subjects	School that was differentially effective across subjects	School that showed a low level of equitability across subjects	School that was consistently ineffective type across subject
	School A	School B	School C	School D
▪ Theme 1: School policy and practice on quality of teaching (Continued)				
■ Theme 1.2: Teaching preparation for the national testing	<ul style="list-style-type: none"> ▪ A presence of the exam analysis and the school's past O-NET scores to understand the strength and weakness where improvement is required ▪ Teachers at all levels collaboratively prepare the students for the O-NET exams ▪ Preparing the O-NET exams horizontally across all subjects and vertically across all academic levels ▪ Employ external tutors for student preparation for the O-NET exams 	<ul style="list-style-type: none"> ▪ Focus on teaching preparation for the O-NET exams in five core subjects ▪ School time is given in the second semester to prepare the students for the O-NET exam ▪ Preparing the O-NET exams vertically across all academic levels ▪ Employ external tutors for student preparation for the O-NET exams 	<ul style="list-style-type: none"> ▪ Teaching the topics that are presumed to feature in the exams ▪ No specific time is given for teaching preparation for the O-NET exams 	<ul style="list-style-type: none"> ▪ No clear school policy and practice ▪ Relied on individual subject teachers' responsibilities

Table 9-2 Summary of school profiles, and themes and sub-themes (*Continued*)

School context/themes	School that showed high level of equitability across subjects	School that was differentially effective across subjects	School that showed a low level of equitability across subjects	School that was consistently ineffective type across subject
	School A	School B	School C	School D
▪ Theme 2: School policy and practice on providing school learning environment				
	<ul style="list-style-type: none"> ▪ Invest the government subsidized fund mostly in academic pursuits ▪ Invest in the purchase of equipment and educational technology to support teaching and learning ▪ Create an interactive learning atmosphere for students of the same grade and of different grades ▪ Promote extra activities relating to vocational development 	<ul style="list-style-type: none"> ▪ Focus on creating the learning environment through academic and non- academic activities throughout the academic year ▪ Encourage teachers to use modern technologies in the classroom ▪ Create an interactive learning atmosphere for students of the same grade and of different grades 	<ul style="list-style-type: none"> ▪ Focus on non-academic activities in learning ▪ School focuses on 'O-NET scores primarily, resulting in a destroyed learning atmosphere ▪ Most students learn for degree and job application 	<ul style="list-style-type: none"> ▪ Focus on provision on vocational training/career development

Table 9-2 Summary of school profiles, and themes and sub-themes (*Continued*)

School context/themes	School that showed high level of equitability across subjects	School that was differentially effective across subjects	School that showed a low level of equitability across subjects	School that was consistently ineffective type across subjects
	School A	School B	School C	School D
▪ Theme 3: Ensuring that every student can succeed				
✿ Theme 3.1: Dealing with different students' backgrounds at intake (Grade 7)	<ul style="list-style-type: none"> ▪ A presence of screen tests used to group the students ▪ Base knowledge adjustment activity is provided before commencing a semester 	<ul style="list-style-type: none"> ▪ Base knowledge adjustment activity is provided before commencing a semester 	<ul style="list-style-type: none"> ▪ Depends on classroom teacher and/or subjects teacher 	<ul style="list-style-type: none"> ▪ No clear policy and practice
✿ Theme 3.2: Providing learning opportunity according to students' needs/abilities	<ul style="list-style-type: none"> ▪ Grouping students based on abilities ▪ Each group of students are given the development base on their full capacity ▪ Implementing 'besiege' strategy 	<ul style="list-style-type: none"> ▪ Assist low- performance students, depending on subject teachers primarily 	<ul style="list-style-type: none"> ▪ Focuses on developing extra-curriculum activities and students of outstanding performance 	<ul style="list-style-type: none"> ▪ No clear school policy and practice ▪ Rely on classroom teachers/subject teachers

Table 9-2 Summary of school profiles, and themes and sub-themes (*Continued*)

10. Chapter 10: Conclusion, discussion and recommendation

The final chapter describes the main findings derived from the empiricals, which includes both the quantitative and qualitative studies concerning the school policies and relevant implications; practical and theoretical contributions to school effectiveness in the context of Thai education; as well as research limitations and recommendations for future work.

10.1 Conclusion

The study focuses on '*what makes schools effective*' and '*how and why schools perform in this manner*'. Specifically, our research covers three main research questions:

Question I: To what extent does student attainment vary at the student, classroom and school levels in Thailand? Which student, classroom and school variables significantly affect student attainment in Thailand?

Question II: What is the extent of student attainment equity in Thailand? Which school factors significantly affect attainment equity at the school level in Thailand?

Question III: Do schools perform differentially in terms of quality and equity across subjects within schools? How and why do schools perform in this manner?

To answer the research questions above, the explanatory mixed methods design or explanatory sequential design was implemented in two main phases: quantitative phase (phase I) and qualitative phase (phase II).

❖ Phase I: Quantitative phase

In Phase I, the major aim is to model school effectiveness and attainment equity in Thailand. This phase consists of four subparts, as follows:

Part A: Modelling school effectiveness – investigating factors affecting student attainment in Thailand based on the dynamic model of educational effectiveness Creemers and Kyriakides (2008). It investigated the extent to which school factors have significant effects on student attainment and what percentage of variation in

student attainment is due to differences at student, classroom and school levels using the multilevel analysis. In addition, the residuals at the school level from the multilevel, called school contextual value-added (school CVA), were used to identify the school quality.

Based on comparison of the null models of the eight subjects, the findings showed that the highest variation in student attainment lies at student level, followed in turn by classroom and school levels. Overall, the findings based on the three-level model across eight subjects, after controlling for student characteristics and classroom and school contexts, revealed that:

- One main aspect of the overarching factors related to school policy on teaching has a significant effect on student attainment across subjects, including the quality of teaching.
- Two main aspects of the overarching factors related to school policy on creating the school learning environment have a significant effect on student attainment across subjects, including the provision of sufficient learning resources and value of favour in learning.

Overall, as proposed by Creemers and Kyriakides (2008), multidimensional constructs used for defining and measuring such three school effectiveness factors significantly contributing to student attainment include: frequency, quality, stage, focus and differentiation.

Part B: Calculating attainment equity indexes – associated with school equity using Kelly's attainment equity and Theil's T index (Kelly, 2012). In addition, it investigated the extent to which school factors have significant effects on attainment equity. Findings revealed that, overall, the average SES is a vital predictor to attainment equity in *nearly all* eight subjects whereas percentage of girls and school size inconsistently affect attainment equity across eight subjects.

Part C: Combining quality and equity among subjects, it related to school quality and equity in terms of school process output focus (Kelly, 2012). The findings from this part were used for classifying typology across eight main subjects: high equitability (high quality and high equity), differentially effective (high quality, but low equity), low equitability (low quality and low equity), and uniformly ineffective (low quality but high equity) (Kelly, 2012). Findings in this section were shown in the accompanying material.

Part D: Schools were grouped based on the pattern of similarities of the school CVA and Kelly's AE across eight main subjects based on the findings in Part C. According to Kelly (2012), school were classified into four main types:

Type I: Schools that showed a high level of equitability across subjects

Type II: Schools that were differentially effective across subjects

Type III: Schools that showed a low level of equitability across subjects

Type IV: Schools that were consistently ineffective across subjects

❖ **Phase II: Qualitative research**

Phase II, the qualitative phase, focused on seeking explanations derived from the quantitative findings (Part D). A multiple-case research study was adopted to answer the question of why schools performed differently in terms of quality and equity. Findings revealed that effective and ineffective schools have differently implemented the following school policies and practices:

- (i) Rigorous teaching/instruction aligned to the Thai national curriculum
- (ii) Teaching preparation for the national exams
- (iii) Providing an academic learning environment
- (iv) Dealing with different students' background at intake
- (v) Providing teaching/instruction to students' needs and/or abilities

The first two items refer to the school policies and practices regarding the quality of teaching. The third involves the school policies and practices on creating a school learning environment. The last two refer to the school policies and practices implemented to ensure that all students can achieve their learning performance.

10.2 Discussion

To answer the research questions above, this study focuses on the cognitive outcomes in all eight main subjects according to the Thai Basic Core Educational Curriculum. However, an integrated discussion based on the common findings across eight subjects is undertaken in order to allow the researcher to compare and contrast among all outcomes. The discussion here follows the sequence of the research questions.

10.2.1 Research question I

To what extent does student attainment vary at the student, classroom and school level in Thailand? Which school factors significantly affect student attainment in Thailand?

❖ Variations of student attainment

According to the three-level variance component model adopted in the study, the variation in student attainment was decomposed into student, classroom, and school levels. The null/naïve models showed that most variation in student attainment is apparent at the student level, followed by the classroom and school level, respectively. The findings are consistent with previous empirical studies, mainly concerning cognitive outcomes [e.g. Mathematics (Creemers & Kyriakides, 2010b; Webster & Fisher, 2000; Young, 1998), Science (Webster & Fisher, 2000; Young, 1998), Language and Religion (Creemers & Kyriakides, 2010b)]. The findings demonstrated that the variation at the classroom level is far greater than that at the school level. It can be said that the classroom effect is more important than the school effect (Creemers & Kyriakides, 2008; Teddlie et al., 2000).

With respect to the proportion of the variation, given the three-level data structure, it is surprising that the variation in student attainment at school level is lower than 10% across the subjects as whole, especially in Arts, Mathematics and English Language. Unexpectedly, the modest size was approximate only 3%, 4% and 4%, respectively. In comparison between the variation of student attainment between school level and classroom level, the classroom was found to have a more significant effect than the school. Based on these outcomes, from a superficial view, it can be said that school level does not matter to students, and only classroom level is supposed to affect student attainment in Thai education system. However, an analysis of the two-level data structure was performed only for the student and school level; the variation of student attainment at school level was approximately 6-20% of total variation across eight main subjects. (See). The findings reflect a certain fact that the '*school level still matters for the Thai education system*', consistent with previous studies as shown earlier.

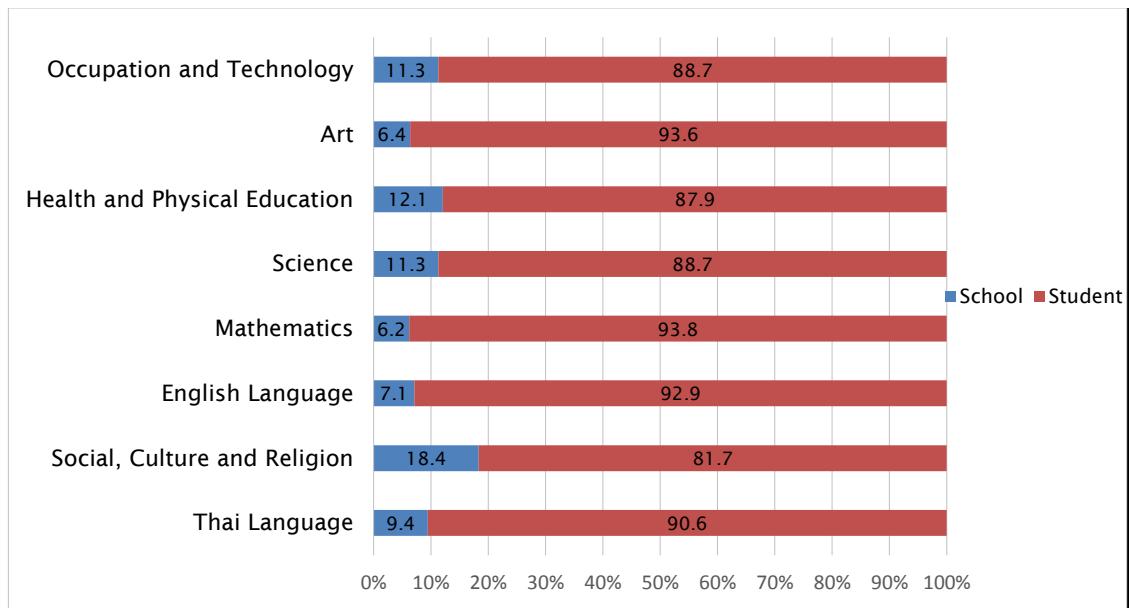


Figure 10-1 Percentage of variations of student attainment at student and school level: Two-level model

❖ **School effectiveness factors significantly affecting student attainment**

To answer the research question concerning the school qualities that affect student attainment in the Thai educational system, the conceptual framework under the dynamic model of educational effectiveness by Creemers and Kyriakides (2008) was adopted in the current study. It is viewed as the most up-to-date and effective educational model continuously developed from the comprehensive model of educational effectiveness (1994). The effectiveness factors were selected from the significant variables using meta-analysis (Kyriakides et al., 2010).

Therefore, the most up-to-date model was selected to determine whether and to what extent the model is suitable for the Thai educational context.

To develop a generic model of Thai school/educational effectiveness, in the current study, only significant variables were chosen and used for the integrated conclusion and discussion across eight subjects. Thus, the *overall* discussion is undertaken to allow the research to compare similarities and contrast in meanings and implications of the crucial effectiveness factors that affect student attainment. Nevertheless, the findings showed that the variance at the school level on Mathematics and English language, after controlling for student characteristics, classroom contexts, and school contexts, had *no* statistical significance ($p>.05$)

(see Model 5 in Chapter 8). For this reason, in the analysis, the school effectiveness factors based on the dynamic model were tested in these two subjects. Therefore, the discussions and conclusions may not be able to refer to these two subjects.

- **School policy on teaching**

The findings indicated that overall school policy concerned with the quality of teaching has a significantly positive effect on student attainment. Such a positive relationship exists in the Thai educational system and is consistent with the original version of the original dynamic model of educational effectiveness by Creemers and Kyriakides (2008) as well as the integrated model of school effectiveness by Scheerens (1990) and the comprehensive model of educational effectiveness by Creemers (1994). It has been widely recognised and proven theoretically for both school/educational effectiveness (Reynolds et al., 2000; Scheerens, 1992; Teddlie, Kirby, & Stringfield, 1989) and teacher effectiveness (Campbell, Kyriakides, Muijs, & Robinson, 2004; Muijs & Reynolds, 2010). Such school policy and practice is recognised as a vital facilitator in creating the condition of effective teaching in the classroom, thereby eventually leading to the quality of learning among students (Creemers & Kyriakides, 2008, 2010b). Without good-quality teaching/instruction, raising student attainment is difficult.

In addition, in the current study, school policy on the quality of teaching was measured by and related to eight main teacher factors, including classroom teaching/instruction, orientation, structuring, modelling, application, questioning, and assessment (Creemers & Kyriakides, 2008). This highlights the fact that school policy and practice on the quality of teaching needs to be linked with the classroom effectiveness factors, which refers to '*instruction/teaching roles*' to improve teaching in specific ways, not in general ways.

- **School policy related to creation of the school learning environment**

The findings indicate that, *overall*, school policy and practice related to creating the school learning environment has a significantly positive effect on student outcomes. Specifically, the school policy and practice concerned with provision of sufficient learning resources for teachers and students, as well as values in favour of learning, significantly influences student attainment. This is consistent with the original versions of the dynamic model of educational effectiveness by Creemers and Kyriakides (2008), the integrated model of school effectiveness by Scheerens

(1990), and the comprehensive model of educational effectiveness by Creemers (1994).

In general, it is found that school climate factors have been integrated into student learning in different ways such as academic engagement (Cornell, Shukla, & Konold, 2016) and learning motivation (Cohen, Mccabe, & Michelli, 2009).

According to Stringfield and Slavin (1992), 'school climate' refers to the general or whole school environment. However, the dynamic model views 'school climate' as based on the extent to which a learning environment is created or designed by school (Creemers et al., 2013). In addition, it can be considered that the most crucial predictor of school effectiveness for learning is the primary function rendered by the school. Nonetheless, the investigation of school effectiveness/education demonstrated that an effective school has the potential to satisfy the learning needs of students and engage the systematic changes of internal processes so that the ultimate educational goals, even in conditions of uncertainty are achieved (Creemers & Kyriakides, 2010a).

In essence, a significant discovery is that school policy concerned with the provision of sufficient learning resources has a positive effect on student attainment. According to a study by Hanushek (1989), the availability and effective application of school learning resources has an essential effect on student learning. Similarly, adequate learning resources move and stimulate the learning atmosphere among the learners and the student learning outcomes in both cognitive and non-cognitive respects. However, Creemers et al. (2013) argued that learning resources include but are not limited to physical resources and human resources in the school.

Another interesting finding in the current study is that, in some subjects (Social Studies, Culture and Religion, Arts, and Occupation and Technology), even the school contextual factors of educational difficulties (measured by school shortage or inadequacy in terms of qualified teachers, textbooks, instructional technologies, and equipment) have significantly and negatively affected student attainment (see Model 5 in Chapter 8). After a set of variables relating to the school policy and practice on creating school environment was added to the model, it was found that school educational difficulties have no adverse effect on student attainment. This implies that even in a school with inadequacies and limited school resources, its policies and practices have still optimised the budgets for activities. It is noted that 'the unlimited surpasses the limited' with regard to school effectiveness and efficiency.

- **Effectiveness dimensions affecting student attainment**

Apart from the three effectiveness factors affecting student attainment, the findings show that the mechanism of the three effectiveness factors above has been worked out through the mechanism of the dynamic model, including *frequency, stage, focus, quality and differentiation* (see Chapter 3). This finding contributes to the dynamic model of educational effectiveness in practice in the context of Thailand and is in line with the original version of the dynamic model.

To raise student attainment in practice, the three effectiveness factors mentioned above could not perform an exclusive function as optimally as it could because, it is merely indicative of, with its features, the characteristics of the factors that are significant to Thai education. The school policy and practice still required the more specific on each school effectiveness factors, as cited by Creemers and Kyriakides (2008) and Creemers (1994). Therefore, the effectiveness factors as multi-dimensional structure provide a clearer and more specific picture of the school on how it ought to be effective and how it contributes to the specific school strategy development to ensure more practical and apparent improvement in school performances.

10.2.2 Research question II

What is the extent of student attainment equity in Thailand? Which school factors significantly affect attainment equity at the school level in Thailand?

A multiple regression analysis revealed that the overall average SES, percentage of girls, school types, and school size make a significant contribution to attainment equity at the school level. However, in the current study, such school contextual factors showed no consistent effect across eight subjects.

❖ Average SES

The results showed that the average SES at the school level represented a significant contribution to school attainment equity in the following subjects: Thai Language, Social Studies, Culture and Religion, English language, Health and Physical Education, Arts, and Occupation and Technology. That is, a school with higher average SES is more likely to achieve higher attainment equity. This is consistent with the multilevel model that SES at the student level has a positive effect on student attainment.

Generally, SES is perceived as a vital predictor of student outcomes (Ainscow et al., 2012; Kelly, 2012). The findings indicate that a school with a higher average SES is capable of drawing the attention of parents with the financial power to support their children's education, in terms of being able to provide instructional materials, tutorials, and learning opportunities, etc. In addition, a school with a higher average SES is likely to have better resources, which include materials, infrastructure, modern technologies and applications, and qualified teachers/staff. With such resources, student attainment is enhanced continuously across groups of students. Thus, a high average SES narrows the gap in student attainment.

❖ Percentage of girls

The findings showed that the percentage of girls at the school level influences school attainment equity in Health and Physical Education, Arts, and Occupation and Technology. That is, a school with a high percentage of girls is more likely to achieve a higher level of attainment equity. It is consistent with the multilevel model study at the student level, which indicates that girls tend to outperform boys. The findings imply that, if girls perform better than boys at the individual level, a school with a higher proportion of girls is likely to perform better in student attainment.

The tendency for a larger proportion of girls within schools to achieve a higher student attainment may be due to greater competitiveness as seen in higher education. Moreover, a rich and active academic atmosphere drives students to develop and improve themselves. As a result, the academic achievement at school level or grade level bunches up.

❖ School size

The findings show that the size of a school affects school attainment equity in mathematics, English language, and science. A larger school is more likely to achieve higher attainment equity than small and medium-sized schools. In the context of Thai educational, larger schools tend to have a higher level of academic availability with more comprehensively equipped instructional supplies and personnel. For this reason, Thai parents prefer for their children to attend a large school as they expect it to provide a higher quality of education. However, the candidate students at large schools are recruited and selected based on their academic abilities. Indeed, schools are ranked roughly according to parents' perspectives on the extent of the academic excellence that a school achieves. Poor and disadvantaged students are more likely to attend a low-status school, while

moderate and relatively fair SES students are more likely to attend a larger school. Thus, larger schools have better opportunities to select high-achieving students, while smaller schools, lacking opportunities to select students, depend on their students' determination. Therefore, screening of students can to some degree ensure the quality of the students at larger schools, while screening can hardly be achieved at smaller schools. Consequently, the students at smaller schools are more likely to be diverse, whereas larger schools in Thailand experience a lower gap in student attainment.

10.2.3 Research question III

Do schools perform differently in terms of quality and equity across subjects within schools? How and why do schools perform in this manner?

❖ School policy and practice on the quality of teaching

The results suggested that effective schools have implemented school policy and practice in alignment with the rigorous teaching/instruction requirements under the Thai national curriculum in order to get their students ready for national testing. In contrast, ineffective schools have less rigorous teaching standards and indicators, which affect the pedagogy of the national curriculum. Consistent with other findings, this finding indicates that effective schools strongly focus on academic performance and a high level of teaching quality (Sammons et al., 1997).

A study conducted by the RMC Research Corporation (2006) indicates that effective schools have a high level of expectation for students to meet the standards, benchmarks, and indicators. As such, their school policies and practices place emphasis on conforming all activities to the national curriculum requirement.

Furthermore, Haycock (1999) investigated high-performing schools and schools with restricted educational resources in a rural community; similarly, the findings show that effective schools have implemented scheduled and systematic pedagogical plans, designated teaching and evaluation methods, and monitored the quality of the students in compliance with the national standards and the core curriculum requirements.

However, from the educational politics perspective of the national curriculum, the government dictates and adopts human resource development to achieve desirable outcomes for a favourable society. Also, it is often argued that local autonomy is ambiguous and restricted to what the teachers believe is right for their students,

which is often what the local community desires (Barber, 1996). The current study reflects these respective problems. For example, schools tend to primarily provide vocational programs or career-related activities for its poorer and more disadvantaged students, placing an emphasis on earning a living. Furthermore, a majority of these students leave secondary school and do not continue onto a higher level of education. As mentioned by Reid et al. (1988), schools have been under pressure to strike a balance between a '*formal curriculum*' (academic contents to be taught) and a '*hidden curriculum*' (social values in education and expectations of students after leaving school).

Ainscow et al. (2012) indicate that merely measuring student attainment-based school performance under the national curriculum may result in a mismatch between the national curriculum and the students' needs. In the current study, '*School B*' (that was differentially effective across subjects) adopted an integrated practice of local wisdom and a national curriculum in a balanced environment. This solution simultaneously helps to achieve the standards and indicators under the national curriculum and educate the students on what they can expect in the future after they leave the academic realm.

❖ Teaching preparation for national testing

In the current study, effective schools implemented school policies and practices in alignment with the rigorous teaching/instruction requirements under the Thai national curriculum and got their students ready for national testing. In contrast, ineffective schools have weakened the teaching standards and indicators provided by the national curriculum as well as the non-academic-focused practices (e.g. extracurricular and vocational development), in a way that is inconsistent with the national curriculum and standards. Consistent with previous studies, this indicates that *effective* schools have a high level of expectation with respect to their students' academic performance. For this reason, they have primarily targeted academic objectives.

In general, school performance measurement in many countries is primarily based on national testing, as is the case in Thailand. The school performance measured outcomes represent the quality of the schools. The interview data shows that both effective and ineffective schools made efforts to achieve the targeted school raw scores (exceeding an average required by the school district, province, country, etc.). A difference in focus evidently unveils the school policy and practice in two different types of schools. *Effective* schools tend to intensely focus on student

development through the school process, whereas *ineffective* schools tend to focus only on school outcomes. With a different focus, the two types of schools achieve their goals differently. To explain, effective schools focus on the continuous development of the students through the intensive and systematic instructional process, while ineffective schools are highly focused on exam-driven teaching, which is consistent with the education situation in China but with the slight difference that exam-focused teaching can propel school performance (Peng, 2013). In Thailand, where there is somewhat less learner capital, the students are not prompted to continue to a higher level. Ignoring the teaching standards and the national curriculum has subsequently devaluated human development.

❖ **School policy and practice in the provision of the school learning environment**

The study indicated that effective schools implemented school policies and practices in creating learning environments, physical investments, resources and academic atmosphere primarily through a variety of activities within the school. Consistent with the findings in the quantitative phases, the school policy on the provision of sufficient learning resources made a significant contribution to student attainment. Linnakyla, Malin, and Taube (2004) indicate that the school climate plays an extremely important role in promoting and supporting the development of the school and educational effectiveness because the academic atmosphere and learning environment arouses the students' learning. A primary function of the school, especially in socioeconomically disadvantaged areas, is to create an attractive academic environment as it is important for the students' learning and communication development as a learning community. Furthermore, having an attractive academic climate moves the schools toward effectiveness and further improvement (Muijs, Harris, Chapman, Stoll, & Russ, 2004).

In the context of education, given that the budget, resources, and educational personnel are limited and constrained, the school learning environment largely depends on, as determined by the schools themselves, the budget allocation, physical resources, and human resources (e.g. teachers and external experts). As mentioned above, effective schools strongly focus on creating an academic atmosphere, whereas ineffective schools devalue students' learning and place substantial weight on non-academic areas. Nonetheless, both the academic and non-academic outcomes are expected from the schools by society. However, compulsory education is viewed as necessary for people to advance to a higher level of education and live effectively in society. It is therefore believed that a

school focusing, promoting, and supporting a non-academic rather than an academic learning environment is ‘*going astray*’.

❖ **Provision of learning opportunities to ensure that every student can succeed**

A school’s commitment to the provision of learning opportunities to ensure that every student can succeed is a priority when it comes to improving equity within the school. In particular, the findings revealed that effective schools established school policy and practice on dealing with students with different backgrounds at intake and provided learning opportunities according to students’ individual needs and abilities. The qualitative findings are in agreement with this finding. This suggests that school policy and practice on teaching and creating a school learning environment to improve schooling quality should be characterised as ‘*differentiation*’ based on the learners’ specific needs, which emphasizes individual differences and unique learners’ needs. However, Creemers and Kyriakides (2008) argue that ‘*the differentiation dimension*’ does not imply that all students are expected to achieve the same purposes or outcomes, but that aligning the functions of each school effectiveness factors must be consistent with the learners’ specific needs to ensure each individual students’ achievement.

In addition, many previous empirical studies on high-performing schools have documented that effective schools have varying expectations for different groups of students and provide assistance and support that is adequate and necessary to reach the expected targets (Creemers et al., 2013; Haycock, 1999; RMC Research Corporation, 2006). According to Stoll and Fink (1996, p. 28), the dominant features of effective schools are as follows:

...promotes progress for all of its pupils beyond what would be expected given considerations of initial attainment and backgrounds, ensures that each pupil achieves the highest standard possible, enhances all aspects of pupil achievement and development and continues to improve from year to year.

The quote reflects the key role of pushing for effectiveness in terms of equity; namely, improving equity starts with building upon and developing what individuals are capable of to achieve what they ought to achieve.

10.3 Recommendation for policy and practice in Thai education system

Regarding past education policies, the paradigm shifts from an emphasis on quantitative expansion to the quality of education. The body of knowledge about '*what makes a school effective in the Thai education system*' is required as a key guideline for educational reform and policy-making in Thailand. In the past, there were no empirical investigations of school effectiveness that sought the integration of the quality and equity and/or student attainment across eight subjects according to the Basic Core Educational Curriculum within a single study. Also, *no* previous research has suggested a clear picture of the integration of all academic strands under the Thai Basic Educational Core Curriculum in a single paper. Therefore, the current study provides a detailed description of the school factors as a motivator to build the quality of education and attainment at the school level to benefit subsequent educational policy development for school/educational improvement in both the within- and beyond-school levels.

- **Potential method to measure school/educational effectiveness**

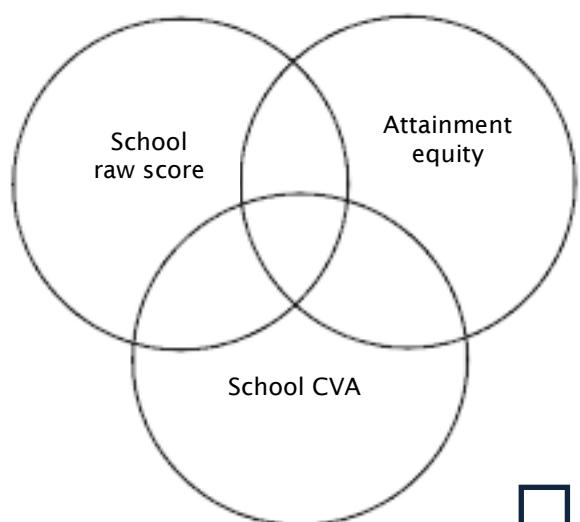
In the evaluation of Thai educational quality at the school level, it currently adopts the school league practices by comparing average school raw scores with the average levels (e.g., Education District Offices at the provincial, regional, and national levels, etc.), which results in unfairness measuring school performance. In addition, the results demonstrate that school raw scores are judged by school performance alone, leading to *unfair comparison* and *biased conclusions*, destroying quality of education. Interviews with the headteacher and other teachers indicated that if a school does not reach an average, which indicates failure of the school, a negative social label is implicitly rendered to the school.

In the current study, school performance is measured in terms of both quality and equity with the use of the School CVA and Kelly's AE index as a powerful pair of measures to identify the strengths and opportunities for school improvement (Kelly, 2012). Sammons (1999) argues that '*value-added*' is a necessary condition for an effective school, however, to a certain extent, it is not completely sufficient. Similarly, according to Peng (2013, p. 171), '*... value-added is not an effective representative for measured scores on evaluating the school effectiveness, but it should be used as a complement to the measured scores*'.

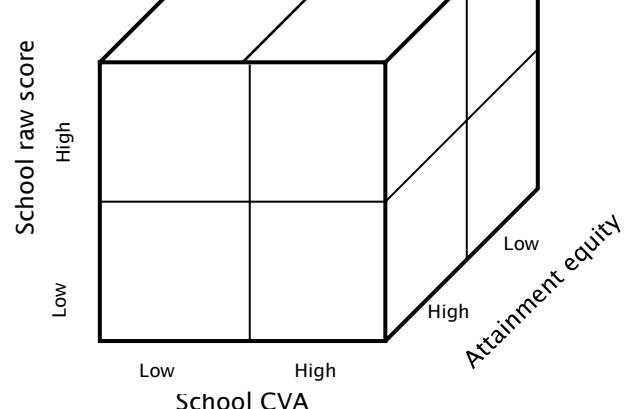
Therefore, an effective combination of multiple measurements for school performance is required. However, the ultimate goal of school effectiveness is to achieve both quality and equity in school performance comprehensively in various dimensions and reflect problems at the school level more accurately and precisely. The school raw scores and the School CVA-Kelly's AE should be applied to school effectiveness measurement.

Subject level

Concept



Measurement



School level

School classification based on the similarities of school raw score-school CVA-attainment equity patterns across eight main subjects

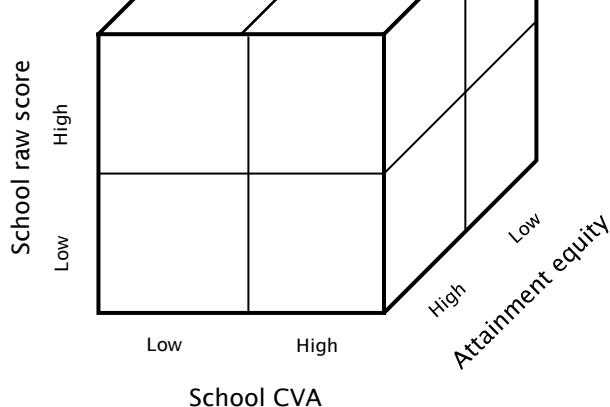


Figure 10-2 Proposed method to measure school/educational effectiveness

- **School effectiveness factors**

The findings in this study suggested that student characteristics appear to be a crucial factor having a strong effect on student attainment, evidenced by the percentage of student attainment, mainly at the student level. However, these factors are difficult to manage with government intervention and/or educational policy and practice. Given the complex nature of education in terms of the relationship between external school factors and student outcomes, in practice the school or educational agencies are more likely to cope with them through the school mechanism. In the present study, we mainly focus on school factors; the findings will provide some key guidelines.

The findings indicated that the differences in school effectiveness factors and effectiveness dimensions would affect the varying extent of student attainment in different subjects. In fact, even at the same school, there are different grades and subjects; each subject varies with its characteristics. Grades and subject vary even when the same teacher teaches the same course to different classes. This implies that school policy and practice related to the quality of education and attainment must be specific to each subject and each grade level. Given the complex nature of school effectiveness, the findings suggest core guidelines for schools to pursue broad improvement based on the shared characteristics across academic strands as indicated in the '*Thai Provincial Model of School Effectiveness*'. The model provides ways to improve the quality of learners by focusing on the administrative mechanism at the school level as follows:

- ❖ School policy and practice related to the quality of teaching (connecting with classroom practices including orientation, structuring, modelling, application, questioning, and assessment)
- ❖ School policy and practice related to creating the school learning environment
- ❖ School policy and practice related to provision of sufficient learning resources
- ❖ School policy and practice related to values favoured in learning.

In addition, to provide a clearer and better picture of what makes a school effective and to assist the policy makers and practitioners in creating specific school strategies for improving quality of schooling, such three school effectiveness factors should be defined and measured by multidimensional constructs:

- ❖ Frequency
- ❖ Focus
- ❖ Stage
- ❖ Quality
- ❖ Differentiation

- **Effective school policy and practice to raise school quality and equity**

The quantitative findings showed a comparison in the similarities and the differences between effective and ineffective schools in terms of quality and equity by selecting schools that demonstrate the specifically distinguished characteristics across eight main subjects in each school type to provide rich information of school data, suggesting that effective and ineffective schools have followed different practices at school levels:

- ❖ School policy and practice in teaching
 - Rigorous teaching and instruction aligned to the national curriculum
 - Teaching preparation for the national exams (O-NET)
- ❖ School policy and practice on provision of school learning environment
- ❖ Ensuring that every student can succeed
 - Dealing with different students' background at intake
 - Provision instruction/learning opportunity according to students' needs

Based on the findings mentioned above, the measures and practices to enhance quality and equity at the school level in the given timeline are provided in three stages as follows.

- ❖ **Stage I: Pre-class**

The school needs to provide a preparatory course so that the varying degrees of background knowledge amongst students can be adjusted to result in a more even starting point with regard to basic knowledge. Such activities may take place before the start of the semester and concurrently during the early stages of learning.

- ❖ **Stage II: During class**

At this stage, the school is responsible for implementing the policies to control and monitor the quality of teaching and learning to meet the standards and indicators aligned with the national curriculum. In addition, the school must provide

the practices that support and assist the students of each group according to the needs of students in each group, in order to ensure that all students achieve what they are capable of achieving. The school also has to create an academic environment that is conducive to academic learning to optimally promote and stimulate students' learning.

❖ **Stage III: Preparation for national testing**

This stage overlaps with stage II. The school needs to prepare its students at every grade level on a regular and continuous basis such that they become accustomed to the O-NET exams. The school must also provide intensive tutorials for the forthcoming O-NET exams to ensure that the students are well-equipped and well-prepared prior to taking the O-NET.

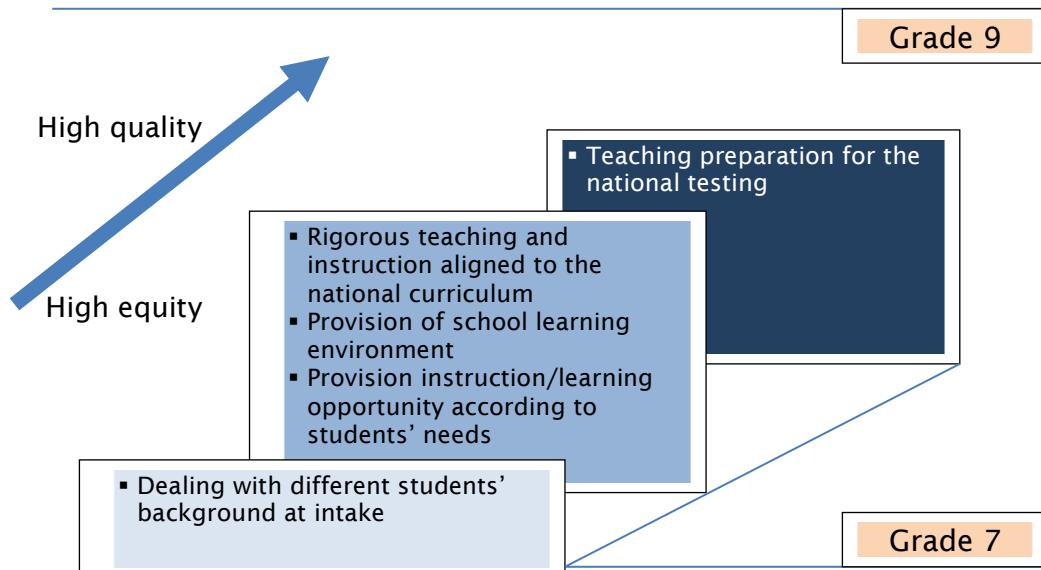


Figure 10-3 Thee stages to raise quality and equity within school

10.4 Contribution to the field of school/educational effectiveness research

In the previous section, the results of this study revealed the context-specific implications for guidelines relating to policies and practices in the context of the Thai education system. However, the findings can be further generalised to consider their significance beyond Thailand and to include a knowledge base or theoretical development of school/education effectiveness research. As Thailand is a part of Asia and global educational reforms, the findings provide a contribution to the global movement of school effectiveness research especially in developing Asian countries. As described by Cheng and Tam (2007), almost all Asian countries have endeavoured heavily toward educational investment with the high expectation that the improved quality of education would contribute to the economic and social development of the country; however, the educational outcomes regarding the quality of education have remained disappointing. This reflects a gap in the knowledge base in the field of school/educational effectiveness research in developing countries, which needs to be filled. Therefore, theoretical development of school/effectiveness research in developing countries is considered as an attempt to provide a comprehensive point of view of what makes a school effective, in both quality and equity of schooling, by seeking school effectiveness factors that lead to desired school outcomes. As cited by Scheerens (2001), '*the knowledge base in the empirical studies of developing countries will provide an incremental contribution to school/educational effectiveness and international comparison.*'

Therefore, this study, 'modelling school effectiveness and attainment equity in Thailand,' is considered to have an important role in driving and accumulating a knowledge base of school/educational effectiveness and improvement as part of worldwide educational reforms aimed at promoting both quality and equity of education. Based on the quantitative and qualitative findings, the researcher would like to draw attention to two school effectiveness models which were developed as main contributions in the study: (i) the provincial dynamic model of school effectiveness (based on quantitative findings) and (ii) the Thai school effectiveness-equity model (based on qualitative findings).

10.4.1 The provincial dynamic model of school effectiveness

In this study, the dynamic model of educational effectiveness, which is the most recent model in the field of school/educational effectiveness research, was adopted. As described in Chapter 3, the development of the dynamic model is mainly based upon a critical analysis of the comprehensive model of educational effectiveness by Creemers (1994) and a systematic review using meta-analysis (Kyriakides, Creemers, & Antoniou, 2010). As seen from the previously developed model, the trend of knowledge base or theoretical development in this field not only focuses on searching for effectiveness factors, but also attempts to define and measure effectiveness factors with multidimensional constructs which contribute to creating educational policy and practice in a more specific way (Creemers & Kyriakides, 2008).

The rationale of the provincial model

The development of the provincial dynamic model here is primarily based on the original version of the dynamic model for the following two main reasons.

Firstly, this original version of the dynamic model was mainly developed and tested within educational contexts in Western countries. The question relating to this model is how relevant it can be when applied to the educational contexts of developing countries with restricted educational resources, and how well it can be applied as a guide to promote the quality of schooling and equity in countries working within the 'vicious cycle' mentioned in Chapter 1. Therefore, this study has settled on the theory-driven approach, in which the original version of the dynamic model was adopted and tested within this different educational context. The results of this study contributed significantly to increasing robustness of the dynamic model, especially in developing countries.

Secondly, the development of the original version of the dynamic model was exclusively based on students' cognitive outcomes in Mathematics, Language, and Religious Education and an affective outcome in Religious Education (Creemers & Kyriakides, 2010). Similarly, most school/educational effectiveness studies have been mainly focused on only mathematics and language rather than on the whole curriculum (Creemers & Kyriakides, 2008). This is the main reason that the knowledge base of school/educational effectiveness has been restricted to further implications. Similarly, the generic model developed still retained a gap in knowledge due to imperfections and poor investigation of the whole desired student outcomes. To make a broader contribution to the knowledge base in the

field of school/educational effectiveness research, this quantitative study exclusively focuses on overall academic strands relating to the whole Thai Basic Core Curriculum (Ministry of Education, 2008a). Therefore, the findings of this study are expected to expand upon the limited knowledge base relating to school/educational effectiveness in a broader way within the school context.

The main characteristics of the provincial model

The key features of the Thai Provincial Dynamic Model of School Effectiveness are as follows:

Firstly, the provincial model is multilevel due to the way the school is structured, constituting three main levels: school, classroom, and student. This model concentrates primarily on the school process or 'within-school' factors. The 'beyond-school' factors (e.g. national and regional level) as proposed in the original version are excluded. The classroom level includes classroom contextual factors alone, whilst the quality of classroom teaching (orientation, structuring, modelling, application, questioning, assessment, management of time and classroom as a learning environment) as proposed in the original version are also excluded.

Secondly, it is assumed that school effectiveness factors not only have a direct and indirect effect on student outcomes but also directly influence classroom-level factors (Creemers & Kyriakides, 2010b; Kyriakides, Campbell, & Gagatsis, 2000). In other words, it is expected that school-level effectiveness factors play an important role in classroom teaching and student learning, respectively, within the school's context.

Thirdly, student outcomes in this study focus only on the cognitive outcomes across the whole core curriculum (the Basic Education Core Curriculum), while affective, psychomotor and new learning outcomes, as shown in Figure 2-3, are excluded.

Fourthly, in keeping with the original model, the provincial model is indicative of the effect of school effectiveness factors measured and identified in multidimensional constructs: frequency, focus, stage, quality, and differentiation (Creemers & Kyriakides, 2008).

Fifthly, the provincial dynamic model in this study could not include all independent variables in the multilevel model at the same time since some effectiveness factors (especially in school effectiveness factors and

multidimensional constructs) were strongly correlated with each other, causing 'multicollinearity' and leading to biased coefficient. To avoid this, a set of variables was included separately in the multilevel model. Therefore, school effectiveness factors affecting student outcomes in each dimension are taken into consideration separately (see Table 8-3 to Table 8-10).

The effectiveness school factors of the provincial dynamic model

Figure 10-4 presents the 'Thai Provincial Dynamic Model of School Effectiveness'. The results indicate three main overall school effectiveness factors affecting student outcomes in the Thai educational context. These include:

- School policy and practice related to the quality of teaching which promotes and encourages the teachers to improve students' learning through use of effective traditional teaching practices (Creemers & Kyriakides, 2008).
- School policy and practice related to creating an effective learning environment for classrooms as well as the whole school and the actions taken involve appropriate allocation of educational resources and investment in school activities at appropriate levels that would stimulate and facilitate learning for both students and teachers (Creemers & Kyriakides, 2008).
- School policy and practice relating to value on favour of learning which refers to the strategies implemented by the school to encourage both students and teachers to have a positive attitude towards continuous learning (Creemers & Kyriakides, 2008).

In addition, these three effectiveness factors, defined and measured in terms of multidimensional constructs (frequency, focus, stage, quality and differentiation), also affect student attainment.

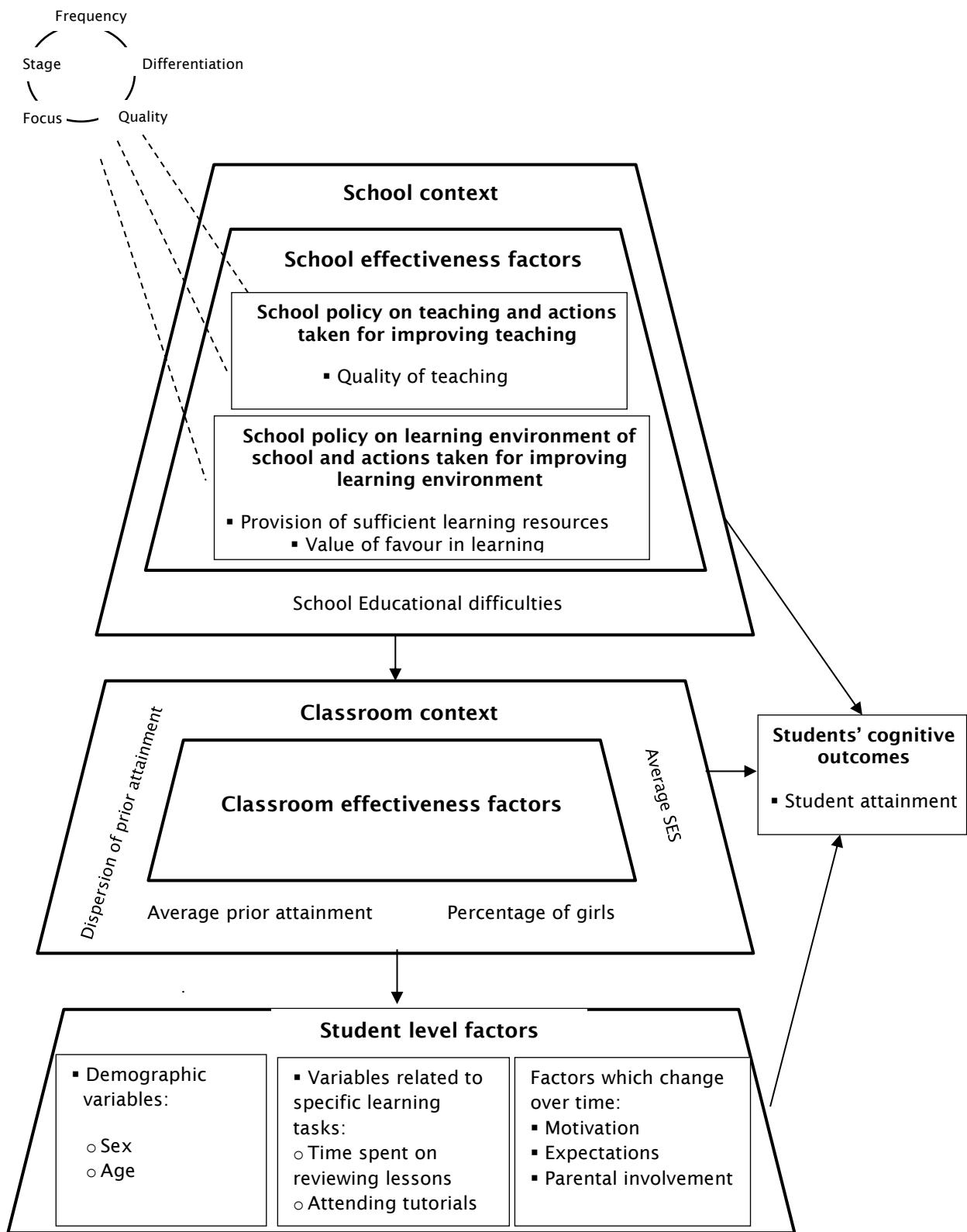


Figure 10-4 The Thai provincial dynamic model of school effectiveness

[Developed from the quantitative findings based on the original version of the dynamic model of educational effectiveness by Creemers and Kyriakides (2008)]

10.4.2 The Thai school effectiveness-equity model

In addition to the provincial dynamic model mentioned in the previous section, this qualitative study is considered to be the first research in a Thai educational context that combines both quality and equity within a single study. Although it is clearly evidenced by previous empirical studies that adequate educational resources and suitable school environment play a tremendous role in improving students' learning (Creemers & Kyriakides, 2008), personally the researcher believes that, given some school limitations (e.g. educational resources and budget constraints), the school can make a difference to students to some degree and its effects may vary from school to school. Therefore, this qualitative research aims at providing a clear picture by opening a 'school black box' to investigate why schools perform differently in terms of quality and equity of schooling.

As presented in , outcomes derived from the qualitative findings are shown in the model called the 'Thai school effectiveness-equity model'. Adopting the input-process-output model, this model is mainly focused on the school process which is connected with school inputs and outputs. To judge the school quality and equity, Sammons (2007) states that at least three main questions must be answered: the school is effective in promoting which outcome, for which student groups and over what time period? To apply these to this study, the school outputs refer to both quality and equity of schooling and the school inputs refer to student characteristics in terms of academic backgrounds. For the period of time, it is expected that there is a progress in student learning and/or attainment from time to time which, in this study, refers to Grade 7 (at intake) and Grade 9 (at exit).

Sergiovanni (1995) states that school success closely relies on having an effective school process. Specifically, Ainscow (2005) mentions that 'inclusion' requires a continuous process relating to identifying educational resources and obstacles in order to provide all students with equal educational opportunities to achieve meaningful education regardless of individual differences (e.g. ethnicity and student diversity). Therefore, identifying the major obstacles that affect the quality of schooling and inequality has to be a priority. The results, here, demonstrate that students' prior knowledge and literacy at intake are crucial factors that tremendously influence a student's ability to learn at a higher level. In other words, a lack of good prior knowledge and literacy is considered a barrier to higher level study. This is supported by the quantitative findings (see Chapter 8), and many

previous studies and school effectiveness models (see Chapter 3) demonstrate that prior attainment has the strongest impact on post attainment.

Within a whole school context, Ainscow et al. (2012) indicate that inequity primarily results from school structures and practices such as teaching methods, grouping students, school policy and practices related to students with special needs. Similarly, Dyson et al. (2002) argue that barriers to inclusive education at the school level are caused by school and classroom environment, school curriculum and classroom management. These school factors are closely linked with school process and mechanism through policy and practice. Therefore, the key to promoting quality and equity of schooling is inevitably concerned with school processes. In addition, as noted by Sergiovanni (1995), school process is only meaningful when its characteristics are closely linked to and related to school outcomes. In other words, separating school processes from expected outcomes achieves nothing.

To achieve the two ultimate goals (high quality and high equity), schools need to execute thorough school processes and mechanisms, with the expectation that this school policy and practice lead to improving teaching and learning as shown in the quantitative findings and the dynamic model (Creemers & Kyriakides, 2008). In the first stage of school improvement in quality and equity of schooling, it is imperative that schools deal with the diversity of student academic backgrounds at intake relating to the dilemmas of low prior attainment and illiteracy. If these issues are not resolved early, the problems will persist meaning that both quality and equity will hardly improve.

Further to this, school policy and practice should be developed to provide an effective academic learning environment. It is expected that school policy and practice not only affect a school's overall environment, but also have a wider impact on the classroom level. As supported by the original version of the dynamic model, school policy and practice directly involve classroom management among teachers (Creemers & Kyriakides, 2008). In addition, in the specific context of the Thai education system, rigorous teaching and instruction aligned to the Thai national curriculum, including teaching preparation for the O-NET exam, is a pre-requisite of quality and equity since it shows what the societal expectations are for student characteristics of Thai education.

In addition, the provision of teaching/instruction that meets students' individual needs and/or abilities should be paralleled with intensive classroom teaching. This

would promote progress of all groups of students, especially in students with special needs. It is considered a ‘school safety net’ that assists the ‘at risk’ marginalised groups.

As mentioned earlier, the Thai school effectiveness-equity model is informative since it focuses on school processes and mechanisms to promote the quality and equity of schooling, given consideration of students’ individual differences in prior attainment and literacy at intake. This is considered a big challenge in educational contexts, particularly in developing countries. Therefore, this study provides an expansion of the limited knowledge of school processes through policies and practices that lead to quality and equity of schooling.

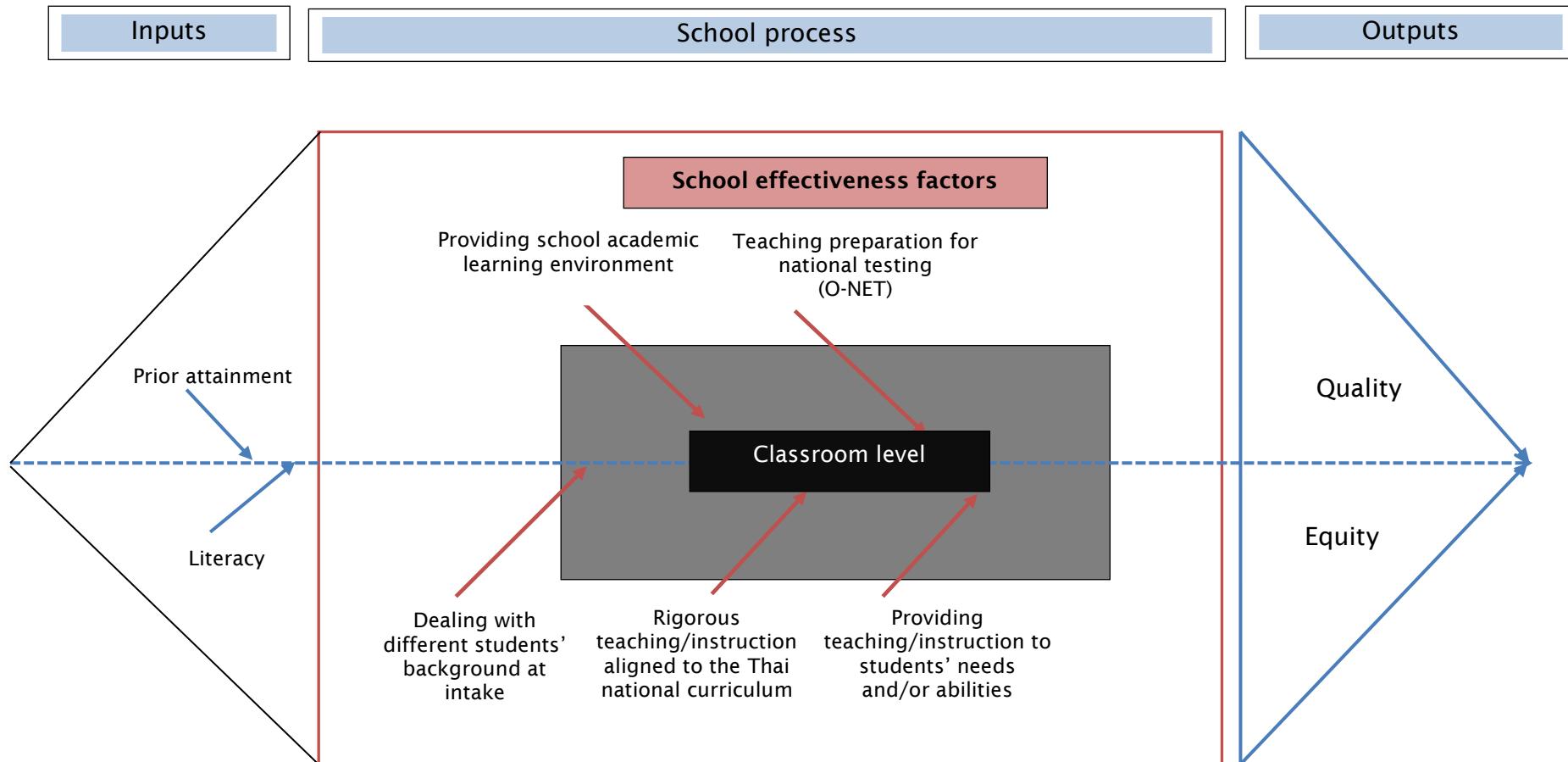


Figure 10-5 The Thai provincial school effectiveness-equity model based on the qualitative findings

10.5 Limitations and recommendations for future research

All research has encountered some limitations. However, the identified limitations not only serve as caution for understanding the study and findings, but they also indicate the areas which require a deeper consideration and further investigation to minimise those limitations and acquire an expanded knowledge. Despite the limitations found in this study, this doctoral thesis is significant as a starting point for future research on school effectiveness in Thailand.

- **Generalisation to any other province and to the whole country**

In the present study, the data was gathered from one cohort of students in the academic year 2012/13 in Prachin Buri Province, Thailand. This overview of school effectiveness research has some limitations concerning the generalisation or implementations to any other provinces. This indicates a further limitation on making generalisations about the entire country (see Chapter 6), since the quality of Thai education across the provinces and regions is dissimilar in both the quality of education and attainment. For future research work, other provinces should be examined in order to compare the similarity and dissimilarity in factors that affect the quality of schooling and attainment equity.

Furthermore, in this study, the lower secondary level as a final stage of the compulsory education system in Thailand was emphasised. As previously mentioned, the findings can be generalised in schools operating only a lower secondary level. However, it raises the question of whether it can be applied to other levels of Thai education. Therefore, future work is also required to examine other levels of education, namely the primary and upper secondary levels.

- **Emphasis on various educational outcomes**

In the present study, the dynamic model of educational effectiveness was adopted with the focus on cognitive outcomes, based solely on the national testing data of the NIETS. To obtain a more complete picture of educational effectiveness, future work should examine the non-cognitive outcomes of schooling, for instance: affective, psychomotor and new learning domains (Creemers & Kyriakides, 2008, 2012), or the desirable characteristics required by the Basic Educational Core Curriculum of Thailand (Ministry of Education, 2008a) (see Chapter 2).

- **Emphasis on classroom and student factors**

The findings indicated that most of the variation of student attainment is located at the student level, followed by the classroom and school level respectively. The present study found that the classroom level is much more significant than school level. Therefore, the suggested future investigations should focus on classroom factors that have an impact on student attainment, particularly in Mathematics and English Language; as the three-level model, after controlling student characteristics, classroom context and school context, found no statistically significant variation of student attainment at the school level. The benefits of future research are expected to complement and widen the body of knowledge on school effectiveness, and to increase the validity of the model.

- **Model development from parsimonious to complex as reality of educational nature**

With a deficit of the national systematic educational database, the body of knowledge relating to school/educational effectiveness in the country could not progress as expected and it has remained in the '*infant stage*'. With the constraints of the doctoral research budget and time, the author has simply focused on modelling parsimonious models as a fundamental baseline for further model development. As Creemers and Kyriakides (2008) mention, the model development should not be parsimonious, but should reflect its nature of complexity. The development of complex models requires advanced methodology. Thus, in future work, the quantitative study should cover the advanced statistical techniques (e.g. multilevel structural equation model, multilevel simultaneous equation model and multilevel social network analysis) to understand the mechanisms of the system of the quality improvement in Thailand's education system.

In addition, the development of the provincial dynamic model of school effectiveness, here, has been based on some assumptions. Future work should focus on reducing some assumptions, such as the interaction terms among variables within and/or between levels, testing non-linear relationships between effectiveness factors and student attainment, and so on.

Appendices

Appendix A Ethical approval in phase I (quantitative phase)



Mr Sorrapong Charoenkittayawut
School of Education
University of Southampton
University Road
Highfield
Southampton
SO17 1BJ

RGO Ref: 8758

03 September 2012

Dear Mr Charoenkittayawut

Project Title Modelling School Effectiveness and Attainment Equity in Thailand

This is to confirm the University of Southampton is prepared to act as Research Sponsor for this study, and the work detailed in the protocol/study outline will be covered by the University of Southampton insurance programme.

As the sponsor's representative for the University this office is tasked with:

1. Ensuring the researcher has obtained the necessary approvals for the study
2. Monitoring the conduct of the study
3. Registering and resolving any complaints arising from the study

As the researcher you are responsible for the conduct of the study and you are expected to:

1. Ensure the study is conducted as described in the protocol/study outline approved by this office
2. Advise this office of any change to the protocol, methodology, study documents, research team, participant numbers or start/end date of the study
3. Report to this office as soon as possible any concern, complaint or adverse event arising from the study

Failure to do any of the above may invalidate the insurance agreement and/or affect sponsorship of your study i.e. suspension or even withdrawal.

On receipt of this letter you may commence your research but please be aware other approvals may be required by the host organisation if your research takes place outside the University. It is your responsibility to check with the host organisation and obtain the appropriate approvals before recruitment is underway in that location.

May I take this opportunity to wish you every success for your research.

Yours sincerely

Dr Martina Prude
Head of Research Governance

Tel: 023 8059 5058
email: rgoinfo@soton.ac.uk

Corporate Services, University of Southampton, Highfield Campus, Southampton SO17 1BJ United Kingdom
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Appendix B Permission from provincial governor in Prachin Buri Province

ที่ ปจ ๐๐๑๖.๓/ ๑๔๔๗๖



ศala กลางจังหวัดปราจีนบุรี
ถนนสุวินทวงศ์ ปจ.๒๕๕๓๐

๑๔
๑๔
ธันวาคม ๒๕๕๕

เรื่อง ขอความอนุเคราะห์ในการเก็บรวบรวมข้อมูลโรงเรียนมัธยมศึกษาในจังหวัดปราจีนบุรี

เรียน ผู้อำนวยการสำนักงานเขตพื้นที่การศึกษามัธยมศึกษา เขต ๗

สิ่งที่ส่งมาด้วย สำเนาหนังสือของ นายสรพงษ์ เจริญกุตยาภิเษก ลงวันที่ ๗ ธันวาคม ๒๕๕๕

ด้วย นายสรพงษ์ เจริญกุตยาภิเษก นักศึกษาระดับปริญญาเอก หลักสูตร Doctor of Philosophy (Education) จาก School of Education, University of Southampton ประเทศสหราชอาณาจักรได้จัดทำดุษฎีนิพนธ์ในหัวข้อ “Modelling School Effectiveness and Attainment Equity” ภายใต้การดูแลของ Professor Dr.Anthony Kelly ซึ่งโครงการดังกล่าวได้ผ่านการพิจารณาของคณะกรรมการวิจัยในมหาวิทยาลัยเป็นที่เรียบร้อยแล้ว ในการนี้ นายสรพงษ์ เจริญกุตยาภิเษก ได้ขออนุญาตดำเนินการศึกษาวิจัยและเก็บข้อมูลในโรงเรียนรัฐบาลและเอกชน ในจังหวัดปราจีนบุรี โดยจะทำการเก็บรวบรวมข้อมูลจากนักเรียนที่กำลังศึกษาในระดับชั้นมัธยมศึกษาปีที่ ๓ ประจำปีการศึกษา ๒๕๕๕ ผู้ปกครอง ครุ และผู้บริหารสถานศึกษา ตั้งแต่เดือนธันวาคม ๒๕๕๕ เป็นต้นไป รายละเอียดตามสิ่งที่ส่งมาด้วยนี้

จังหวัดปราจีนบุรีพิจารณาแล้ว เห็นว่าผลที่ได้จากการศึกษาในครั้งนี้จะเป็นประโยชน์ในการวางแผนพัฒนาการศึกษาของจังหวัดปราจีนบุรีในโอกาสต่อไป จึงขอให้สำนักงานเขตพื้นที่การศึกษาประถมศึกษาปราจีนบุรี เขต ๑ และ เขต ๒ และสำนักงานเขตพื้นที่การศึกษามัธยมศึกษา เขต ๗ ได้แจ้งสถานศึกษาในสังกัดให้ความอนุเคราะห์ นายสรพงษ์ เจริญกุตยาภิเษก ในการดำเนินการศึกษาวิจัยและเก็บรวบรวมข้อมูลตามความประสงค์

จึงเรียนมาเพื่อกรุณาพิจารณา และขอขอบคุณมา ณ โอกาสนี้

ขอแสดงความนับถือ

(นายอรุณ พุ่มเพรา)
รองผู้ว่าราชการจังหวัด รักษาราชการแทน
ผู้ว่าราชการจังหวัดปราจีนบุรี

สำนักงานจังหวัด
กลุ่มงานอำนวยการ
โทร./โทรสาร ๐๓๗-๔๕๕๐๐๕

Appendix C Permission to use the national testing data (O-NET)



บันทึกข้อตกลงฉบับนี้ทำขึ้น ณ สถาบันทดสอบทางการศึกษาแห่งชาติ(องค์การมหาชน) เมื่อวันที่ ๒๙ พฤษภาคม ๒๕๕๖ ระหว่าง สถาบันทดสอบทางการศึกษาแห่งชาติ(องค์การมหาชน) โดย รองศาสตราจารย์ ดร.สัมพันธ์ พันธุ์พุกษ์ ตำแหน่ง ผู้อำนวยการสถาบันทดสอบทางการศึกษาแห่งชาติ (องค์การมหาชน) สำนักงานด้านอยู่ที่ ๑๒๘ อาคารพญาไทพลาซ่า ชั้น ๓๖ แขวงทุ่งพญาไท เขตราชเทวี กรุงเทพมหานคร ซึ่งต่อไปนี้เรียกว่า “ผู้ให้ข้อมูล” ฝ่ายหนึ่ง กับ นายสรพงษ์ เจริญกุตยา ณ อยู่ที่ ๕๒ หมู่ที่ ๔ ตำบลศรีเมืองหาโพธิ อำเภอศรีเมืองหาโพธิ จังหวัดปราจีนบุรี ซึ่งต่อไปนี้เรียกว่า “ผู้ขอข้อมูล” ฝ่ายหนึ่ง ทั้งสองฝ่ายได้ตกลงร่วมกันจัดทำบันทึกข้อตกลงฯ ดังนี้

๑. บันทึกข้อตกลงนี้จัดทำขึ้นระหว่าง ผู้ให้ข้อมูล กับ ผู้ขอข้อมูล โดยมีวัตถุประสงค์ ที่จะให้ ผู้ขอข้อมูล ใช้ประโยชน์จากข้อมูลผลทดสอบทางการศึกษาระดับชาติขั้นพื้นฐาน (O-NET) ที่ผู้ให้ข้อมูล ได้ดำเนินการจัดการทดสอบและรวบรวมข้อมูลผลทดสอบนี้ โดยข้อมูลที่จะนำไปใช้ประโยชน์ คือ ข้อมูลผลทดสอบทางการศึกษาระดับชาติขั้นพื้นฐาน (O-NET) ของนักเรียน ชั้นมัธยมศึกษาปีที่ ๓ ปีการศึกษา ๒๕๕๕-๒๕๕๖

๒. ผู้ขอข้อมูล ตกลงว่าจะนำข้อมูลไปใช้ในภารกิจ เพื่อใช้ในการเป็นข้อมูลประกอบในการทำวิทยานิพนธ์ เรื่อง “MODELLING SCHOOL EFFECTIVENESS AND ATTAINMENT EQUITY IN THAILAND”

๓. ผู้ขอข้อมูล จะต้องเป็นผู้รับผิดชอบในการจัดทำวัสดุอุปกรณ์เพื่อใช้ในการบันทึกหรือบรรจุข้อมูลที่ขอให้ประโยชน์ ตลอดจนรับผิดชอบค่าธรรมเนียมและค่าใช้จ่ายต่างๆ ที่เกิดขึ้นจากการนี้ด้วย

๔. ผู้ขอข้อมูล จะต้องไม่นำข้อมูลไปใช้ผิดจากข้อตกลงหรือนำไปใช้ในลักษณะที่ส่งผลกระทบหรือก่อให้เกิดความเสียหายแก่เจ้าของข้อมูล หากไฟล์นี้หรือเกิดความรับผิดทางแพ่งหรืออาญา ผู้ขอข้อมูล ต้องเป็นผู้รับผิดชอบในฐานะผู้ก่อให้เกิดความเสียหายชั้นดัน และเป็นผู้รับผิดชอบทางแพ่งแต่เพียงฝ่ายเดียว

๕. เพื่อให้การปฏิบัติงาน เกิดความคล่องตัวและมีประสิทธิภาพ ผู้ให้ข้อมูล ได้มอบหมายให้ นายอภิวัฒน์ พึงโพธิ์เจริญพันธ์ เป็นผู้ประสานงานในการดำเนินการตามข้อตกลงนี้

๖. ผู้ให้ข้อมูล...

๖. ผู้ให้ข้อมูล ขอสงวนสิทธิ์ในการระงับการใช้ประโยชน์จากข้อมูลผลคะแนนทดสอบทางการศึกษาระดับชาติขั้นพื้นฐาน (O-NET) เป็นการชั่วคราวหรือการเปลี่ยนแปลงวิธีการขอใช้ประโยชน์ข้อมูลได้ตามที่เห็นสมควร

๗. หาก ผู้ข้อมูล ไม่ปฏิบัติตามหลักเกณฑ์หรือวิธีการปฏิบัติที่ได้กำหนดไว้ในบันทึกข้อตกลงฉบับนี้ ผู้ให้ข้อมูล มีสิทธิยกเลิกหรือระงับการใช้ประโยชน์จากข้อมูลผลคะแนนทดสอบทางการศึกษาระดับชาติขั้นพื้นฐาน (O-NET) ได้ในทันทีที่ตรวจสอบพบ โดยไม่ต้องแจ้งให้ทราบล่วงหน้า

๘. เมื่อการใช้ประโยชน์จากข้อมูลผลคะแนนทดสอบทางการศึกษาระดับชาติขั้นพื้นฐาน (O-NET) ตามข้อ ๑ เสร็จสิ้น ผู้ข้อมูล ตกลงว่าจะส่งวิทยานิพนธ์ฉบับสมบูรณ์ ตามข้อ ๒ จำนวน ๑ ชุด ให้แก่ ผู้ให้ข้อมูล ต่อไป

บันทึกข้อตกลงฉบับนี้มีผลบังคับใช้ตั้งแต่วันที่มีการลงนามในบันทึกข้อตกลงเป็นต้นไป และทำขึ้นเป็นสองฉบับ มีข้อความถูกต้องตรงกันทุกประการ ทั้งสองฝ่ายได้อ่านและเข้าใจข้อความในบันทึกข้อตกลงเป็นอย่างดีแล้ว เห็นว่าถูกต้องตรงตามความประสงค์ จึงได้ลงนามไว้เป็นสำคัญ ต่อหน้าพยาน และเก็บรักษาไว้ฝ่ายละหนึ่งฉบับ

ลงชื่อ..... ลงชื่อ.....
 (นายสรพงษ์ เจริญกุศลยาภิ)
 ผู้ข้อมูล (รองศาสตราจารย์ ดร.สัมพันธ์ พันธุ์พุกนิช)
 ผู้อำนวยการ
 สถาบันทดสอบทางการศึกษาแห่งชาติ (องค์การมหาชน)

ลงชื่อ.. ..พยาน ลงชื่อ.. ..พยาน

Appendix D Student questionnaire

Official Use:

[] [] [] [] []

STUDENT QUESTIONNAIRE

PRACHIN BURI PROVINCE

School of Education

University of Southampton

INFORMATION ABOUT YOU

page 1

1. Student ID

Please check with your student card and fill your 5 digit numbers in the boxes.

[] [] [] [] []

2. Sex

Tick one box only

[] Male
[] Female

3. Date of Birth

[] [] / [] [] / [1] [9] [] []
Day Month Year

4. Height

.....
Number of centimetres

5. Weight

.....
Number of kilograms

6. Your permanent address

- a. Village
- b. Sub-District
- c. District
- d. Province

7. Which grade/age did you start learning English language?

- a. At school
Grade
- b. At home
Age

YOUR PERCEPTIONS

PAGE 2

8. How do you perceive your abilities in the following subjects?

Tick only one box in each row

Subjects	Very low	Low	Medium	High	Very high
a. Thai Language	[]	[]	[]	[]	[]
b. Social studies, Culture and Religion	[]	[]	[]	[]	[]
c. English Language	[]	[]	[]	[]	[]
d. Mathematics	[]	[]	[]	[]	[]
e. Science	[]	[]	[]	[]	[]
f. Health and Physical Education	[]	[]	[]	[]	[]
g. Arts	[]	[]	[]	[]	[]
h. Occupations and Technology	[]	[]	[]	[]	[]

9. How do you enjoy studying in the following subjects?

Tick only one box in each row

Subjects	Very low	Low	Medium	High	Very high
a. Thai Language	[]	[]	[]	[]	[]
b. Social Studies, Culture and Religion	[]	[]	[]	[]	[]
c. English Language	[]	[]	[]	[]	[]
d. Mathematics	[]	[]	[]	[]	[]
e. Science	[]	[]	[]	[]	[]
f. Health and Physical Education	[]	[]	[]	[]	[]
g. Arts	[]	[]	[]	[]	[]
h. Occupations and Technology	[]	[]	[]	[]	[]

YOUR PERCEPTIONS

PAGE 3

10. How do you perceive the importance of the following subjects to your future study?

Tick only one box in each row

Subjects	Very low	Low	Medium	High	Very high
a. Thai Language	[]	[]	[]	[]	[]
b. Social Studies, Culture and Religion	[]	[]	[]	[]	[]
c. English Language	[]	[]	[]	[]	[]
d. Mathematics	[]	[]	[]	[]	[]
e. Science	[]	[]	[]	[]	[]
f. Health and Physical Education	[]	[]	[]	[]	[]
g. Arts	[]	[]	[]	[]	[]
h. Occupations and Technology	[]	[]	[]	[]	[]

11. How well do your parents/guardians expect you to do in the following subjects?

Tick only one box in each row

Subjects	Very low	Low	Medium	High	Very high
a. Thai Language	[]	[]	[]	[]	[]
b. Social studies, Culture and Religion	[]	[]	[]	[]	[]
c. English Language	[]	[]	[]	[]	[]
d. Mathematics	[]	[]	[]	[]	[]
e. Science	[]	[]	[]	[]	[]
f. Health and Physical Education	[]	[]	[]	[]	[]
g. Arts	[]	[]	[]	[]	[]
h. Occupations and Technology	[]	[]	[]	[]	[]

STUDYING OUTSIDE CLASS

PAGE 4

12. How much times every week (approx.) do you usually review lessons in the following subjects?

Tick only one box in each row

Subjects	'None'	Less than 1 hour	1-2 hours	3-4 hours	More than 4 hours
a. Thai Language	<input type="checkbox"/>				
b. Social studies, Culture and Religion	<input type="checkbox"/>				
c. English Language	<input type="checkbox"/>				
d. Mathematics	<input type="checkbox"/>				
e. Science	<input type="checkbox"/>				
f. Health and Physical Education	<input type="checkbox"/>				
g. Arts	<input type="checkbox"/>				
h. Occupations and Technology	<input type="checkbox"/>				

ATTENDING TUTORIALS

PAGE 5

13. Have you attended tutorial classes outside your school?

Tick one box only

[] Yes

[] No (Go to the next question) 



If yes, which the following subjects and how many hours have you attended the tutorial class?

Tick as many boxes as appropriate and write down the number of hours you have attended in each period

[] **Thai Language**

[] Weekday....hours per week [] Semester break.....hours
[] Weekend...hours per week [] Summer break.....hours

[] **Social Studies, Culture and Religion**

[] Weekday....hours per week [] Semester break.....hours
[] Weekend...hours per week [] Summer break.....hours

[] **English Language**

[] Weekday....hours per week [] Semester break.....hours
[] Weekend...hours per week [] Summer break.....hours

[] **Mathematics**

[] Weekday....hours per week [] Semester break.....hours
[] Weekend...hours per week [] Summer break.....hours

[] **Science**

[] Weekday....hours per week [] Semester break.....hours
[] Weekend...hours per week [] Summer break.....hours

[] **Health and Physical Education**

[] Weekday....hours per week [] Semester break.....hours
[] Weekend...hours per week [] Summer break.....hours

[] **Arts**

[] Weekday....hours per week [] Semester break.....hours
[] Weekend...hours per week [] Summer break.....hours

[] **Occupations and Technology**

[] Weekday....hours per week [] Semester break.....hours
[] Weekend...hours per week [] Summer break.....hours

ACTIVITIES OUTSIDE CLASS

PAGE 6

14. How much time every week (approx.) do you usually spend doing the following activities?

Tick only one box in each row

Items	'None'	Less than 1 hour	1-2 hours	3-4 hours	More than 4 hours
a. Doing homework	<input type="checkbox"/>				
b. Using computer for enjoyment	<input type="checkbox"/>				
c. Using computer for studying	<input type="checkbox"/>				
d. Joining organised activities	<input type="checkbox"/>				
e. Socialising with friends	<input type="checkbox"/>				
f. Health and Physical Education	<input type="checkbox"/>				
g. Working at a paid job or working at home	<input type="checkbox"/>				
h. Watching TV or movies	<input type="checkbox"/>				

PARENT INVOLVEMENT

PAGE 7

15. How often every week do you discuss your classes/homework in the following subjects with your parents/guardian?

Tick only one box in each row

Subjects	'Never'	1-2 times	3-4 times	More than 4 times
a. Thai Language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Social studies, culture and religion	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. English Language	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Mathematics	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Science	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Health and Physical Education	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Arts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Occupations and Technology	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

YOUR DIFFICULTIES

PAGE 8

16. Have you had any difficulties dealing with aspects of your education in the following items?

Tick only one box in each row

Items	Yes	No
a. Uniforms	[]	[]
b. Stationary	[]	[]
c. Books	[]	[]
d. Lunch Meal	[]	[]
e. Money	[]	[]
f. Travel to School	[]	[]

17. After your Grade 9, do you intend to continue your education?

Tick one box only

Yes

No (Go to the next question) 



If yes, which study program do you plan to attend in your next level after grade 9?

Tick one box only

Academic pathway 

Identify which program you plan to attend:

Tick one box only

Mathematics and Science

Arts (Mathematics)

Arts (Language)

Other (specify).....

Vocational pathway

Other (specify).....



When do you expect to leave formal education?

Tick one box only

Grade 12

Vocational Certificate

High Vocational Certificate

University

Other (specify).....

THINGS YOU HAVE

PAGE 10

18. Do you have the following items in your home?

Tick only one box in each row

Items	Yes	No
a. Desk to study	[]	[]
b. Room of your own	[]	[]
c. Quiet place to study	[]	[]
d. Computer you can use for homework or study	[]	[]
e. Educational software	[]	[]
f. Internet connection	[]	[]
g. Dictionary	[]	[]
h. Books related to your studies	[]	[]
i. General books	[]	[]



If yes to question (i), which of the following best describes how many books there are in your home?

Tick one box only

- [] A few
- [] Many
- [] Very Many

THANK YOU VERY MUCH

Appendix E Parents/guardian questionnaire

Official Use:

[] [] [] [] [] []

PARENTS/GUARDIAN QUESTIONNAIRE

PRACHIN BURI PROVINCE

School of Education

University of Southampton

INFORMATION ABOUT YOUR STUDENT

PAGE 1

Instruction: *Before passing the questionnaire to your parents/guardians, please answer the below question.*

Student ID

Please check with your student card and fill your 5 digit numbers in the boxes.

[][][][][]

The remainder of this questionnaire will be answered by parents/guardian.

GENERAL INFORMATION

PAGE 2

1. Do you have any other child who is currently studying in Grade 9 in public or private schools in Prachi Buri Province?

Tick one box only

[] Yes

[] No (Go to the next question)



If yes, what is/are your child/children's name and which school is/are he/she/they currently studying?

a.

b.

c.

d.

e.

f.

g.

h.

First name

Last name

School's name

FATHER OR MALE GUARDIAN

PAGE 3

2. What is the highest level of education completed by father or male guardian?

Tick one box only

- Non-Educated
- Primary School
- Secondary School
- Vocational Certificate
- Undergraduate Degree
- Postgraduate Degree

3. What is father or male guardian's main occupation?

Tick one box only

- Housework/house parent
- Unemployed
- Government officer
- Professional
- Technical work
- Service or sale in the shop/market
- Skilled and other enterprise
(e.g. manufacturing, metal, machine, constructing etc.)
- Primary occupation
(e.g. labor in agriculture, fishing, construction, production, transport etc.)
- Soldier /Police
- Other (specify).....

4. What is father or male guardian's income per year (approx.)?

.....

Baht per year

MOTHER OR FEMALE GUARDIAN

PAGE 4

5. What is the highest level of education completed by mother or female guardian?

Tick one box only

- Non-Educated
- Primary School
- Secondary School
- Vocational Certificate
- Undergraduate Degree
- Postgraduate Degree

6. What is mother or female guardian's main occupation?

Tick one box only

- Housework/house parent
- Unemployed
- Government officer
- Professional
- Technical work
- Service or sale in the shop/market
- Skilled and other enterprise
(e.g. Manufacturing, metal, machine, constructing etc.)
- Primary occupation
(e.g. labor in agriculture, fishing, construction, production, transport etc.)
- Soldier/Police
- Other (specify).....

7. What is mother or female guardian's income per year (approx.)?

.....

Baht per year

PARENTS' OR GUARDIAN'S PERCEPTION

PAGE 5

8. How do you agree or disagree with the following statements?

Tick only one box in each row

Statement	'I do not know'	Strongly Disagree	Disagree	'Average'	Agree	Strongly Agree
a. Most teachers are competent.	<input type="checkbox"/>					
b. Most teachers are dedicated.	<input type="checkbox"/>					
c. Student achievement standards are high in this school.	<input type="checkbox"/>					
d. The academic content in this school meets a high standard.	<input type="checkbox"/>					
e. The instructional methods used are of a high standard.	<input type="checkbox"/>					
f. The school atmosphere/ethos is conductive to study.	<input type="checkbox"/>					
g. Student progress is closely monitored by school.	<input type="checkbox"/>					
h. The school regularly provides information about student progress.	<input type="checkbox"/>					

SCHOOL INVOLVEMENT

PAGE 6

9. How often have you discussed the following issues with teacher(s) in the school?

e. Child's behaviour

Tick one box only

- Never
- Seldom
- Sometimes
- Always

f. Child's academics

Tick one box only

- Never
- Seldom
- Sometime
- Always

10. How often have you attended meetings at the school?

Tick one box only

- Never
- Seldom
- Sometimes
- Always

11. What is your highest expectation for your child that he/she reaches?

Tick one box only

- Grade 9
- Grade 12
- Vocational Certificate
- High Vocational Certificate
- University

SCHOOL CHOICE

12. Why did you choose this school for your child?

Tick as many as appropriate

- I had no input; my child chose it
- Short distance from home
- Good reputation
- The particular curriculum/courses/subjects provided
- Religious belief/ school philosophy
- Other family members attended
- Low Expense / financial reasons
- Attractive school climate
- High student achievement
- Safe environment
- Other (specify).....

Please return this questionnaire to your child.

Thank you very much!!

Appendix F Teacher questionnaire: A sample questionnaire for Thai Language teachers

Official Use:

[] [] [] [] [] [] [] [] []

TEACHER QUESTIONNAIRE THAI LANGUAGE

PRACHIN BURI PROVINCE

**School of Education
University of Southampton**

INFORMATION ABOUT YOU

PAGE 1

1. Sex

Tick one box only

Male
 Female

2. Age

.....

Number of years

3. What is your education background and what was the main area of study?

Tick as many boxes as appropriate.

<input type="checkbox"/> Bachelor Degree	<i>Tick one box only</i> <input type="checkbox"/> Thai Language/Thai Literature/Thai Studies <input type="checkbox"/> Thai Education/ Teaching Thai Language <input type="checkbox"/> Other (specify).....
<input type="checkbox"/> Master's Degree	<i>Tick one box only</i> <input type="checkbox"/> Thai Language/Thai Literature/Thai Studies <input type="checkbox"/> Thai Education/ Teaching Thai Language <input type="checkbox"/> Other (specify).....
<input type="checkbox"/> Doctoral Degree	<i>Tick one box only</i> <input type="checkbox"/> Thai Language/Thai Literature/Thai Studies <input type="checkbox"/> Thai Education/ Teaching Thai Language <input type="checkbox"/> Other (specify).....

4. How many years in total have you taught Thai language?

.....

Number of years

5. How many years have you taught Thai language in this school?

.....

Number of years

SHORTAGE

PAGE 2

6. Do you have a shortage in any of following resource areas?

Tick only one box in each row

Shortage of ...	The shortage affects teaching quality	The shortage does <u>not</u> affect teaching quality
a. Computer <u>hardware</u>	[<input type="checkbox"/>]	[<input type="checkbox"/>]
b. Computer <u>software</u>	[<input type="checkbox"/>]	[<input type="checkbox"/>]
c. Support for using computers	[<input type="checkbox"/>]	[<input type="checkbox"/>]
d. Textbooks for students' use	[<input type="checkbox"/>]	[<input type="checkbox"/>]
e. Instructional equipment	[<input type="checkbox"/>]	[<input type="checkbox"/>]
f. School facilities	[<input type="checkbox"/>]	[<input type="checkbox"/>]

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school?

School policy in teaching and actions taken for improving teaching consists of three main aspects:

- (i) Making good use of teaching time (i.e. management of time, student and teacher absenteeism, homework/assignments/academic tasks, lesson schedule and timetable, provision of learning opportunity/extracurricular activities)
- (ii) Provision of learning opportunity (i.e. the achievement of specific purposes determined by usage of educational technology/equipment/educational innovation in teaching, coping with students with special educational needs (e.g. students who struggle with their study, gifted students, students with special interests, students with learning difficulties), and long-term planning provided by teachers)
- (iii) Quality of teaching/Teacher instructional behavior in the classroom (e.g. orientation, structuring lessons, questioning techniques, student assessment, providing the opportunity to practice, developing students' thinking skills and problem solving etc.)

School policy for creating a school learning environment (SLE) and actions taken for improving the SLE includes of five main aspects:

- (i) Student behavior outside the classroom during school break time
- (ii) Collaboration and interaction among teachers
- (iii) Partnership policy
- (iv) Provision of learning educational resources
- (v) Developing positive attitude towards learning

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
1. At teacher/staff meetings, the following school policy and actions in teaching and/or school learning environment have been concerned with:					
a. Making good use of teaching time	<input type="checkbox"/>				
b. Provision of learning opportunities/ extra curriculum activities (e.g. school trip, academic camping, academic festivals, tutorials, academic clubs, sports festivals etc.)	<input type="checkbox"/>				
c. Effective teaching methods	<input type="checkbox"/>				
d. Teachers' and staff's roles dealing with student behaviours outside classroom during school break time	<input type="checkbox"/>				

SCHOOL POLICY

PAGE 4

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
e. Developing interaction between teachers and students	<input type="checkbox"/>				
f. Collaboration and interaction among teachers in teaching	<input type="checkbox"/>				
g. Collaboration and interaction among teachers in doing research and/or developing educational innovations	<input type="checkbox"/>				
h. Collaboration and interaction among teachers in student affairs (e.g. student clubs, student administration etc.)	<input type="checkbox"/>				
i. Budget allocation for buying educational technology equipment for teaching (e.g. overhead projectors, computers etc.)	<input type="checkbox"/>				
j. Budget allocation for improving school learning environment (e.g. library books, software, sports equipment etc.)	<input type="checkbox"/>				
k. Value in favor learning/continual learning	<input type="checkbox"/>				
l. Teacher professional development	<input type="checkbox"/>				
2. The school takes part in academic programs which are intended to improve the quality of teaching in: (e.g. action research projects, pilot projects in development in the quality of teaching, MOU with other schools or educational institutes, World-Class Standard school projects, Baldrige Education Criteria of Performance Excellence projects etc.)					
a. Management of teaching time	<input type="checkbox"/>				
b. Provision of learning opportunities/ extra curriculum activities	<input type="checkbox"/>				

SCHOOL POLICY

PAGE 5

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
c. Developing teaching quality and instructional behavior roles	<input type="checkbox"/>				
3. Teaching materials/notification are displayed on school noticeboards related to:					
a. Making good use of teaching time	<input type="checkbox"/>				
b. Provision of learning opportunities/ extra curriculum activities	<input type="checkbox"/>				
c. Effective teaching methods	<input type="checkbox"/>				
d. Usage of technology equipment/educational innovation in teaching	<input type="checkbox"/>				
4. At the parent meetings launched by school, the approaches of cooperation between parents/guardians and teachers to deal with the following issues are discussed and decisions made:					
a. Student absenteeism	<input type="checkbox"/>				
b. Homework/assignments/academic tasks	<input type="checkbox"/>				
c. Students with special educational needs	<input type="checkbox"/>				
d. Provision of learning opportunity and/or support by parents/guardians (e.g. financial support, educational visits)	<input type="checkbox"/>				
5. Experts/specialists are invited to conduct in-service training for teachers.	<input type="checkbox"/>				

SCHOOL POLICY

PAGE 6

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
6. In my school, teachers realize that everyone can learn from each other no matter what level knowledge and skills he/she has.	<input type="checkbox"/>				
7. The school has systematic records in:					
a. Student absenteeism	<input type="checkbox"/>				
b. Teacher/staff absenteeism	<input type="checkbox"/>				
c. Students with special educational needs	<input type="checkbox"/>				
d. Long-term planning prepared by teachers	<input type="checkbox"/>				
e. Provision of extra curriculum activities (not included in the curriculum)	<input type="checkbox"/>				
f. Problems with student misbehaviors/bullying during school break time	<input type="checkbox"/>				
g. Usage of educational tools/equipment/technology for teaching practice	<input type="checkbox"/>				
8. Before the semester starts, the following school policy is established:					
a. Management of teaching time	<input type="checkbox"/>				
b. Provision of learning opportunities/ extra curriculum activities	<input type="checkbox"/>				
c. Effective teaching methods	<input type="checkbox"/>				

SCHOOL POLICY

PAGE 7

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
d. Teachers' and staff's roles dealing with student behaviours outside classroom during school break time	[]	[]	[]	[]	[]
e. Collaboration and interaction among teachers	[]	[]	[]	[]	[]
f. Parental involvement in students' learning process	[]	[]	[]	[]	[]
g. Effective use of educational tools/equipment/technology for teaching	[]	[]	[]	[]	[]
h. Value and approach to train teachers	[]	[]	[]	[]	[]
9. The following school policy is continuous:					
a. Management of teaching time	[]	[]	[]	[]	[]
b. Improving teaching quality/teacher instructional roles	[]	[]	[]	[]	[]
c. Teachers' and staff's roles dealing with student behaviors outside classroom during school break time	[]	[]	[]	[]	[]
d. Collaboration and interaction among teachers	[]	[]	[]	[]	[]
e. Parental involvement	[]	[]	[]	[]	[]
f. Provision of learning resources	[]	[]	[]	[]	[]
g. Value of favor learning/continual learning	[]	[]	[]	[]	[]

SCHOOL POLICY

PAGE 8

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
10. At teacher/staff meetings, discussions assist me to specifically improve my practices in:					
a. Management of teaching time	<input type="checkbox"/>				
b. Provision of learning opportunities/ extra curriculum activities	<input type="checkbox"/>				
c. Teaching practice in classroom	<input type="checkbox"/>				
d. Teacher's role during school break time	<input type="checkbox"/>				
e. Involving parents/guardian to enhance students' learning process	<input type="checkbox"/>				
f. Usage of educational tools/ equipment/technology for teaching practice	<input type="checkbox"/>				
11. Each decision made related to teaching proposes to accomplish specific objectives.	<input type="checkbox"/>				
12. School policy in teaching provides specific guidelines referring to specific curriculum/ academic strands/grade levels in the following issues:					
a. Management of teaching time	<input type="checkbox"/>				
b. Provision of learning opportunities/ extra curriculum activities	<input type="checkbox"/>				
c. Teaching practice in classroom	<input type="checkbox"/>				

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
13. Each decision made related to school learning environment proposes to accomplish specific purposes.	<input type="checkbox"/>				
14. A different decision is made for specific problem in school learning environment the school encounters.	<input type="checkbox"/>				
15. A specific policy has been defined in my school to deal with students' behaviour during break time.	<input type="checkbox"/>				
16. When teaching specific lessons or series of chapters in my school, teachers assist each other by sharing their ideas and instructional materials.	<input type="checkbox"/>				
17. Teachers/staff participate in school- based seminars/meetings organised by the school for cooperatively deal with the specific problems that school currently encounters.	<input type="checkbox"/>				
18. Teaching practices are observed by the school principal or other staff members who provide specific recommendations to enhance teachers' efficiency or improve their teaching.	<input type="checkbox"/>				
19. School makes decision to launch academic activities/extra curriculum activities during break time or semester to encourage students to develop/improve specific learning goals.	<input type="checkbox"/>				

SCHOOL POLICY

PAGE 10

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
20. School provides resolutions towards specific co-operation with parents/guardians to enhance student learning process.	[]	[]	[]	[]	[]
21. School policy is concerned with providing educational tools/equipment for teaching in each subject.	[]	[]	[]	[]	[]
22. School policy proposes projects to build good attitudes on learning in specific academic strands.	[]	[]	[]	[]	[]
23. School policy is concerned with the value of favor learning in every group of people in school.	[]	[]	[]	[]	[]
24. Teachers in my school are encouraged to coordinate with the students' parents to cope with the students' personal problems.	[]	[]	[]	[]	[]
25. School provides sufficient learning resources/equipment for students with extra learning need (e.g. students who are at risk and/or gifted students).	[]	[]	[]	[]	[]
26. Sufficient time is taken into consideration when determining the school-timetable to allow both students and/or teachers to rotate between different classrooms.	[]	[]	[]	[]	[]

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
27. The teacher/staff meetings make a positive impact on me in the following aspects:					
a. Management of teaching time spent on the academic activities in curriculum	<input type="checkbox"/>				
b. Management of teaching time spent on the extra academic activities beyond the formal curriculum	<input type="checkbox"/>				
c. Coping with student absenteeism	<input type="checkbox"/>				
d. Homework/assignment/academic tasks	<input type="checkbox"/>				
e. Coping with students with special educational needs	<input type="checkbox"/>				
f. Long-term planning in teaching	<input type="checkbox"/>				
g. Teacher instructional roles	<input type="checkbox"/>				
h. Improving students' learning strategies	<input type="checkbox"/>				
i. Creating learning environment in the classroom	<input type="checkbox"/>				
j. Interaction with students during school break time	<input type="checkbox"/>				
k. Usage of new technology equipment/educational innovation in improving the quality of teaching	<input type="checkbox"/>				
28. School break time is considered an opportunity to personally discuss/interact with students.	<input type="checkbox"/>				

SCHOOL POLICY

PAGE 12

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
29. Teachers in my school agree that school break time is an opportunity for teachers to communicate/interact with students who struggle in their learning.	[]	[]	[]	[]	[]
30. Previous research findings and/or guidelines/academic documents provided by the Ministry of Education or educational institutes are applied to form a school policy relating to:					
a. Collaboration and interaction among teachers	[]	[]	[]	[]	[]
b. Parental involvement	[]	[]	[]	[]	[]
c. Educational resources utilisation for teaching	[]	[]	[]	[]	[]
31. Teachers in my school observe each other teaching which is useful to consult and exchange views to improve their teaching.	[]	[]	[]	[]	[]
32. A clear policy for parental involvement to enhance their children's learning process is formed in my school.	[]	[]	[]	[]	[]
33. At teacher/staff meetings, decisions are usually made to provide suitable methods to allow parents to participate in their children's learning process.	[]	[]	[]	[]	[]

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
34. My school provides the chance for various external groups/people to participate in our learning process and coordinate with our teachers.	<input type="checkbox"/>				
35. Opportunities for teachers offered by the school have an influence on professional development and training as discussed at staff meetings.	<input type="checkbox"/>				
36. The way teachers can develop by learning something through his/her faults were mentioned in school meetings.	<input type="checkbox"/>				
37. School provides extra support to students with extra learning needs (e.g. students who are at risk and/or gifted students).	<input type="checkbox"/>				
38. Extra support is provided to teachers who need of further professional development.	<input type="checkbox"/>				
39. School takes into account teachers' professional development to improve the quality of teaching in less effective points.	<input type="checkbox"/>				
40. More support is provided to teachers who face difficulties in implementing school policy in teaching.	<input type="checkbox"/>				

7. To what degree do you perceive the school policy and actions taken for improving teaching and school learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
41. School policy is designed to <u>further support</u> the students who are less likely to implement the school policy on teaching in the following issues:					
a. Student absenteeism (e.g. Students who are out of school for a long period)	[]	[]	[]	[]	[]
b. Students who face financial problems	[]	[]	[]	[]	[]
c. Students with inappropriate behaviours	[]	[]	[]	[]	[]
d. Teachers who drop out regularly	[]	[]	[]	[]	[]
42. School policy attempts to stimulate students' curiosity and/or to build value of favor learning in the academic strands that students are weak.	[]	[]	[]	[]	[]
43. The teachers spend more time with students who encounter academic problems than with other classmates during break time.	[]	[]	[]	[]	[]
44. More often meetings are prepared for cooperation and sharing ideas between the school teachers who teach the same grades/subjects.	[]	[]	[]	[]	[]
45. Teachers in my school are encouraged to coordinate with the students' parents to cope with academic problems.	[]	[]	[]	[]	[]
46. In-service seminars are held by the management team (including principal and deputy head) for a specific group of teachers when necessary (for instance, teachers who are recently appointed).	[]	[]	[]	[]	[]

SCHOOL EVALUATION

PAGE 15

8. To what degree do you perceive the evaluation of school policy in teaching in your school?

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
1. Data used in evaluation in implementing school policy in teaching is collected from:					
a. Students	[]	[]	[]	[]	[]
b. Teachers	[]	[]	[]	[]	[]
c. Parents/Guardians	[]	[]	[]	[]	[]
2. How the teaching policy is implemented into practice is observed by the principal and/or other members of the school staff and the findings are presented by this team to staff.	[]	[]	[]	[]	[]
3. The school policy or new decisions in teaching can be redefined by using data gathered during assessment of the school policy in teaching.	[]	[]	[]	[]	[]
4. Evaluation of school policy in teaching is a continuous process.	[]	[]	[]	[]	[]
5. The school policy in teaching is independently evaluated for a specific domain (i.e. time management, provision of learning opportunity, quality of teaching, school learning environment)	[]	[]	[]	[]	[]
6. Evaluation is conducted in the school to assess teachers' capacity to apply the school policy on teaching	[]	[]	[]	[]	[]
7. The school leaders/principal use the findings from the evaluation of the school policy in teaching for formative reasons (e.g. improving teaching quality, teaching career development).	[]	[]	[]	[]	[]

SCHOOL EVALUATION

PAGE 16

8. To what degree do you perceive the evaluation of school policy in teaching in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
8. The data gathered for evaluating the school policy in teaching is reliable.	<input type="checkbox"/>				
9. Data gathered for evaluating the school policy in teaching is valid.	<input type="checkbox"/>				
10. Issues of school policies on teaching which are considered problems or weakness of the school are followed-up.	<input type="checkbox"/>				
11. Issues of school policies on teaching which are considered problems or weakness of the school will be examined in much more detail and depth.	<input type="checkbox"/>				

SCHOOL EVALUATION

PAGE 17

9. To what degree do you perceive the evaluation of school policy in learning environment in your school?

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
1. In consequence of the school policy, the school assesses the extent to which difficulties of student orderliness during break time could be decreased.	<input type="checkbox"/>				
2. How the school policy on learning environment is implemented into practice is observed by the principal and/or other members of the school staff and the findings are presented by this team to staff.	<input type="checkbox"/>				
3. The evaluation of the teachers' effort to speak to students in order to encourage them to improve positive perspectives towards school and studying is conducted.	<input type="checkbox"/>				
4. The redesigned policy or new decision making applies the data gathered during the assessment of the policy on the wider learning environment.	<input type="checkbox"/>				
5. Evaluation of school policy on learning environment is a continuous process.	<input type="checkbox"/>				
6. The school policy on teaching is independently evaluated for specific domain (i.e. student behavior during school time break, collaboration and interaction among teachers, partnership policy, provision of learning resources, and value of favor learning).	<input type="checkbox"/>				
7. The evaluation is done to assess teachers' attempt to accomplish the school's cognitive, emotional and several academic purposes.	<input type="checkbox"/>				

SCHOOL EVALUATION

PAGE 18

9. To what degree do you perceive the evaluation of school policy in learning environment in your school? (continued)

Tick only one box in each row

Items	Strongly Disagree	Disagree	'Neutral'	Agree	Strongly agree
8. The data gathered during the assessment of the school's learning circumstance is general and the school staff is mentioned as an entire party without any reference to specific people.	[]	[]	[]	[]	[]
9. The data gathered for evaluating the school policy on learning environment is reliable.	[]	[]	[]	[]	[]
10. Data gathered for evaluating the school policy on learning environment is valid.	[]	[]	[]	[]	[]
11. The professional improvement/additional school specifies academic requirement of teachers.	[]	[]	[]	[]	[]
12. Issues of school policies on learning environment which are considered problems or weaknesses are continuously followed-up.	[]	[]	[]	[]	[]
13. Issues of school policies on learning environment which are considered problems or weaknesses will be examined in much more detail and depth.	[]	[]	[]	[]	[]

THANK YOU VERY MUCH

Appendix G Headteacher questionnaire

Official Use:

[] [] []

HEADTEACHER QUESTIONNAIRE

PRACHIN BURI PROVINCE

School of Education

University of Southampton

INFORMATION ABOUT YOU

PAGE 1

1. Sex

Tick one box only

[] Male
[] Female

2. Age

.....

Number of years

3. How many years in total have you worked as a headteacher?

.....

Number of years

4. How many years have you worked as a headteacher in this school?

.....

Number of years

5. How many years did you work as a teacher before becoming a headteacher?

.....

Number of years

6. What is your education background and what was main area of study?

Tick as many boxes as appropriate

[] Bachelor Degree in
[] Master's Degree in
[] Doctoral Degree in
[] Other (specify).....

INFORMATION ABOUT YOU

PAGE 2

7. What percentages (approx.) of time do you spend on the following activities?

Activities	Percent
a. Administrative and management%
b. Instructional leadership and strategic tasks%
c. Teaching%
d. Supervising and evaluating teachers/staff%
e. Dealing with parents%
f. Public relations (e.g. funding, promoting the school etc.)%
g. Other (specify).....%
TOTAL	100%

INFORMATION ABOUT YOUR SCHOOL

PAGE 3

8. What type is your school?

Tick one box only

Public school
 Private school

9. What is total number of students in your school?

.....

Number of students

10. How many of the following teachers are on the staff of your school?

Write down the number of teachers in each row

Academic strands	Full-time	Part-time
a. Thai Language
b. Social Studies, Culture and Religion
c. English Language
d. Mathematics
e. Science
f. Health and Physical Education
g. Arts
h. Occupations and Technology
i. Others (specify).....

11. How many administrators are on the staff in your school?

.....

Number of administrators

INFORMATION ABOUT YOUR SCHOOL

PAGE 4

12. What is the profile of your school in terms of the percentage of students (approx.) who have the following economic backgrounds?

Tick one box in each row

Economic Status	Percentage of students in school				
	0-20%	21-40%	41-60%	61-80%	81-100%
a. Very poor	[]	[]	[]	[]	[]
b. Middle income	[]	[]	[]	[]	[]
c. Affluent	[]	[]	[]	[]	[]

13. Does your school have enrichment or remedial programs in the following subjects in Grade 7-9?

Tick only one box in row (a)-(h)

Subjects	Yes	No
a. Thai Language	[]	[]
b. Social Science	[]	[]
c. English Language	[]	[]
d. Mathematics	[]	[]
e. Science	[]	[]
f. Health and Physical Education	[]	[]
g. Arts	[]	[]
h. Occupations and Technology	[]	[]

INFORMATION ABOUT YOUR SCHOOL

PAGE 5

14. Are students in your school grouped by ability in the following subjects in Grades 7-9?

Tick only one box in row (a)-(h)

Subjects	Yes	No
a. Thai Language	[]	[]
b. Social Science	[]	[]
c. English Language	[]	[]
d. Mathematics	[]	[]
e. Science	[]	[]
f. Health and Physical Education	[]	[]
g. Arts	[]	[]
h. Occupations and Technology	[]	[]

SCHOOL DIFFICULTIES

PAGE 6

15. In your opinion, is your school's capacity to provide instruction hindered by any of the following items (15.1, 15.2, 15.3, and 15.4)?

15.1 Lack of qualified teachers

Tick one box only

[] Yes

[] No (Go to question 15.2) 



If yes, in what subjects and to what extent.

Tick only one box in each row

Subjects	'None'	A little	Quite a lot
a. Thai Language	[]	[]	[]
b. Social Studies, Culture and Religion	[]	[]	[]
c. English Language	[]	[]	[]
d. Mathematics	[]	[]	[]
e. Science	[]	[]	[]
f. Health and Physical Education	[]	[]	[]
g. Arts	[]	[]	[]
h. Occupations and Technology	[]	[]	[]

15.2 Shortage or inadequacy of textbooks in ...

Tick one box only

[] Yes

[] No (Go to the question 15.3) 



If yes, in what subjects and to what extent.

Tick only one box in each row

Subjects	'None'	A little	Quite a lot
a. Thai Language	[]	[]	[]
b. Social Studies, Culture and Religion	[]	[]	[]
c. English Language	[]	[]	[]
d. Mathematics	[]	[]	[]
e. Science	[]	[]	[]
f. Health and Physical Education	[]	[]	[]
g. Arts	[]	[]	[]
h. Occupations and Technology	[]	[]	[]

SCHOOL DIFFICULTIES

PAGE 8

15.3 Shortage or inadequacy of instructional technologies or equipment...

Tick one box only

[] Yes

[] No (Go to the question 15.4) 



If yes, in what subjects and to what extent.

Tick only one box in each row

Subjects	'None'	A little	Quite a lot
a. Thai Language	[]	[]	[]
b. Social Studies, Culture, and Religion	[]	[]	[]
c. English Language	[]	[]	[]
d. Mathematics	[]	[]	[]
e. Science	[]	[]	[]
f. Health and Physical Education	[]	[]	[]
g. Arts	[]	[]	[]
h. Occupations and Technology	[]	[]	[]

15.4 Shortage or inadequacy of school facilities

Tick one box only

[] Yes

[] No (Go to the next question) 



If yes, in what items and to what extent.

Tick only one box in each row

Topics	'None'	A little	Quite a lot
a. Classrooms	[]	[]	[]
b. Science laboratory	[]	[]	[]
c. Language laboratory	[]	[]	[]
d. Library	[]	[]	[]
e. Gymnasium	[]	[]	[]
f. Assembly area/theater	[]	[]	[]
g. Cafeteria	[]	[]	[]
h. Social Space	[]	[]	[]
i. Playing fields	[]	[]	[]
j. Buildings	[]	[]	[]

THANK YOU FOR VERY MUCH

Appendix H Interview guideline: Teacher

General information about respondent

How long have you been a teacher?

- At this school
- In total

In the last three academic years, which subjects and grades have you taught?

School resources

Do you think that your school has adequate educational resources for good quality learning and teaching overall and in the particular subject you have taught?

Probe

- Qualified teachers
- Textbooks
- Instructional technology and equipment
- School facilities
- Anything else?

Student quality and characteristics

How would you describe the student backgrounds and behaviors among lower secondary students in your school?

Probe

- Socio-economic status and family backgrounds
- Educational difficulties
- Special educational needs
- Bullying/violence/drug abuse
- Academic competition

What is your opinion about the academic quality of students you have in the lower secondary level in your school?

Probe

- At intake (Grade 7)
- Progress/value-added (Grade 7-9)
- Variations/differences at intake (Grade 7)
- Variations/differences at student outcome (Grade 9)

What is your opinion about the non-academic quality of students you have in the lower secondary level in your school?

Academic quality improvement

How would you describe school implementations and guidelines in order to improve quality of schooling overall and/or in particular subjects?

Probe

- School policy for teaching and of actions taken to improve teaching
- School policy for creating a school learning environment and actions taken for improving the school learning environment
- Evaluation of school policy for teaching and of actions taken to improve teaching
- Evaluation of school policy for creating a school learning environment and actions taken for improving the school learning environment
- Anything else?

Attainment Equity

How would you describe school implementations and guidelines in order to improve academic quality of different groups of students overall and/or in particular subjects?

Probe

- Gifted students
- Students with different academic abilities
- Students who came from different socio-economic backgrounds
- Students with special needs

Probe

- School policy for teaching and of actions taken to improve teaching
- School policy for creating a school learning environment and actions taken for improving the school learning environment
- Evaluation of school policy for teaching and of actions taken to improve teaching
- Evaluation of school policy for creating a school learning environment and actions taken for improving the school learning environment

Personal Opinions

What would you attribute your school's success (or lack of it) to? What is right/wrong with your school?

How would describe the strengths and weaknesses in your school?

Others

Is there any other issue you would like to discuss or suggest about your school?

Demographic characteristics of the respondent

- Gender
- How old are you?
- What is your highest education?

Appendix I Interview guideline: Headteacher

General information about respondent

How long have you been a headteacher?

- At this school
- In total

How long have you worked as a teacher?

- At this school
- In total

School environment

How would you describe the community/local environment where your school is located?

Probe

- Economic
- Social
- Urban/rural
- Other schools in the community

School resources

Do you think that your school has adequate educational resources for good quality learning and teaching overall and/or in particular subjects?

Probe

- Qualified teachers
- Textbooks
- Instructional technologies and equipment
- School facilities
- Anything else?

Student characteristics and quality

How would you describe the student backgrounds and student behaviours among lower secondary students in your school?

Probe

- Socio-economic status
- Family backgrounds
- Educational difficulties
- Special educational needs
- Academic competition

What is your opinion about the academic quality of your students you have in the lower secondary level in your school overall and/or in particular subjects?

Probe

- At intake (Grade 7)
- Progress/Value-added (Grades 7-9)
- Variations at intake (Grade 7)
- Variations at student outcomes (Grade 9)

What is your opinion about the non-academic quality of students you have in the lower secondary level in your school?

Academic quality improvement

How would you describe school implementations and guidelines in order to improve quality of schooling overall and/or in particular subjects?

Probe

- School policy for teaching and of actions taken to improve teaching
- School policy for creating a school learning environment and actions taken for improving the school learning environment
- Evaluation of school policy for teaching and of actions taken to improve teaching

- Evaluation of school policy for creating a school learning environment and actions taken for improving the school learning environment
- Anything else?

Attainment Equity

How would you describe school implementations and guidelines in order to improve academic quality of different groups of students overall and/or in particular subjects?

Probe

- Gifted students
- Students with different academic abilities
- Students who came from different socio-economic backgrounds
- Students with special needs

Probe

- School policy for teaching and of actions taken to improve teaching
- School policy for creating a school learning environment and actions taken for improving the school learning environment
- Evaluation of school policy for teaching and of actions taken to improve teaching
- Evaluation of school policy for creating a school learning environment and actions taken for improving the school learning environment

School needs

How much support do you receive from your educational affiliations? Does it meet your school's needs?

Probe

- Academic
- Non-academic

Personal Opinions

What would you attribute your school's success (or lack of it) to? What is right/wrong with your school?

How would describe the strengths and weaknesses in your school?

Others

Is there any other issue you would like to discuss or suggest about your school?

Demographic characteristics of the respondent

- Gender
- How old are you?
- What is your highest education?

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